Ravi Maths Tuition Centre

Time : 150 Mins **PHYSICAL WORLD AND MEASUREMENT 1** **Marks : 1420**

1. The dimensions of K in the equation W $= \frac{1}{2}kx^2$ are:
   a) $[M^1L^0T^{-2}]$ b) $[M^0L^1T^{-1}]$ c) $[M^1L^1T^{-2}]$ d) $[M^1L^0T^{-1}]$
2. Give the nature of work for which Prof. Albert Einstein, a physicist, was awarded the Nobel Prize in physics:
   a) Wave theory of light b) Theory of relativity c) Photo-electric equation
   d) Wave-particledeuality
3. Assertion: Parallax method is used for measuring distances of nearby stars only.
   Reason : With increase of distance of star, parallactic angle becomes too small to be measured accurately.
   a)
   If both assertion and reason are true and reason is the correct explanation of assertion.
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion
   c) If assertion is true but reason is false. d) If both assertion and reason are false
4. Lightyear is used to measure:
   a) distance between stars b) distance between atoms
   c) revolution time of the earth around the sun d) none of the above
5. Dimensions of stress are ____________
   a) $[ML^{-1}T^{-2}]$ b) $[MLT^{-2}]$ c) $[ML^2T^{-2}]$ d) $[ML^0T^{-2}]$
6. SI units of gas constant are:
   a) watt K^{-1} mol^{-1} b) newton K^{-1} mol^{-1} c) joule K^{-1} mol^{-1} d) erg K^{-1} mol^{-1}
7. The equation of state of a gas is given by $\left(p+\frac{a}{V^3}\right)(V-b^2)=cT$
   , where P, V, T are pressure, volume and temperature respectively, and a, b, c are constants. The dimensions of a and bare respectively
   a) $[ML^8T^{-2}]$ and $[L^{3/2}]$ b) $[ML^5T^{-2}]$ and $[L^3]$ c) $[ML^5T^{-2}]$ and $[L^6]$
   d) $[ML^6T^{-2}]$ and $[L^{3/2}]$

8. The equation $\left(P+\frac{a}{V^2}\right)(V-b)=$ constant. The units of a are:
   a) dyne x cm^5 b) dyne x cm^4 c) dyne/cm^3 d) dyne/cm^2
9. A new system of units is proposed in which unit of mass is α kg, unit of length is β m and unit of time is ϒs. What will be value of 5 J in this new system?
   a) $5\alpha\beta^2\gamma^{-2}$ b) $5\alpha^{-1}\beta^{-2}\gamma^2$ c) $5\alpha^{-2}\beta^2\gamma^{-2}$ d) $5\alpha^{-1}\beta^2\gamma^2$
10. Match the Column I with Column II.

Column-I (Units)		Column-II (Dimensional formulae)	
A	Pa s	(p)	$[M^0L^2T^{-2}K^{-1}]$
B	NmK^{-1}	(q)	$[MLT^{-3}K^{-1}]$
C	$J\ kg^{-1}\ K^{-1}$	(r)	$[ML^{-1}T^{-1}]$
D	$Wm^{-1}K^{-1}$	(s)	$[ML^2T^{-2}K^{-1}]$

   a) A - q, B - p, C - r, D - s b) A -p, B - q, C - s, D - r c) A - r, B - s, C - p, D - q
   d) A - s, B - r, C - q, D - P
11. The unit of angular momentum are :
   a) kg-m^2/s^2 b) J/s c) J-s d) kg-ms^{-2}
12. The best method to reduce random errors is:
   a) to change the instrument used for measurement
   b) to take help of experienced observer
   c) to repeat the experiment many times and to take the average results
   d) none of the above
13. One 'lux' is equal to :
   a) lumen/m^2 b) lumen/cm^2 c) candela/m^2 d) candela/cm^2
14. Assertion : the given equation $x=x_0+u_0t+\frac{1}{2}at^2$ is dimensionally correct, where x is the distance travelled by a particle in time t, initial position xo, initial velocity Uo and uniform acceleration a is along the direction of motion.
   Reason : Dimensional analysis can be used for checking the dimensional consistency or homogeneity of the equation
   a)
   If both assertion and reason are true and reason is the correct explanation of assertion.
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion.
   c) If assertion is true but reason is false. d) If assertion is true but reason is false.
15. The velocity of a particle (v) at an instant t is given by v = at + bt^2. The dimension of b is :
   a) [L] b) $[LT^{-1}]$ c) $[LT^{-2}]$ d) $[LT^{-3}]$

16. A new system of units is evolved in which the values of μ_0 and ε_0 are 2 and 8 respectively. Then the speed of light in this system will be:
a) 0.25 b) 0.5 c) 0.75 d) 1

17. Which of the following physical quantities has same unit in all the three system of units?
a) Mass b) Length c) Time d) None of these

18. The time dependence of physical quantityp is given by p= p_o exp ($-at^2$), where a is a constant and r is the time. The constant a ________
a) is dimensionless b) has dimensions [T^{-2}] c) has dimensions [T^2]
d) has dimensions of p

19. The order of magnitude of 147 is:
a) 1 b) 2 c) 3 d) 4

20. Which of the following forces is not fundamental force in nature?
a) Gravitational force b) Electromagnetic force c) Strong nuclear force
d) Tension

21. Which ofthe following will have the dimensions of time?
a) LC b) $\frac{R}{L}$ c) $\frac{L}{R}$ d) $\frac{C}{L}$

22. The value of universal gravitational constant G = 6.67 X 10^{-11} N m^2 kg^{-2}. The value of G in units of g^{-1} cm^3 S^{-2} is :
a) 6.67 x 10^{-8} b) 6.67 x 10^{-7} c) 6.67 x 10^{-9} d) 6.67 x 10^{-10}

23. **Assertion:** The microscopic domain of physics deals with the constitution and structure of matter at the minute scales of atoms and nuclei.
Reason: Classical physics is adequate to deal with the macroscopic domain of physics.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

24. The dimensional formula for magnetic flux is ___________
a) $\left[ML^2\ T^{-2}\ A^{-1}\right]$ b) $\left[ML^3\ T^{-2}\ A^{-2}\right]$ c) $\left[M^0\ L^{-2}\ T^2\ A^{-2}\right]$ d) $\left[ML^2\ T^{-1}\ A^2\right]$

25. A student writes following four different expressions for the displacement 'y' in a periodic motion:

(1) $y = a\sin\frac{2\pi t}{T}$

(2) $y = a\sin Vt$

(3) $y = \frac{a}{T}\sin\frac{t}{a}$

(4) $y = \frac{a}{\sqrt{2}}\left[\sin\frac{2\pi t}{T} + \cos\frac{2\pi t}{T}\right]$

where 'a' is maximum displacement, V is the speed and T is the time period; then dimensionally:

a) 1 and 2 are wrong b) 2 and 3 are wrong c) 3 and 4 are wrong
d) 4 and 1 are wrong

26. The dimensions of modulus of rigidity are:
a) $[M^1L^1T^{-2}]$ b) $[M^1L^2T^{-1}]$ c) $[ML^2T^{-2}]$ d) $[ML^{-1}T^{-2}]$

27. Who discovered the principle of inertia?
a) Newton b) Galileo c) Tycho Brahe d) Kepler

28. Given that T stands for time period and l stands for the length of simple pendulum. If g is the acceleration due to gravity, then which of the following statements about the relation $T^2 = (l/g)$ is correct?
a) It is correct both dimensionally as well as numerically.
b) It is neither dimensionally correct nor numerically.
c) It is dimensionally correct but not numerically.
d) It is numerically correct but not dimensionally.

29. The square of resultant of two equal forces is three times their product. Angle between the forces is:
a) π b) $\frac{\pi}{2}$ c) $\frac{\pi}{4}$ d) $\frac{\pi}{3}$

30. The density of a cube is measured by measuring its mass and length of its sides. If the maximum error in the measurement of mass and length are 4% and 3% respectively, the maximum error in the measurement of density will be ____________
a) 7% b) 9% c) 12% d) 13%

31. The radius of a disc is 1.2 cm. Its area according to idea of significant figure, will be given by:
a) 4.5216 cm^2 b) 4.521 cm^2 c) 4.52 cm^2 d) 4.5 cm^2

32. Number of particles is given by n = - D $\frac{[n_2-n_1]}{x_2-x_1}$ crossing a unit area perpendicular to X- axis in unit time, where n_1 and n_2 are number of particles per unit volume for the value of X meant to x_2 and x_1 : Find dimensions of D called as diffusion constant :
a) $[M^0LT^{-2}]$ b) $[M^0L^2T^{-4}]$ c) $[M^0LT^{-3}]$ d) $[M^0L^2T^{-1}]$

33. If Z = $\frac{A^4 B^{1/3}}{CD^{3/2}}$ and ΔA, ΔB, ΔC, and ΔD are their absolute errors in A, B, C and D respectively. The relative error in Z is :

a) $\frac{\Delta Z}{Z} = 4\frac{\Delta A}{A} + \frac{1}{3}\frac{\Delta B}{B} + \frac{\Delta C}{C} + \frac{3}{2}\frac{\Delta D}{D}$ b) $\frac{\Delta Z}{Z} = 4\frac{\Delta A}{A} + \frac{1}{3}\frac{\Delta B}{B} - \frac{\Delta C}{C} - \frac{3}{2}\frac{\Delta D}{D}$

c) $\frac{\Delta Z}{Z} = 4\frac{\Delta A}{A} + \frac{1}{3}\frac{\Delta B}{B} + \frac{\Delta C}{C} - \frac{3}{2}\frac{\Delta D}{D}$ d) $\frac{\Delta Z}{Z} = 4\frac{\Delta A}{A} + \frac{1}{3}\frac{\Delta B}{B} - \frac{\Delta C}{C} + \frac{3}{2}\frac{\Delta D}{D}$

34. Physics involves the study of

a) plants b) humans c) birds and animals d) nature and natural phenomena

35. Given that the displacement of an oscillating particle is given by y = A sin(Bx + Ct + D). The dimensional formula for (ABCD) is:

a) $[M^0L^{-1}T^0]$ b) $[M^0L^0T^{-1}]$ c) $[M^0L^{-1}T^{-1}]$ d) $[M^0L^0T^0]$

36. Given that the displacement of a particle is given by : $x=A^2 \sin^2 kt$ Where t denotes the time. The unit of k is:

a) hertz b) metre c) radian d) second

37. Unit of energy in SI system is

a) Erg b) Calorie c) Joule d) Electron volt

38. The unit of reduction factor of tangent galvanometer is :

a) Ampere b) Gauss c) Radian d) None of these

39. The equation of state for n moles of an ideal gas is p V = nRT, where R is a constant. The SI unit for R is:

a) JK^{-1} per molecule b) $JK^{-1}mole^{-1}$ c) $JKg^{-1}K^{-1}$ d) $JK^{-1}g^{-1}$

40. The dimensions of Planck's constant are same as :

a) Energy b) Power c) Momentum d) Angular momentum

41. A student uses a simple pendulum of exactly 1 m length to determine g, the acceleration due to gravity. He uses a stopwatch with the least count of 1 second for this and records 40 seconds for 20 oscillations. For this observation, which of the following statements is true?

a) Error ΔT in measuring T, the time period, is 0.05 seconds

b) Error ΔT in measuring T, the time period, is 1 second.

c) Percentage error in the determination of g is 5%. d) Both (a) and (c)

42. Given, force$= \frac{\alpha}{Density+\beta^3}$. What are the dimensions of α, β ?

a) $[ML^2T^{-2}]$, $[ML^{-1/3}]$ b) $[M^2L^4T^{-2}]$, $[M^{1/3}L^{-1}]$ c) $[M^2L^{-2}T^{-2}]$, $[M^{1/3}L^{-1}]$

d) $[M^2L^{-2}T^{-2}]$,$[ML^{-2}]$

43. The physical quantity having the dimensions $[M^{-1}L^{-3}T^3A^2]$ is:

a) resistance b) resistivity c) electrical conductivity d) electromotive force

44. Assertion : Pressure cannot be subtracted from pressure gradient.

Reason : Pressure and pressure gradient have different dimensions

a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

45. SONAR emits which of the following waves?
a) Radio waves b) Micro waves c) Ultrasound waves d) Gamma rays

46. In a particular system, the unit of length, mass and time are chosen to be 10 cm, 10 g and 0.1 s respectively. The unit of force in this system will be equivalent to __________
a) 0.1N b) 1N c) 10N d) 100N

47. Angular momentum has the same dimensions as:
a) Planck's constant b) Universal gravitational constant c) Rydberg constant
d) Boltzmann constant

48. The dimensions of universal gravitational constant are __________
a) $M^{-2} L^2 T^{-1}$ b) $M^{-1} L^3 T^{-2}$ c) $ML^2 T^{-1}$ d) $M^{-2} L^3 T^{-2}$

49. Which one of the following methods is used to measure distance of a planet or a star from the earth?
a) Echo method b) Parallax method c) Triangulation method d) None of these

50. How many light years Alpha Centauri away from the Earth?
a) 1.29 b) 2.29 c) 3.29 d) 4.29

51. The displacement of a progressive wave is represented by
$y = A\sin(\omega t - kx)$ where x is distance and t is time. Determine the dimensional formula of (i) ω and (ii) k.
a) $[M^{-1}],[T^{-1}]$ b) $[T^{-1}],[L^{-1}]$ c) $[M],[T^{-1}]$ d) $[M],[L]$

52. According to Einstein's theory of relativity, the relation between mass and energy is given by:
a) E=mc b) $E=mc^2$ c) $E=mc^3$ d) $E=mc^4$

53. If 49 divisions on the vernier scale coincide with 50 divisions on the main scale of a vernier- calliper, then what would be the least count of the instrument, if graduation on the main scale is 2 mm?
a) $\frac{1}{25}mm$ b) $\frac{1}{50}mm$ c) $\frac{2}{49}mm$ d) $\frac{1}{49}mm$

54. Which of the following represents a volt :
a) $\frac{Joule}{second}$ b) $\frac{Watt}{Ampere}$ c) $\frac{Watt}{Coulomb}$ d) $\frac{Coulomb}{Joule}$

55. Macroscopic forces are:

a) surface tension of a liquid b) viscous force c) contact force between bodies
d) all of the above

56. The value of G = 6.67 x 10^{-11} N-m^2 $(kg)^{-2}$. Its value in CGS system will be:
a) 6.67 x 10^{-8} dyne cm^2 gm^{-2} b) 6.67 x 10^{-6} dyne cm^2 gm^{-2}
c) 6.67 x 10^{-4} dyne cm^2 gm^{-2} d) 6.67 x 10^{-5} dyne cm^2 gm^{-2}

57. Assertion : Angle and angular displacement are dimensionless quantities.
Reason : Angle is equal to arc length divided by radius.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

58. If force (F), velocity (V) and time (T) are taken as fundamental units, then the dimensions of mass are:
a) $[FV^{-1}T^{-1}]$ b) $[FV^{-1}T]$ c) $[FVT^{-1}]$ d) $[FVT^{-2}]$

59. A hypothetical experiment is conducted to determine Young's formula
$Y = \frac{\cos\theta T^x.\tau}{l^3}$. If Y = Young's modulus, T = time period, τ = torque and I = length, then find the value of x:
a) zero b) 1 c) 2 d) 3

60. The ratio of molar volume to atomic volume for 1 mole of hydrogen is
(Take size of hydrogen molecule to be 1 $\mathring{A}$)
a) 7.1 x 10^4 b) 7.1 x 10^6 c) 7.1 x 10^{10} d) 7.1 x 10^8

61. Given that: $y = A\sin\left[\left(\frac{2\pi}{\lambda}\right)(ct - x)\right]$ where Y and x are measured in meters. Which of the following statements is true?
a) The unit of λ is same as that of x and A.
b) The unit of λ is same as that of x but not of A.
c) The unit of c is same as that of $2\pi/\lambda$
d) The unit of (ct - x) is same as that of $2\pi/\lambda$

62. A light year is a unit of:
a) time b) distance c) speed d) year

63. Dimensional formula of a physical quantity x is [M^{-1} L^3 T^{-2}]. The errors in measuring the quantities M, L and T respectively are 2%, 3% and 4%. The maximum percentage of error that occurs in measuring the quantity x is:
a) 14% b) 19% c) 9% d) 10%

64. While measuring acceleration due to gravity by a simple pendulum, a student makes a positive error of 2% in the length of the pendulum and a positive error of 1% in the value of time period. His actual percentage error in the measurement of the value of g will be:
   a) 3% b) 0% c) 4% d) 5%
65. Using the principle of homogeneity of dimensions, which of the following is correct?
   a) $T^2 = \frac{4\pi^2 r^3}{GM}$ b) $T^2 = 4\pi^2 r^2$ c) $T^2 = \frac{4\pi^2 r^3}{G}$ d) $T = \frac{4\pi^2 r^3}{G}$
66. The displacement of a progressive wave is represented by y = A sin(ωt - kx) where x is distance and t is where x is distance and t is time. The dimensions of $\frac{\omega}{k}$ are same as those of :
   a) velocity b) wave number c) wavelength d) frequency
67. The unit of force and length are doubled, the unit of energy will be:
   a) $\frac{1}{4} times$ b) $\frac{1}{2} times$ c) 2 times d) 4 times
68. In a hydroelectric power station:
   a) thermal energy is converted into electrical energy
   b) gravitational potential energy is converted into electrical energy
   c) kinetic energy is converted into potential energy
   d) chemical energy is converted into electrical energy
69. Light year is the unit of :
   a) distance b) time c) speed d) intensity of light
70. If p represents radiation pressure, c represents speed of light and S represents radiation energy striking unit area per sec. The non-zero integers x, y, z such that $p^x S^y c^z$ is dimensionless are ________.
   a) x = l, y = l, z = 1 b) x = 1, y= 1, z = l c) x = 1, y = -l, z = 1 d) x = 1, y = l, z= -l
71. The unit of the coefficient of viscosity in SI system is:
   a) m/kg-s b) m-s/kg^2 c) kg/m-s^2 d) kg/m-s
72. Turpentine oil is flowing through a tube of length l and radius r. The pressure difference between the two ends of the tube is p. The viscosity of oil is given by η= $\frac{p(r^2-x^2)}{4vl}$ where v IS velocity of oil at a distance x from the axis of the tube. The dimensional formula of viscosity is
   a) $[M^0L^0T^0]$ b) $[M^1L^{-1}T^{-1}]$ c) $[ML^2T^{-1}]$ d) $[M^{-1}L^{-1}T^{-2}]$
73. In an experiment, the period of oscillation of a simple pendulum was observed to be 2.63 s, 2.56 s, 2.42 s, 2.71 s and 2.80 s. The mean absolute error is :
   a) 0.11 s b) 0.12 s c) 0.13 s d) 0.14 s
74. When a man is standing, rain drops appear to him falling at 60° from the horizontal from his front side. When he is travelling at 5 km per hour on a horizontal road they appear to him falling at 30°, from the horizontal from his front side. The actual speed of the rain is (in km per hour):

a) 3 b) 4 c) 5 d) 6

75. Units of magnetic flux are:

a) weber/metre b) newton x metre/ampere c) joule x coul/metre d) tesla

76. **Assertion:** In a nuclear process mass gets converted into energy.

Reason: According to Einstein's mass energy equivalence relation, mass m is equivalent to energy E, given by the relation $E = mc^2$ where c is the speed of light in vacuum.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

77. If the velocity of light (c), gravitational constant (G) and Planck's constant (h) are chosen as fundamental units, then which of the following represents the dimensions of the mass?

a) $[c^{1/2}G^{1/2}h^{1/2}]$ b) $[c^{1/2}G^{-1/2}h^{-1/2}]$ c) $[c^{1/2}G^{-1/2}h^{-1/2}]$ d) $[c^{-1/2}G^{1/2}h^{1/2}]$

78. The SI unit of universal gas constant (R) is :

a) Watt / K mol b) Newton / K mol c) Joule / K mol d) Erg / K mol

79. Which of the following statements is not correct?

a) Physics is the study of nature and natural phenomena.

b) Physics and technology are not related to each other.

c)

Electrodynamics deals with electric and magnetic phenomena associated with charged and magnetic bodies.

d)

The physical quantities that remain unchanged in a process are called conserved quantities.

80. Height of liquid in a capillary tube is given as: $h = 2s\cos\theta / r\rho g.$ Where S is the surface tension of liquid, r is the radius of capillary tube, ρ is density and g is acceleration due to gravity then dimensional formula for S is:

a) $[ML^0T^{-2}]$ b) $[M^0LT^2]$ c) $[ML^2T^{-2}]$ d) $[M^0L^0T^{-3}]$

81. If power (P), surface tension (S) and Planck's constant (h) are arranged so that the dimensions of time in their dimensional formulae are in ascending order, then which of the following is correct?

a) P, S, h b) P, h, S c) S, P, h d) S, h, P

82. Assertion: A number 2.746 rounded off to three Significant figures is 2.75, while the number 2.743 would be 2.74.

Reason : In rounding off the uncertain digits, the preceding digit is raised by 1 if the insignificant digit to be dropped is more than 5 and is left unchanged if the latter is less than 5.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false

83. While measuring the diameter of a wire by screw gauge, three readings were taken are 1.002 cm, 1.004 cm and 1.006 cm. The absolute error in the third reading is:

a) 0.002 cm b) 0.004 cm c) zero d) 1.002 cm

84. A physical quantity $y = \frac{a^4b^2}{(cd^4)^{1/3}}$ has four observables a, b,c and d. The percentage error in a, b, c and dare 2%, 3%, 4% and 5% respectively. The error in y will be:

a) 6% b) 11% c) 12% d) 22%

85. Which one of the following is not a unit of British system of units?

a) Foot b) meter c) pound d) Second

86. Spot out the odd one.

a) calorie b) kilowatt hour c) joule d) watt

87. One centimeter on the main scale of Vernier calipers is divided into ten equal parts. If 10 divisions of the main scale coincide with 8 small divisions of the main scale, the least count of the calipers is:

a) 0.01 cm b) 0.02 cm c) 0.05 cm d) 0.005 cm

88. Which of the following units is not a base unit?

a) metre b) candela c) ampere d) pascal

89. A physical quantity $P = \frac{\sqrt{abc^2}}{d^3e^{1/3}}$ is determined by measuring a, b, c, d and e separately with the percentage error of 2%, 3%, 2%, 1% and 6% respectively. Minimum amount of error is contributed by the measurement of:

a) b b) a c) d d) e e) c

90. Match the Column I with Column II

Column-I		Column-II	
A)	Life time of an excited state of an atom	(p)	10^{17}

B)	Average human life-span	(q)	10^{11}
C)	Age of Egyptian pyramids	(r)	10^{9}
D)	Age of the universe	(s)	10^{-8}

a) A - s, B - r, C - q, D - P b) A - p, B - q, C - r, D - s c) A - q, B - p, C - s, D - r
d) A - r, B - s, C - P. D - q

91. Density of wood is 0.5gm/cc in the CGS system of units. The corresponding value in MKS units is :
a) 500 b) 5 c) 0.5 d) 5000

92. A wire when heated shows a 2% increase in length. The increase in cross-sectional area would be :
a) 1% b) 2% c) 4% d) 4π %

93. Who invented the cyclotron?
a) James Chadwick b) James Clerk Maxwell c) Michael Faraday
d) Ernest Orlando Lawrence

94. If area (A), velocity (υ) and density (ρ) are taken as fundamental units, what is the dimensional formula for force?
a) $[A\upsilon^2\rho]$ b) $[A^2\upsilon\rho]$ c) $[A\upsilon\rho^2]$ d) $[A\upsilon\rho]$

95. The unit ofpermittivity of free space, ϵ_o is____________
a) Coulomb^2/ (Newton-metre)^2 b) Coulomb/Newton-metre
c) Newton-metre^2/Coulomb^2 d) Coulomb^2/Newton-metre^2

96. Which of the following physical quantities has a unit but no dimensions?
a) Relative velocity b) Relative density c) Strain d) Angle

97. Which of the following physical quantities is/are dimensionless?
a) Strain b) Specific gravity c) Angle d) All of these

98. If the units of mass, length and time are doubled, unit of angular momentum will be:
a) doubled b) tripled c) quadrupled d) 8 times the original value

99. The distance of a galaxy from the earth is of the order of 1025m. The time taken by light to reach the earth from the galaxy is :
a) 3 x 10^{14}s b) 3 x 10^{16}s c) 3 x 10^{18}s d) 3 x 10^{20}s

100. Which of the following time measuring devices is most precise?
a) A wall clock b) An atomic clock c) A digital watch d) A stop watch

101. **Assertion:** Gravitational force is always attractive in nature, while electromagnetic force can be attractive or repulsive.
Reason: Electromagnetic force dominates terrestrial phenomena.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

102. Which of the following sets have different dimensions?
a) Pressure, Young's modulus, stress
b) Emf, potential difference, electric potential c) Heat, work done, energy
d) Dipole moment, electric flux, electric field

103. Which of the following properties of laser beam can be used to measure long distances?
a) It is very intense b) It is highly monochromatic
c) It is an unidirectional beam of light. d) All of these

104. Which dimensions will be the same as that of time?
a) LC b) $\frac{R}{L}$ c) $\frac{L}{R}$ d) $\frac{C}{L}$

105. Fathom is the unit to measure the :
a) speed of ship b) depth of sea c) distance of the ship d) speed of cyclone

106. Which of the following is a dimensional constant?
a) Refractive index b) Poisson's ratio c) Relative density
d) Gravitational constant

107. The SI unit of gravitational potential is:
a) J b) J-kg^{-1} c) J-kg d) J-kg^{-2}

108. The pressure on a square plate is measured by measuring the force on the plate and the length of the sides of plate. If the maximum error in the measurement of force and length are respectively 4% and 2%, the maximum error in the measurement of pressure is:
a) 1% b) 2% c) 6% d) 8%

109. A physical quantity X is related to four measurable quantities a, b, c and d as given, $X = a^2b^3c^{5/2}d^{-2}$ The percentage error in the measurement of a, b, c and dare 1%, 2%, 2% and 4% respectively. What is the percentage error in quantity X?
a) 15% b) 17% c) 21% d) 23%

110. Classical physics is applicable to
a) microscopic world b) macroscopic world
c) both microscopic and macroscopic world d) cannot say

111. The dimensional formula $[ML^0T^{-3}]$ is more closely associated with:
a) power b) energy c) intensity d) velocity gradient

112. Young's modulus of steel is 1.9 x 10^{11} N m^{-2}. When expressed in cgs units of dynes cm^{-2} it will be equal to (1 N = 10^5 dyne, 1 m^2 = 10^4 cm^2)
a) 1.9 x 10^{10} b) 1.9 x 10^{11} c) 1.9 x 10^{12} d) 1.9 x 10^{13}

113. The SI unit of electron mobility is:
a) $m^2s^{-1}V^{-1}$ b) msV^{-1} c) $ms^{-1}V$ d) $m^2s^{-2}V^{-2}$

114. Which of the following instruments has minimum least count?
a)
A vernier callipers with 20 divisions on the vernier scale coinciding with 19 main scale divisions
b) A screw gauge of pitch 1 mm and 100 divisions on the circular scale.
c) A spherometer of pitch 0.1 mm and 100 divisions on the circular scale
d) An optical instrument that can measure length to within a wavelength of light.

115. The length of a simple pendulum is about 100 cm known to an accuracy of I mm. Its period of oscillation is 2 s determined by measuring the time for 100 oscillations using a clock of 0.1 s resolution. What is the accuracy in the determined value of g?
a) 0.2% b) 0.5% c) 0.1% d) 2%

116. Force of friction and tension in a string are
a) Gravitational forces b) Electromagnetic forces c) Nuclear forces
d) Weak forces

117. The density of material in CGS system of unit is 4 g/cm^3 . In a system of units in which unit of length is 10 cm and unit of mass is 100 g, the value of density of material will be :
a) 0.4 b) 40 c) 400 d) 0.04

118. The dimensions of 11MB, where I is the moment of inertia, M is the magnetic moment and B is the magnetic induction respectively, are those of:
a) $(time)^{1/2}$ b) time c) $(time)^2$ d) $(time)^3$

119. In a thermal power station:
a) chemical energy of burning coal is converted into electrical energy
b) gravitational energy is converted into electrical energy
c) potential energy is converted into kinetic energy
d) geothermal energy is converted into electrical energy

120. Electron microscope uses electron for their which property
a) spin b) wave nature c) negative charge d) none of these

121. The speed (v) of ripples on the surface of water depends on surface tension (σ), density (ρ) and wavelength (λ). The square of speed (v) is proportional to:
a) $\frac{\sigma}{\rho\lambda}$ b) $\frac{\rho}{\sigma\lambda}$ c) $\frac{\lambda}{\sigma\rho}$ d) $\rho\lambda\sigma$

122. In the relation: $y = a\sin(\omega t - kx)$. the dimensional formula for K is:
a) $[M^0LT]$ b) $[M^0L^{-1}T^0]$ c) $[M^0LT^{-1}]$ d) $[M^0L^{-1}T^{-1}]$

123. If x = at + bt^2 where x is the distance travelled by the body in kilometers and t is the time in seconds, so units of b will be :
a) km/s b) km-s c) km/s^2 d) km-s^2

124. The velocity of a particle is given by: υ =at^2 + bt + c. If υ is measured in ms^{-1} and t is measured in s, the unit of:
a) a is ms^{-1} b) b is ms^{-1} c) c is ms^{-1}
d) a and b are same but that of c is different

125. Which of the following relations is correct?
a) E = mc b) E = mc^2 c) E = 2mc^2 d) E = mc^2/4

126. Given that g is acceleration due to gravity and R is the radius of the earth. Then [g/R]$^{1/2}$possesses the dimensions of:
a) orbital speed b) angular speed c) escape velocity d) time period

127. The radius of a sphere is 1.41 cm. Its volume to an appropriate number of significant figures is
a) 11.73 cm^3 b) 11.736 cm^3 c) 11.7 cm^3 d) 117 cm^3

128. The device used for measuring the mass of atoms and molecules is :
a) spring balance b) torsional balance c) mass spectrograph
d) common balance

129. The velocity of a particle depends upon the time t according to the equation: $\upsilon = \sqrt{ab} + bt + \frac{c}{d+t}$. The physical quantities which are represented by a, b, c and d, are in the following order :
a) distance, distance, acceleration, time b) distance, acceleration, distance, time
c) acceleration, distance, distance, time d) none of the above

130. If the error in measurement of radius of sphere is 2% then the error in the determination of volume of the sphere will be :
a) 4% b) 6% c) 8% d) 2%

131. The solid angle subtended by the periphery of an area 1 cm^{-2} at a point situated symmetrically at a distance of 5 cm from the area is :
a) 2 x 10^{-2} steradian b) 4 x 10^{-2} steradian c) 6 x 10^{-2} steradian
d) 8 x 10^{-2} steradian

132. If 3.8 x 10^{-6} is added to 4.2 x 10^{-5} giving due regard to significant figures, then the result will be:
a) 4.58 x 10^{-5} b) 4.6 x 10^{-5} c) 4.5 x 10^{-5} d) none of these

133. A screw gauge has least count of 0. 01 mm and there are 50 divisions in its circular scale. The pitch of the screw gauge is _____________.
a) 1.0mm b) 0.01mm c) 0.25mm d) 0.5mm

134. An experiment measured quantities a, b, c and then x is calculated from $x = ab^2/c^3$. If the percentage errors in a, b, c are ±1%, ±3% and ±2% respectively, the percentage error in x can be:
a) ±13% b) ±7% c) ±4% d) ±1%

135. The unit of Stefan-Boltzmann 's constant (σ) is:
a) $\frac{watt^4}{m \times K^4}$ b) $\frac{calorie}{m^2 \times K^4}$ c) $\frac{watt}{m^2 \times K^4}$ d) $\frac{joule}{m^2 \times K^4}$

136. According to Newton, the viscous force acting between liquid layers of area A and velocity gradient $\frac{\Delta v}{\Delta z}$ is given by $F = -\eta A \frac{dv}{dz}$ where η is constant ___________.
a) $[\mathrm{ML^{-2}\,T^{-2}}]$ b) $[\mathrm{M^0\,L^0\,T^0}]$ c) $[\mathrm{ML^2\,T^{-2}}]$ d) $[\mathrm{ML^{-1}\,T^{-1}}]$

137. Astronomical unit (AU) is the distance between earth and the sun, 1 AU is equal to :
a) 1.496×10^8 km b) 9.46×10^{12} km c) 3.084×10^{13} km d) 4.596×10^{15} km

138. The quantities RC and (L/R) (where R, L and C stand for resistance, inductance and capacitance respectively) have the dimension of:
a) force b) linear momentum c) linear velocity d) time

139. If and ε_0, μ_0 c represents the relative permittivity of free space, the magnetic permeability of free space and the velocity of light respectively, which of the following combinations is correct?
a) $C = \frac{1}{\mu_0 \varepsilon_0}$ b) $C = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$ c) $C = \mu_0 \varepsilon_0$ d) $C = \sqrt{\mu_0 \varepsilon_0}$

140. Which of the following pairs of physical quantities have same dimensions?
a) Force and power b) Torque and energy c) Torque and powder
d) Force and torque

141. The acceleration due to gravity on the moon is
a) $\left(\frac{1}{6}\right)^{th}$ that of the earth b) same that of the earth c) $\left(\frac{1}{3}\right)^{rd}$ that of the earth
d) $\left(\frac{1}{5}\right)^{th}$ that of the earth

142. The dimensions of self-inductance are:
a) $[MLT^{-2}A^{-2}]$ b) $[ML^2T^{-1}A^{-2}]$ c) $[ML^2T^{-2}A^{-2}]$ d) $[ML^2T^2A^{-1}]$

143. Which scientist experimentally proved the existence of electromagnetic waves?
a) Sir J.C. Bose b) Maxwell c) Marconi d) Hertz

144. Planck's constant (h), speed of light in vacuum (c) and Newton's gravitational constant (G) are three fundamental constants. Which of the following combinations of these has the dimension of length?
a) $\frac{\sqrt{hG}}{C^{3/2}}$ b) $\frac{\sqrt{hG}}{C^{5/2}}$ c) $\frac{\sqrt{hc}}{G}$ d) $\frac{\sqrt{Gc}}{h^{3/2}}$

145. If force (F), work (W) and velocity (υ) are taken as fundamental quantities, then the dimensional formula of time (T) is:
a) $[WF\upsilon]$ b) $[WF\upsilon^{-1}]$ c) $[W^{-1}F^{-1}\upsilon^{-1}]$ d) $[WF^{-1}\upsilon^{-1}]$

146. The numbers 2.745 and 2.735 on rounding off to 3 significant figures will give
a) 2.75 and 2.74 b) 2.74 and 2.73 c) 2.75 and 2.73 d) 2.74 and 2.74

147. The modulus of elasticity is dimensionally equivalent to:
a) strain b) force c) stress d) coefficient of viscosity

148. 1 unified atomic mass unit (1 u) is equal to :
a) 1.66 x 10^{-25} kg b) 1.66 x 10^{-27} kg c) 1.66 x 10^{-29} kg d) 1.66 x 10^{-31} kg

149. The least count of a stop watch is 0.1 sec. The time of 20 oscillations of the pendulum is found to be 20 sec. The percentage error in the time period is:
a) 0.25% b) 0.5% c) 0.75% d) 1.0%

150. In the formula X = 3 YZ^2, X and Z have dimensions of capacitance and magnetic induction respectively. The dimensions of Y in MKSQ system are
a) $[M^{-3}L^{-2}T^4Q^4]$ b) $[M^{-2}L^{-1}T^5Q^3]$ c) $[M^{-1}L^{-2}T^4Q^4]$ d) $[M^{-3}L^{-1}T^4Q^4]$

151. The equation of the stationary wave is:
$y=2A\sin\left(\frac{2\pi ct}{\lambda}\right)\cos\left(\frac{2\pi x}{\lambda}\right)$. Which of the following statements is wrong?
a) The unit of ct is same as that of λ b) The unit of x is same as that of λ
c) The unit of $2\pi c/\lambda$. is same as that of $2\pi x/\lambda t$
d) The unit of c/λ is same as that of x/λ

152. Assertion: When percentage errors in the measurement of mass and velocity are 1% and 2% respectively, the percentage error in K.E. is 5%.
Reason: $\frac{\triangle K}{K}=\frac{\triangle m}{m}+\frac{2\triangle v}{v}$
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

153. Dimension of resistance in an electric circuit in terms of dimensions of mass M, of length L, of time T and of current I, would be :
a) ML^2T^{-2} b) $ML^2T^{-1}I^{-1}$ c) $ML^2T^{-3}I^{-2}$ d) $ML^2T^3I^{-1}$

154. Newton/metre^2 is the unit of :
a) Energy b) Momentum c) Force d) Pressure

155. Classical physics does not include subjects like
a) mechanics b) light c) heat d) elementary particles

156. The dimensional formula for permeability II is given by:
a) $[MLT^{-2}A^{-2}]$ b) $[M^0L^{-1}T]$ c) $[M^0L^2T^{-1}A^2]$ d) none of these

157. Lightning was discovered by
a) Ohm b) Thomson c) Franklin d) Faraday

158. Which of the following statements is incorrect regarding significant figures?
   a) All the non-zero digits are significant.
   b) All the zeros between two non-zero digits are significant.
   c)
   Greater the number of significant figures in a measurement, smaller is the percentage error.
   d) The power of 10 is counted while counting the number of significant figures.

159. Which of the following relation is certainly wrong dimensionally?
   a) $h = \frac{1}{2}gt^2$ b) $h = \frac{v^2}{2g}$ c) $\lambda = vt$ d) $P = \frac{1}{3c^2/\rho}$

160. The mean time period of second's pendulum is 2.00 sand mean absolute error on the time period is 0.05 s. To express maximum estimate of error, the time period should be written as
   a) (2.00± 0.0l)s b) (2.00± 0.025)s c) (2.00± 0.05)s d) (2.00± 0.10)s

161. Henry/ohm can be expressed in
   a) Second b) Coulomb c) Mho d) Metre

162. If the size of bacteria is 1 micron, what will be the number of it in 1 m length?
   a) One hundred b) One crore c) One thousand d) One million

163. Who was awarded Nobel Prize for the theory of the unification of weak and electromagnetic interactions?
   a) Rutherford b) A. Salam c) H.J. Bhabha d) S. Chandrashekhar

164. Volt is equal to:
   a) c/q b) N/m^2 c) Joule/coulomb d) N-m ^{2}/coulomb

165. Niels Bohr gave his theory on the basis of:
   a) classical theory of helium atom b) classical theory of hydrogen atom
   c) quantum theory of helium atom d) quantum theory of hydrogen atom

166. When C, R and L represent general identity, then dimensions of C^2RL are:
   a) $[M^0L^0T^3A^0]$ b) $[ML^2T^3A^2]$ c) [ML TA] d) none of these

167. If force is proportional to square of velocity, then the dimensions of proportionality constant is:
   a) $[ML^{-1}T]$ b) $[ML^{-1}T^0]$ c) $[MLT^0]$ d) $[M^0LT^{-1}]$

168. Which of the following quantities measured from different inertial reference frames are same?
   a) Force b) Velocity c) Displacement d) Kinetic energy

169. An athlete in the olympic games covers a distance of 100 min 2s. His kinetic energy can be estimated to be in the range:
   a) 200J-500J b) 2x 10^5 J-3x10^5 J c) 20,000J - 50,000 J d) 2,000J - 5,000 J

170. If the acceleration due to gravity is represented by unity in a system of units and one second be the unit of time, the unit of length is:

a) 9.8 m b) 1 m c) 98 m d) 0.98 m

171. If F denotes force and t time, then in the equation F = at $^{-1}$ + bt^2, dimensions of a and b respectively are:
a) [LT^{-4}] and [LT^{-1}] b) [LT^{-1}] and [LT^{-4}] c) [MLT^{-4}] and [MLT^{-1}]
d) [MLT^{-1}] and [MLT^{-4}] e) [MLT^{-3}] and [MLT^{-2}]

172. The correct order in which the dimensions of length increases in the following quantities is:
(i) permittivity
(ii) resistance
(iii) magnetic permeability
(iv) stress
a) (i), (ii), (iii), (iv) b) (iv), (iii), (ii), (i) c) (i), (iv), (iii), (ii) d) (iii), (ii), (iv), (i)

173. Which of the following is a derived unit?
a) Unit of mass b) Unit of length c) Unit of time d) Unit of volume

174. The van der Waals' equation of state for some gases can be expressed as:
$\left(p + \frac{a}{V^2}\right)(V - b) = RT$ Where P is the pressure, V the molar volume and T is the absolute temperature of the given sample of gas, a, b and R constants. The dimensions of 'a' are:
a) [ML^5T^{-2}] b) [$ML^{-1} T^{-2}$] c) [L^3] d) [L^6]

175. The dimension of the ratio of angular to linear momentum is:
a) [M^0LT^0] b) [MLT^{-1}] c) [ML^2T^{-1}] d) [$M^{-1}L^{-1}T^{-1}$]

176. The dimensions of $\frac{e^2}{4\pi\varepsilon_0 hc}$ where e, ε_0 , h and care electronic charge, electric permittivity, Planck's constant and velocity of light in vacuum respectively:
a) [$M^0L^0T^0$] b) [ML^0T^0] c) [M^0LT^0] d) [M^0L^0T]

177. If physical quantity X is represented by X = $M^aL^bT^{-c}$ and the maximum percentage errors in M, L and T are $\alpha\%, \beta\% \quad and \quad \gamma\%$ respectively, then the total maximum percentage error in X is:
a) $(\alpha a + \beta b - \gamma c)\%$ b) $(\alpha a + \beta b + \gamma c)\%$ c) $(\alpha a - \beta b - \gamma c)\%$ d) none of these

178. The dimensional formula of entropy is identical to that of the:
a) universal gas constant b) coefficient of thermal conductivity
c) Boltzmann's constant d) Avogadro's number

179. The Richardson equation is given by I=$AT^2e^{-B/kt}$ The dimensional formula for AB^2 is same as that
a) IT^2 b) kT c) Ik^2 d) Ik^2/T

180. Assertion : The dimensional formula of surface energy is [$M^1L^2T^{-2}$].
Reason: Surface energy has same dimensions as that of potential energy.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

181. Which one of the following is not measured in units of energy?
a) Couple x angle turned through b) Moment of inertia x (angular velocity)^2
c) Force x distance d) Impulse x time

182. The unit of thermal conductivity is ____________.
a) $\mathrm{Jm^{-1}\,K^{-1}}$ b) $\mathrm{WmK^{-1}}$ c) $\mathrm{Wm^{-1}\,K^{-1}}$ d) $\mathrm{JmK^{-1}}$

183. Gauss is a unit of which of the following quantities?
a) H b) B c) ϕ d) I

184. The number of signification figure in 0.06900 is
a) 5 b) 4 c) 2 d) 3

185. A calorie is a unit of heat energy and its value is 4.18 J where 1 J = 1 kg m^2 s^{-2}. Suppose we use a new system of units in which unit of mass equals α kg, the unit of length equals β m and the unit of the time is γ sec. Then the value of a calorie in the new system of units is
a) $4.18\frac{\gamma^2}{\alpha\beta^2}$ b) $4.18\frac{\alpha\beta^2}{\gamma^2}$ c) $4.18\frac{\gamma^2}{\alpha}$ d) $4.18\frac{\beta^2}{\alpha\gamma^2}$

186. In International System of units, there are seven base quantities whose units are defined. Which physical quantity has a prefix with its unit?
a) Mass b) Thermodynamic temperature c) Luminous intensity
d) Amount of substance

187. If x = a^n, then fractional error $\frac{\Delta x}{x}$ is equal to:
a) $\pm\left(\frac{\Delta a}{a}\right)^n$ b) $\pm n\left(\frac{\Delta a}{a}\right)$ c) $\pm n\log_e\frac{\Delta a}{a}$ d) $\pm n\log\frac{\Delta a}{a}$

188. The energy of a system as a function of time t is given as E(t) = A^2 exp(-αt), where α = 0.2 s^{-1}. The measurement of A has an error of 1.25%. If the error in the measurement of time is 1.50%, the percentage error in the value of E(t) at t = 5 s is
a) 2% b) 4% c) 3% d) 5%

189. What is the length of the arc of a circle of radius 30 cm which subtend an angle $\frac{\pi}{6}$ at the centre?
a) 11.7 cm b) 14.7 cm c) 16.7 cm d) 15.7 cm

190. Out of the following the only pair that does not have identical dimensions is:
a) angular momentum and Planck's constant
b) moment of inertia and moment of a force c) work and torque

d) impulse and momentum

191. Dimensions of resistance in an electrical circuit, in terms of dimensions of mass M, of length L, time T and current I, would be ___________

a) $ML^2 T^{-2}$ b) $ML^2 T^{-1}I^{-1}$ c) $ML^2 T^{-3}I^{-2}$ d) $ML^2 T^{-3}I^{-1}$

192. Dimensional formula of self-inductance is _______.

a) $[MLT^{-2} A^{-2}]$ b) $[ML^2 T^{-1} A^{-2}]$ c) $[ML^2 T^{-2} A^{-2}]$ d) $[ML^2 T^{-2} A^{-1}]$

193. Measure of two quantities along with the precision of respective measuring instrument is A=2.5ms^{-1} ± 0.5 m s^{-1} B=0.10 s± 0.01ls The value of AB will be

a) (0.25 ± 0.08) m b) (0.25 ± 0.5) m c) (0.25 ± 0.05) m d) (0.25 ± 0.135) m

194. One barn is equal to :

a) 10^{-30} m^2 b) 10^{28} m^2 c) 10^{-28} m^2 d) 10^{30} m^2

195. Which of the following relations is dimensionally incorrect?

a) 1u = 931.5 MeV b) 1u = 931.5 MeV/c^2 c) 1u = 1.67x10^{-27} kg

d) None of these

196. The liquid drop of density ρ, radius r and surface tension σ oscillates with time period T. Which of the following expressions for T^2 is correct?

a) $\rho r^3/\sigma$ b) $\rho\sigma/r^3$ c) $r^3\sigma/\rho$ d) None of these

197. The dimension of a magnetic field in M, L, T and C (Coulomb) is given as:

a) $[MLT^{-1}C^{-1}]$ b) $[MT^2C^{-2}]$ c) $[MT^{-1}C^{-1}]$ d) $[MT^{-2}C^{-1}]$

198. A new unit of length is chosen such that the speed of light in vacuum is unity. What is the distance between the sun and the earth in terms of the new unit iflight takes 8 min and 20 s to cover this distance?

a) 300 b) 400 c) 500 d) 600

199. Which one of the following statements is incorrect?

a) Direct and indirect methods are used for the measurement of physical quantities.

b) Scientific notation and the prefixes are used to simplify numerical computation.

c) A dimensionally correct equation need not.be a correct equation

d) The SI units is based on six base units

200. Given that: $F=-\eta A\frac{dv}{dx}$, where F is force, A is area and $\frac{dv}{dx}$ is velocity gradient,then dimensional formula of η should be:

a) $[ML^{-1}T^{-1}]$ b) $[ML^{-1}T]$ c) $[ML^{-2}T^{-2}]$ d) $[ML^2T^{-1}]$

201. Checking the correctness of equations using the method of dimensions is based on

a) the type of system b) equality of inertial frames of references

c) principle of homogeneity of dimensions d) none of these

202. The mass of a body is 20.000 g and its volume is 10.00 cm^3. If the measured values are expressed up to the correct significant figures, the maximum error in the value of density is:

a) 0.001 g cm^{-3} b) 0.010 g cm^{-3} c) 0.100 g cm^{-3} d) none of these

203. The SI unit of momentum is :

a) $\frac{kg}{m}$ b) $\frac{kg.m}{sec}$ c) $\frac{kg.m^2}{sec}$ d) $kg \times Newton$

204. The dimensions of the quantity $\vec{E} \times \vec{B}$, where $\vec{E}$ represents the electric field and $\vec{B}$ the magnetic field may be given as :

a) $[MT^{-3}]$ b) $[M^2LT^{-5}A^{-2}]$ c) $[M^2LT^{-3}A^{-1}]$ d) $[MLT^{-2}A^{-2}]$

205. The potential energy of a particle varies with distance x from a fixed origin as V= $\left(\frac{A\sqrt{x}}{x+B}\right)$; where A and B are x + B constants. The dimensions of AB are:

a) $[ML^{5/2}T^{2}]$ b) $[ML^2T^{-2}]$ c) $[M^{3/2}L^{3/2}T^{-2}]$ d) $[ML^{7/2}T^{-2}]$

206. If the surface tension of a liquid is measured to be 0.06 N/m and absolute error is 0.0015 N/m. The percentage error in measurement of surface tension is

a) 4.5% b) 3.5% c) 2.5% d) 1.5%

207. If p is radiation pressure, c represents speed of light and Q represents radiation energy striking unit area per second, then non zero integers x, y, and z such that $P^xQ^yC^z$ zis dimensionless are:

a) x =1, y =1, z = -1 b) x =1, y = -1, z =1 c) x = -1, y = l, z = 1

d) x =1, y = l, z = 1

208. In the relation $V = \frac{\pi p r^4}{8\eta l}$, where the symbols have their usual meanings, the dimensions of V are

a) $[M^0L^3T^0]$ b) $[M^0L^3T^{-1}]$ c) $[M^0L^{-3}T]$ d) $[ML^3T^0]$

209. If the value of force is 100 N and value of acceleration is 0.001 ms^{-2} s, what is the value of mass in this system of units?

a) 10^3 kg b) 10^4 kg c) 10^5 kg d) 10^6 kg

210. Match the Column I with Column II.

Column-I		Column-II	
A)	Distance between earth and sun	(p)	Micron
B)	Interatomic distance in a solid	(q)	Fermi
C)	Size of a nucleus	(r)	Light year
D)	Wavelength of infrared laser	(s)	Angstrom

a) A - P. B - q, C - r, D - s b) A - r, B - s, C - q, D - P c) A - q, B - p, C - s, D - r

d) A - s, B - r, C - p, D - q

211. What is the SI unit of permeability?

a) Henry per metre b) Teslametre per ampere c) Weber per ampere metre

d) All the above units are correct

212. In an experiment, the percentage of error occurred in the measurement of physical quantities A, B, C and D are 1%, 2%, 3% and 4% respectively. Then the maximum percentage of error in the measurement X, where $X = \frac{A^2 B^{1/2}}{C^{1/3} D^3}$ will be

____

a) 16% b) -10% c) 10% d) $\left(\frac{3}{13}\right)$%

213. If the unit of force is 1 kilonewton, the length is 1 km and time 100 s, what will be the unit of mass?

a) 1,000 kg b) 1 kg c) 10,000 kg d) 100 kg

214. Dimensional formula of intensity of radiation is:

a) $[M^1L^2T^{-2}]$ b) $[M^1L^0T^3]$ c) $[M^1L^0T^{-3}]$ d) $[M^0L^2T^{-2}]$

215. Sir C.V. Raman's name is linked with the discovery of:

a) the theory of expansion of the universe b) structure of atom

c) scattering of light d) electricity

216. The values of two resistors are $R_1 = (6 \pm 0.3)k\Omega$ and $R_2 = (10 \pm 0.2)k\Omega$. The percentage error in the equivalent resistance when they are connected in parallel is :

a) 5.125% b) 2% c) 3.125% d) 7% e) 10.125%

217. Which of the following system of units is not based on unit of mass, length and time?

a) CGS b) FPS c) MKS d) SI

218. The ratio of one micron to one nanometre is

a) 10^3 b) 10^{-3} c) 10^{-6} d) 10^{-9}

219. Coefficient of thermal conductivity has the dimensions:

a) $[MLT^{-3}K^{-1}]$ b) $[ML^3T^3K^2]$ c) $[ML^3T^{-3}K^{-2}]$ d) $[M^2L^3T^{-3}K^2]$

220. Two resistors of resistances $R_1 = (300 \pm 3)\ \Omega$ and $R_2 = (500 \pm 4)\ \Omega$ are connected in series. The equivalent resistance of the series combination is :

a) $(800 \pm 1)\ \Omega$ b) $(800 \pm 7)\ \Omega$ c) $(200 \pm 7)\ \Omega$ d) $(200 \pm 1)\ \Omega$

221. The dimensions of R in the equation $Q = Q0(1-e^{-t/rc})$

a) $[ML^2T^{-3}A^{-2}]$ b) $[ML^2T^{-2}A^{-3}]$ c) $[M^2L^2T^{-3}A^{-2}]$ d) $[ML^2T^{-1}A^{-2}]$

222. The ratio of the volume of the atom to the volume of the nucleus is of the order of

a) 10^{10} b) 10^{15} c) 10^{20} d) 10^{25}

223. kWh is a unit of:

a) power b) energy c) force d) temperature

224. If momentum (p), area (A) and time (t) are taken to be fundamental quantities, then energy has the dimensional formula

a) $[p^1A^{-1}t^{-1}]$ b) $[p^2A^1t^1]$ c) $[p^1A^{-1/2}t^1]$ d) $[p^1A^{1/2}t^{-1}]$

225. An artificial satellite is revolving around a planet of mass M and radius R, in a circular orbit of radius r. From Kepler's third law about the period of a satellite around a common central body, square of the period of revolution T is proportional to the cube of the radius of the orbit r. So, dimensional formula for time period T is:

a) $T = \frac{K}{R}\sqrt{\frac{r^3}{g}}$ b) $T = \frac{K}{R^2}\sqrt{\frac{r}{g}}$ c) $T = \frac{K}{R}\sqrt{\frac{r^2}{g}}$ d) $T = \frac{K}{R^{3/2}}\sqrt{\frac{r}{g}}$

226. Dimensional formula of power is:

a) $[ML^2T^{-3}]$ b) $[ML^3T^{-2}]$ c) $[ML^2T^{-2}]$ d) $[ML^{-1}T^{-1}]$

227. Given that: $y = a\cos\left(\frac{t}{p} - qx\right)$, where t represents time in second and x represents distance in metre. Which of the following statements is true?
a) The unit of x is same as that of q b) The unit of x is same as that of p
c) The unit of I is same as that of q d) The unit of t is same as that of p

228. The dimensions of permittivity ε_0 are:
a) $[M^{-1}L^{-3}A^2T^4]$ b) $[M^{-1}L^3A^{-2}T^{-4}]$ c) $[M^{-1}L^{-1}A^2T^2]$ d) $[M^{-1}L^{-3}A^2T^{-4}]$

229. Which of the following functions of A and B may be performed if A and B possess different dimensions?
a) A+B b) A-B c) A/B d) A/e^{AB}

230. Electron-volt is a unit of:
a) charge b) potential c) energy d) coulomb repulsion

231. In the question number 71, what is the difference in the masses of the pieces?
a) 0.02 g b) 0.021 g c) 0.022 g d) 0.024 g

232. Einstein's name is associated with the discovery of:
a) nuclear model of atom b) neutron c) theory of relativity
d) expansion of the universe

233. Suppose refractive index μ is given as: $\mu = A + \frac{B}{\lambda^2}$ Where A and B are constants and λ, is the wavelength, then dimensions of B are same as that of:
a) wavelength b) volume c) pressure d) area

234. The dimensions of $(\mu_0\epsilon_0)^{\frac{-1}{2}}$ are ______
a) $\left[L^{1/2}\,T^{-1/2}\right]$ b) $\left[L^{-1}\,T\right]$ c) $\left[LT^{-1}\right]$ d) $\left[L^{-1/2}\,T^{1/2}\right]$

235. Which of the following group have different dimension?
a) Potential difference, emf, voltage b) Pressure, stress, Young's modulus
c) Heat, energy, work done d) Dipole moment, electric flux, electric field

236. The dimensional formula of magnetic flux is :
a) $[ML^2T^{-2}A^{-1}]$ b) $[ML^0T^{-2}A^{-2}]$ c) $[M^1L^2T^{-2}A^{-1}]$ d) $[ML^2T^{-1}A^3]$

237. Which of the following pairs of physical quantities does not have same dimensional formula?
a) Work and torque b) Angular momentum and Planck's constant.
c) Tension and surface tension d) Impulse and linear momentum.

238. If C, R, Land 1 denote capacity, resistance, inductance and electric current respectively, the quantities having the same dimensions of time are:
$(i)CR \quad (ii)L/R \quad (iii)\sqrt{LC} \quad (iv)LI^2$
a) (i) and (ii) b) (i) and (iii) c) (i) and (iv) d) (i), (ii) and (iii)

239. The density of mercury is 13600 kg-m^{-3}. Its value in CGS system will be:

a) 13.6 g-cm^{-3} b) 1360 g-cm^{-3} c) 136 g-cm^{-3} d) 1.36 g-cm^{-3}

240. **Assertion:** Electrons do not experience strong nuclear force.
Reason: Strong nuclear force is charge-independent force.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

241. The damping force on an oscillator is directly proportional to the velocity. The units of the constant of proportionality are:
a) kg s^{-1} b) kgs c) kg ms^{-1} d) kg ms^{-2}

242. The least count of Vernier callipers is 0.1 mm. The main scale reading, before the zero of the Vernier scale, is 10 and the zeroth division of the Vernier scale coincides with the main scale division. Given that each main scale division is 1 mm,the measured value should be expressed as:
a) 0.01 m b) 1 cm c) 1.0 cm d) 1.00 cm

243. If C and R denote capacitance and resistance respectively, then the dimensional formula of CR is ________
a) $[M^0 L^0 T]$ b) $[M^0 L^0 T^0]$ c) $[M^0 L^0 T^{-1}]$ d) Not expressible in terms of [MLT]

244. In superconductivity there is production of:
a) low magnetic fields b) medium magnetic fields c) ultra high magnetic fields
d) none of these

245. The time period of oscillation of a body is given by K : Represents the kinetic energy, m mass, g acceleration due to gravity and A is unknown. If [A] = $M^xL^yT^z$; then what is the value of x + y + z?
a) 3 b) 2 c) 1 d) 5

246. The length, breadth and thickness of a block are measured as 125.5 em, 5.0 em and 0.32 em respectively. Which one of the following measurements is most accurate measurement of?
a) length b) breadth c) thickness d) height

247. If the error in measuring the radius of the sphere is 2% and that in measuring its mass is 3%, then the error in measuring the density of material of the sphere is :
a) 5% b) 7% c) 9% d) 11%

248. The dimensions of a rectangle are measured with a scale of least count 1 mm. The length is measured as l = 12.20 cm and the breadth is measured as 16.00 cm, The area with uncertainity is :

a) (195.2 ± 1.0) cm^2 b) (195.5 ± 1.0) cm^2 c) (195.0 ± 1.5) cm^2
d) (195.5± 1.5) cm^2

249. Using dimensional analysis which of the following is correct (m is relativistic mass, mo is rest mass, V is the velocity of particle and c is the velocity of light)?
a) $m = \frac{m_0}{\sqrt{1-\frac{V^2}{C^2}}}$ b) $m = \frac{m_0}{\sqrt{1-V^2}}$ c) $m = \frac{m_0}{\sqrt{1-C^2V^2}}$ d) $m = \frac{m_0}{\sqrt{1-C^2}}$

250. Two resistors of resistances R_1 = (100 ± 3)Ω and R_2 = (200 ± 4)Ω are connected in parallel. The equivalent resistance of the parallel combination is :
a) (66.7 ± 1.8)Ω b) (66.7 ± 4.0)Ω c) (66.7 ± 3.0)Ω d) (66.7 ± 7.0) Ω

251. Sir c.v. Raman got Nobel Prize in physics for
a) refraction of light b) reflection of light c) scattering of light
d) dispersion of light

252. Two forces of 5 Nand 12 N simultaneously act on a particle. The net force on the particle is:
a) 17 N b) 12 N c) 13 N d) 7 N e) between 7 Nand 17 N

253. Assertion: Light year and wavelength have same dimensional formula.
Reason: Both have the dimensions of time.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

254. In Physics, unification means:
a) properties of a system and interactions of its constituents of simpler parts
b) manifestation of universal laws
c) physical phenomena in terms of a few concepts and laws d) both (b) and (c)

255. The dimensional formula of electric potential is
a) $[ML^2T^{-3}A^{-1}]$ b) $[M^{-1}L^{-2}T^{-2}A]$ c) $[M^{-1}L^2T^{-2}A^{-1}]$ d) $[ML^2T^{-2}A]$

256. Assuming that the mass m of the largest stone that can be moved by a flowing river depends upon the velocity v of the water, its density p and the acceleration due to gravity g. Then m is directly proportional to:
a) v^3 b) v^4 c) v^5 d) v^6

257. Given that: $\tan\theta = v^2/rg$ gives the angle of banking of the cyclist going round the curve. Here u is the speed of cyclist, r is the radius of the curve and g is the acceleration due to gravity. Which of the following statements about the relation is true?

a) It is both dimensionally as well as numerically correct.
b) It is neither dimensionally correct nor numerically correct.
c) It is dimensionally correct but not numerically.
d) It is numerically correct but not dimensionally.

258. If L and R denote inductance and resistance respectively then the dimensions of L/R are:
a) $[M^1L^0T^0Q^{-1}]$ b) $[M^0L^0TQ^0]$ c) $[M^0L^1T^{-1}Q^0]$ d) $[M^{-1}LT^0Q^{-1}]$

259. Length cannot be measured by:
a) fermi b) debye c) micron d) light year

260. The dimensional formula for angular momentum is ______
a) $[M^0 L^2 T^{-2}]$ b) $[ML^2 T^{-1}]$ c) $[MLT^{-1}]$ d) $[ML^2 T^{-2}]$

261. If C and R denote capacity and resistance respectively, the dimensions of CR are:
a) $[M^0L^0T^1]$ b) $[M^0L^2T^{-2}]$ c) $[M^0L^0T^{-2}]$ d) $[ML^0T^0]$

262. Unit of dipole moment is:
a) Amp-mt b) Cb-mt c) Amp-mt^2 d) Cb-mt^2

263. Match the Column I with Column II.

Column-I		Column-II	
A)	Conductance	p)	gray
B)	Magnetic induction	q)	lumen
C)	Absorbed dose	r)	tesla
D)	Luminous flux	s)	siemens

a) A - s, B - r, C - p, D - q b) A - p, B - q, C - r, D - s c) A- q, B - p, C - s, D - r
d) A - r, B - s, C - p, D - q

264. A dimensionless quantity
a) never has a unit b) always has unit c) may have a unit d) does not exit

265. What is the SI unit of electric field intensity?
a) Cm b) Vm^{-1} c) Am^{-1} d) NA

266. The unit of power is :
a) Joule b) Joule per second only c) Joule per second and watt both
d) Only watt

267. What is the value of a light year in terms of astronomical units?
a) 6.32 x 10^4 A.U. b) 5 x 10^2 A.U. c) 7 x 10^5 A.U. d) 5 x 10^6 A.U.

268. A physical quantity x depends on quantities y and z as follows: x = Ay + B tan Cz, where A, Band C are constants. Which of the following do not have the same dimensions?
a) x and B b) C and x^{-1} c) y and B/ A d) x and A

269. The heat generated in a circuit is given by H $=I^2$ Rt joule, where I is current, R is resistance and t is time. If the percentage errors in measuring I, Rand tare 2%, 1% and 1% respectively, the maximum percentage error in measuring the heat will be :
a) 2% b) 3% c) 4% d) 6%

270. The vernier scale of a travelling microscope has 50 divisions which coincide with 49 main scale divisions. If each main scale division is 0.5 mm, then the least count of the microscope is :
a) 0.01 cm b) 0.5 mm c) 0.01 mm d) 0.5 cm

271. A quantity X is defined by the equation: $X = 3CB^2$, where C is capacitance in farad and B represents magnetic field in tesla. The dimensions of X are:
a) $[ML^{-2}]$ b) $[ML^{-2}T^{-2}A]$ c) $[ML^{-2}T^{-2}A^2]$ d) $[L^{-1}A^{-1}]$

272. The mean length of an object is 5 cm. Which of the following measurements is most accurate?
a) 4.9 cm b) 4.805 cm c) 5.25 cm d) 5.4 cm

273. Assertion: A dimensionally wrong or inconsistent equation must be wrong.
Reason: A dimensionally consistent equation is an exact or a correct equation.
a) If both assertion and reason are false
b)
If both assertion and reason are true and reason is the correct explanation of assertion.
c)
If both assertion and reason are true but reason is not the correct explanation of assertion
d) If assertion is true but reason is false.

274. Matter is mostly electrically neutral because:
a) net charge is constant b) net charge is maximum c) net charge is minimum
d) net charge is zero

275. A spherometer has a least count of 0.005 mm and its head scale is divided into 200 equal divisions. The distance between consecutive threads on the spherometer screw is:
a) 0.005 mm b) 1.0 mm c) 1.0 cm d) 0.0025 mm

276. The correct unit of thermal conductivity is:
a) joule m^{-2} sec^{-1} $(^0C)^{-1}$ b) joule m^{-1} sec^{-1} $(^0C)^{-2}$ c) joule-sec
d) joule metre $^{-1}$ sec^{-1} $(^0C)^{-1}$

277. The order of magnitude of the diameter of the earth is (Diameter of the earth is 1.28 x 10^7m)
a) 5 b) 6 c) 7 d) 8

278. The relative density of a material is found by weighing the body first in air and then in water. If the weight in air is (10.0 ± 0.1)gm and weight in water is (5.0 ± 0.1)gm then the maximum permissible percentage error in relative density is:
a) 1% b) 2% c) 3% d) 5%

279. The velocity v of a particle at time t is given by $v = at + \frac{b}{t+c}$ where a, b and c are constant. The dimensions of a, b and c are respectively __________
a) $\mathrm{L^2, \ T \ and \ LT^2}$ b) $\mathrm{LT^2, LT \ and \ L}$ c) $L, LT\ and\ T^2$ d) $\mathrm{LT^{-2}, \ L}\ and\ \mathrm{T}$

280. Force (F), velocity (I) and time (Z) are taken as fundamental units, then the dimensions of mass are ________.
a) $[\mathrm{FVT^{-1}}]$ b) $[\mathrm{FVT^{-2}}]$ c) $[\mathrm{FV^{-1}\ T^{-1}}]$ d) $[\mathrm{FV^{-1}\ T}]$

281. The period of oscillation of a simple pendulum is T = $2\pi\sqrt{\frac{L}{g}}$ Measured value of L is 10 cm known to 1 mm accuracy and time for 100 oscillations of the pendulum is found to be 50 s using a wrist watch of 1 s resolution. What is the accuracy in the determination of g?
a) 2% b) 3% c) 4% d) 5%

282. Which of the following has the dimension of pressure?
a) $\frac{ML}{T^2}$ b) $\frac{M}{(L^2T^2)}$ c) $\frac{M}{(LT^2)}$ d) $\frac{M}{(LT)}$

283. The dimensional formula of Young's modulus is:
a) $[ML^2T^{-2}]$ b) $[ML^{-1}T^{-2}]$ c) $[MLT^{-3}]$ d) none of these

284. Wavelength of ray of light is 0.00006 m. It is equal to:
a) 6 microns b) 60 microns c) 600 microns d) 0.6 microns

285. If the velocity of light is taken as the unit of velocity and one year is taken as the unit of time, what is the unit of length?
a) 10^{14} m b) 9.46 x 10^{15} m c) 9.46 x 10^{13} m d) 9.46 x 10^{13} cm

286. The range of masses we study in Physics is
a) 10^{-27} kg to 10^{60} kg b) 10^{-27} kg to 10^{55} kg c) 10^{-30} kg to 10^{55} kg
d) 10^{-30} kg to 10^{60} kg

287. Assertion: The number 1.202 has four significant figures and the number 0.0024 has two significant figures.
Reason: All the non zero digits are significant.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

288. The energy (E), angular momentum (L) and universal gravitational constant (G) are chosen as fundamental quantities. The dimensions of universal gravitational constant in the dimensional formula of Planck's constant (h) is:

a) zero b) -1 c) $\frac{5}{3}$ d) 1

289. You measure two quantities as A = 1.0 m ± 0.2 m, B = 2.0 m ± 0.2 m. We should report correct value for $\sqrt{AB}$ as

a) 1.4 m ± 0.4 m b) 1.41 m ± 0.15 m c) 1.4 m ± 0.3 m d) 1.4 m ± 0.2 m

290. $[ML^2T^{-3}]$ represents the dimensions of:

a) pressure b) energy c) power d) force

291. Which of the following is not a branch of physics?

a) Mechanics b) Optics c) Cytogenetics d) Electrodynamics

292. The force F on a sphere of radius 'a' moving in a medium with velocity 'v' is five by F = $6\pi\eta a v$. The dimensions of η are :

a) $[ML^{-3}]$ b) $[ML^{-2}]$ c) $[ML^{-1}]$ d) $[ML^{-1}T^{-1}]$

293. If E, m, l and G denote energy, mass, angular momentum and gravitational constant respectively the quantity $\left(\frac{El^2}{m^5G^2}\right)$ has the dimensions of

a) mass b) length c) time d) angle

294. **Assertion:** The acceleration due to gravity on the moon is one-sixth that on the earth.

Reason: The law of gravitation is the same on both the moon and the earth.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

295. Which of the following statements is incorrect regarding mass?

a) It is a basic property of matter. b) The SI unit of mass is kg

c) The mass of an atom is expressed in u.

d) It depends upon the temperature, pressure or location of the object in space.

296. Assertion: The units of some physical quantities can be expressed as combination of the base units.

Reason: We need only a limited number of units for expressing the derived physical quantities.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

297. The unit of Stefan's constant σ is :
a) $Wm^{2}K^{-4}$ b) $Wm^{-2}K^{-4}$ c) $Wm^{-2}K^{4}$ d) $Wm^{-2}K^{-1}$

298. The number of particles crossing the unit area perpendicular to the x-axis per unit time is given by: $N = -D\left(\frac{n_2 - n_1}{x_2 - x_1}\right)$, where n_1 and n_2 are the numbers of particles per unit volume for the values of x meant to be x_1 and x_2 respectively. What is the dimensional formula for the diffusion constant D?
a) $[M^0LT^2]$ b) $[M^0L^2T^4]$ c) $[M^0LT^{-3}]$ d) $[M^0L^2T^{-1}]$

299. Which of the following have same dimensions?
a) Pressure and density b) Gravitational potential and energy
c) Impulse and momentum d) Stress and strain

300. Which one of the following physical quantities is not a fundamental quantity?
a) Luminous intensity b) Thermodynamic temperature c) Electric current
d) Work

301. Which of the following is not represented in correct unit :
a) $\frac{Stress}{Strain}$ = N/m^2 b) Surface tension = N/m c) Energy = $kg\text{-}m^2/s^2$
d) Pressure = N/m^2

302. **Assertion:** A stone and a feather dropped from the same height do not reach the ground at the same time.
Reason: Acceleration due to gravity is dependent on the mass of the object.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

303. Dimensional formula of ΔQ, heat supplied to the system is
a) $[ML^2T^{-2}]$ b) $[MLT^{-2}]$ c) $[ML^2T^{-1}]$ d) $[MLT^1]$

304. If M = mass, L = length, T = time and I = electric current, then the dimensional formula for electrical resistance R is given by:

a) $[R] = [M^1L^2T^{-3}I^{-2}]$ b) $[R] = [M^1L^2T^3I^2]$ c) $[R]= [M^1L^2T^{-3}I^{-2}]$ d) $[R]=[M^1L^2T^1I^2]$
e) $[R]= [M^{-1}L^2T^{-3}I^{-2}]$

305. Match the Column I with Column II

Column-I (Physical quantity)		Column-II (Dimensional formula)	
A)	Permittivity of free space	(p)	$[M^0L^0T^{-1}]$
B)	Radiant flux	(q)	$[ML^3T^{-3}A^{-2}]$
C)	Resistivity	(r)	$[ML^2T^{-3}]$
D)	Hubble constant	(s)	$[M^{-1}L^{-3}T^4A^2]$

a) A - P. B - q, C - r; D - s b) A - q, B - P. C - s, D - r c) A - s, B - r, C - q, D - P
d) A - r, B - s, C - p, D - q

306. Who was the first to introduce the concept of antiparticle theoretically?
a) Niels Bohr b) Ernest Rutherford c) Albert Einstein d) Paul Dirac

307. Assertion: Light year is the distance that light travels with velocity of 3×10^8 m s^{-1} in one year.
Reason: Light year is the unit for measuring time.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

308. SI unit of radioactivity is:
a) Rutherford b) Roentgen c) Becqueral d) Curie

309. SI unit of magnetic flux is:
a) tesla b) oersted c) weber d) gauss

310. A particle is moving in a circle of radius 'r' with a constant speed 'v'. The change in velocity after the particle has traveled a distance equal to (1/8) of the circumference of the circle is:
a) 0.125 v b) 0.500 v c) 0.765 v d) zero

311. Which of the following units is used to measure the radius of nucleus?
a) Micron b) Nanometer c) Angstrom d) Femtometer

312. Turpentine oil is flowing through a tube of length l and radius r. The pressure difference between the two ends of the tube is p. The viscosity of oil is given by
$h = \frac{p(r^2-x^2)}{4vl}$ where v is the velocity of oil at distance x fiom the axis of the tube.
The dimensions of h are ___________
a) $[M^0 L^0 T^0]$ b) $[MLT^{-1}]$ c) $[ML^2 T^{-2}]$ d) $[ML^{-1} T^{-1}]$

313. Why is it wrong to express 10^6 km as Mkm?
a) M is not the symbol for 10^6
b) Use of double prefixes is conventionally prohibited
c)
Symbols for the units other than commemorating great scientists are not written as capital letters
d) Because of some reason other than those mentioned above

314. If force (F), length (L), current (I) and time (T)are taken as bases then the dimensions of ε_0 are:
a) $[FL^2I^2T^{-2}]$ b) $[F^{-1}L^2I^2T^2]$ c) $[F^{-1}L^{-2}I^2T^2]$ d) $[F^2L^2I^2T^2]$

315. The mass of an object is 0.074 kg and its volume is 290 cm 3. Its density is expressed to the correct significant figures (with rounding off) will be :
a) 0.255 g / cm^3 b) 0.26 g / cm^3 c) 0.25 g / cm^3 d) 0.15 g / cm^3

316. The dimensional formula for latent heat is:
a) $[M^0L^2T^{-2}]$ b) $[MLT^{-2}]$ c) $[ML^2T^{-2}]$ d) $[ML^2T^{-1}]$

317. Which of the following does not depict the correct link between technology and physics?

a)

Fusion test reactor	Magnetic confinement of plasma

b)

Photocell	Photoelectric effect

c)

Rocket propulsion	Laws of thermodynamics

d)

Optical fibres	Total internal reflection of light

318. 10^{-3} gram is called
a) kilogram b) milligram c) decigram d) microgram

319. Dimensional analysis can be used to derive formulae:
a) containing trigonometrical functions b) containing exponential functions
c) containing logarithmic functions d) none of the above

320. Which of the following relations for the displacement of a particle undergoing simple harmonic motion is not correct dimensionally?
a) $y = a\sin\frac{2\pi t}{T}$ b) $y = a\cos\omega t$ c) $y = \frac{a}{T}\sin\left(\frac{t}{a}\right)$ d) $y = a\sqrt{2}\left(\sin\frac{2\pi t}{T} + \cos\frac{2\pi t}{T}\right)$

321. The dimensional formula of physical quantity is $[M^a L^b T^c]$. Then that physical quantity is :
a) surface tension if a = 1, b = 1, c = -2 b) force if a = 1, b = 1, c = 2
c) angular frequency if a = 0, b = 0, c =-1 d) spring constant if a = 1, b = -1, c = -2

322. If the value of atmospheric pressure is 10^6 dyne cm^{-2}, its value in SI units is :
a) 10^4 N m^{-2} b) 10^6 N m^{-2} c) 10^5 Nm^{-2} d) 10^3 N m^{-2}

323. The length and breadth of a rectangular sheet are 16.2 cm and 10.1 cm, respectively. The area of the sheet in appropriate significant figures and error is
a) 164 ± 3 cm^2 b) 163.62 ± 2.6 cm^2 c) 163.6 ± 2.6 cm^2 d) 163.62 ± 3 cm^2

324. Which of the following is not a unit of time?
a) Parsec b) Year c) Second d) Hour

325. The dimensions of mobility of charge carriers are:
a) $[M^{-2}T^2 A]$ b) $[M^{-1} T^2 A]$ c) $[M^{-2}T^3 A]$ d) $[M^{-1}T^3 A]$ e) $[M^{-1}T^2 A^{-1}]$

326. The dimensional formula for permeability of free space μ_o is ____________
a) $[MLT^{-2} A^{-2}]$ b) $[ML^{-1} T^2 A^{-2}]$ c) $[ML^{-1} T^2 A^2]$ d) $[MLT^{-2} A^{-1}]$

327. If velocity of light c, Planck's constant hand gravitational constant G are taken as fundamental quantities then the dimensions of length will be :
a) $\sqrt{\frac{ch}{G}}$ b) $\sqrt{\frac{hG}{c^5}}$ c) $\sqrt{\frac{hG}{c^3}}$ d) $\sqrt{\frac{hc^3}{G}}$

328. Volt/metre is the unit of :
a) Potential b) Work c) Force d) Electric field intensity

329. One second is defined as :
a) 1650763.73 periods of krypton clock b) 652189.6 periods of krypton clock
c) 1650763.73 periods of cesium clock d) 9192631770 periods of cesium clock

330. Which of the following readings taken by microscope of least count 0.00 I cm is correct?
a) 3.28 b) 3.00 c) 3.000 d) 0.02345

331. The length and breadth of a rectangle are (5.7 ± 0.1) cm and (3.4 ± 0.2) cm. The area of rectangle with error limits is approximately:
a) (19.4 ± 1)cm^2 b) (19.4 ± 2) cm^2 c) (19.4±2.5)cm^2 d) (19.4±1.5)cm^2

332. The unit of surface tension in SI system is :
a) $\frac{Dyne}{cm^2}$ b) I = Qt = [Q] [T] = $[M^0L^0T^{-l}Q]$ c) Dyne/cm d) Newton/m^2

333. If the unit of force is 100 N, unit of length is 10 m and unit of time is 100 s, what is the unit of mass in this system of units?
a) 10^5 kg b) 10^7 kg c) 10^2 kg d) 10^9 kg

334. SI unit of pressure is :
a) Pascal b) Dynes/cm^2 c) cm of Hg d) Atmosphere

335. Magnetic field is measured by:
a) weber b) henry c) weber-(metre)^2 d) weber/(metre)^2

336. The dimensions of capacitance are:
a) $[ML^{-2}T^2Q^{-2}]$ b) $[M^{-1}L^2T^{-2}Q^2]$ c) $[M^{-1}L^{-2}T^{-2}Q^2]$ d) $[M^{-1}L^{-2}T^2Q^2]$

337. The dimension of $\frac{1}{2}\varepsilon_0 E^2$, where ε_0 is permittivity of free space and E is electric field, is :
a) ML^2T^{-2} b) $ML^{-1}T^{-2}$ c) ML^2T^{-1} d) MLT^{-1}

338. While measuring the acceleration due to gravity by a simple pendulum, a student makes a positive error of 1% in the length of the pendulum and a negative error of 3% in the value of time period. His percentage error in the measurement of g by the relatio $G = 4\pi^2(l/T^2)$ will be:
a) 2% b) 4% c) 7% d) 10%

339. In which year SI system of units was developed and recommended by General Conference on Weights and Measures?
a) 1951 b) 1961 c) 1971 d) 1981

340. Given that M is the mass suspended from a spring of force constant K. The dimension of the formula for $(M/K)^{1/2}$ is same as that for:
a) frequency b) time period c) velocity d) wavelength

341. Pick out the correct statements about the strong nuclear force from the following.
S1: It is charge independent.
S2: It is the strongest force in nature.
S3: Its range is very large.
S4: It is responsible for the stability of nuclei.
a) S1 and S3 b) S1, S2 and S3 c) S1, S2 and S4 d) S2 and S3

342. The dimensions of light year are:
a) $[L^{-1}]$ b) $[T^{-1}]$ c) [L] d) [T]

343. A body of mass m = 3.513 kg is moving along the x-axis with a speed of 5.00 ms^{-1}. The magnitude of its momentum is recorded as:
a) 17.6 kg ms^{-1} b) 17.565 kg ms^{-1} c) 17.56 kg ms^{-1} d) 17.57 kg ms^{-1}

344. In an experiment four quantities a, b, c and d are measured with percentage error 1%, 2%, 3% and 4% respectively. Quantity P is calculated as follows:
$P = \frac{a^3b^2}{cd}$ Percentage error in P is :
a) 14% b) 10% c) 7% d) 4%

345. The SI unit of pressure gradient is
a) N m^{-2} b) N m c) N m^{-1} d) N m^{-3}

346. Which of the following sets of quantities have same dimensional formulae?
a) Frequency, angular frequency and angular momentum
b) Surface tension, stress and spring constant
c) Acceleration, momentum and retardation
d) Thermal capacity, specific heat and entropy e) Work, energy and torque

347. In which year did Hahn and Meitner discover the phenomenon of neutron -induced fission of uranium?
a) 1938 b) 1950 c) 1945 d) 1928

348. To find the distance d over which a signal can be seen clearly in foggy conditions, a railways engineer uses dimensional analysis and assumes that the distance depends on the mass density p of the fog, intensity (power/area) S of the light from the signal and its frequency v. The engineer finds that d is proportional to $s^{1/n}$. The value of n is :

a) 4 b) 2 c) 3 d) 1

349. The unit of the Stefan-Boltzmann's constant is _______________

a) $W/m^2 K^4$ b) W/m^2 c) $W/m^2 K$ d) $W/m^2 K^2$

350. The dimensions of emf in MKS is:

a) $[ML^{-1}T^{-2}Q^{-2}]$ b) $[ML^2T^{-2}Q^{-2}]$ c) $[MLT^{-2}Q^{-1}]$ d) $[ML^2T^{-2}Q^{-1}]$

351. **Assertion:** If we perform an experiment in our laboratory today and repeat the same experiment on the same objects under identical conditions after a year, the results are found to be the same.

Reason: The laws of nature do not change with time.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

352. If we choose velocity V, acceleration A and force F as the fundamental quantities, then the angular momentum in terms of V, A and F would be:

a) $[FA^{-1}V]$ b) $[FV^3 A^{-2}]$ c) $[FV^2A^{-1}]$ d) $[ML^2T^{-1}]$

353. A body travels uniformly a distance of (13.8 ± 0.2) m in a time (4.0 ± 0.3) s. Its velocity with error limits is :

a) (3.5 ± 0.6) m s^{-1} b) (3.5 ± 0.3) m s^{-1} c) (6.1 ± 0.6) m s^{-1} d) (6.1 ± 0.3) m s^{-1}

354. The dimension of coefficient of viscosity is:

a) $[ML^{-1}T^{-1}]$ b) $[MLT^{-2}]$ c) $[ML^0T^{-2}]$ d) $[MLT^{-1}]$

355. The velocity 'v' of a particle at time t is given by v = at + [b/(t + c)], where a, b, c are constants then dimensions of a, b, c are respectively :

a) L^2,T and LT^2 b) LT^2,LT and L c) L, LT and T^2 d) LT^2, L and T

356. Which of the following statements is not correct regarding conservation laws?

a) A conservation law is a hypothesis based on observations and experiments.

b) Conservation laws do not have a deep connection with symmetries of nature.

c) A conservation law cannot be proved.

d)
Conservation of energy, linear momentum, angular momentum are considered to be fundamental laws of physics.

357. Which one of the following instruments is not used for the measurement of length?
a) Atomic clock b) Vernier callipers c) Screw gauge d) Spherometer

358. The relative density of a material is found by weighing it first in air and then in water. If W_a =(10.0± 0.1)g and W_w = (5.00 ± 0.I)g , the % error in relative density is :
a) 5 b) 10 c) 2.5 d) 7.5

359. Dimensional formula of capacitance is :
a) $[M^{-1}L^{-2}T^4A^2]$ b) $[ML^2T^4A^2]$ c) $[MLT^{-4}A^2]$ d) $[M^{-1}L^{-2}T^{-4}A^{-2}]$

360. The unit of electric field is not equivalent to:
a) $\frac{J}{C}$ b) $\frac{J}{Cm}$ c) $\frac{V}{m}$ d) $\frac{N}{C}$

361. In the relation: $\mathrm{y} = \mathrm{a}\ \cos(\omega t + kx)$, the dimensional formula for Kx is same as that of:
a) a/ω b) a/y c) $\omega t/a$ d) $ya/\omega t$

362. A cube has a side of length 1.2 $\times$ 10^{-2} m. Calculate its volume :
a) 1.728 x 10^{-6} m^3 b) 1.73 x 10^{-6} m^3 c) 1.70 x 10^{-6} m^3 d) 1.732 x 10^{-6} m^3

363. The dimensional formula for Boltzmann's constant is:
a) $[ML^2T^{-2}\theta^{-1}]$ b) $[ML^2T^{-2}]$ c) $[ML^0T^{--2}\theta^{-1}]$ d) $[ML^{-2}T^{--1}\theta^{-1}]$

364. If energy (E), velocity (υ) and time (T) were chosen as fundamental physical quantities for measurement, then the dimensional formula for mass will be:
a) $[E]^1[\upsilon]^2\ [T]^1$ b) $[E]^2[\upsilon]^{-2}[T]^0$ c) $[E]^1[\upsilon]^{-2}[T]^0$ d) $[E]^{-1}[\upsilon]^2[T]^1$

365. Which of the following statements is incorrect?
a) Bohr gave theory of hydrogen atom and Yukawa, the theory of nuclear forces.
b) Law of gravitation was discovered by Newton and principle of inertia by Galileo.
c)
Laws of photoelectric effect were discovered by Einstein and laws of electromagnetic induction by Faraday.
d)
Neutron was discovered by J.J. Thomson and electron was discovered by James Chadwick.

366. Assertion: When we change the unit of measurement of a quantity, its numerical value changes.
Reason: Smaller the unit of measurement smaller is its numerical value.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

367. The ratio of the dimension of Planck's constants and that of the moment of inertia is the dimension of ___________

a) time b) frequency c) angular momentum d) velocity

368. A cube has numerically equal volume and surface area. The volume of such a cube is:

a) 216 units b) 1000 units c) 2000 units d) 3000 units

369. How many wavelengths of Kr^{86} are there in one metre?

a) 1553164.I3 b) 1650763.73 c) 2348123.73 d) 652189.63

370. **Assertion:** In physics, we attempt to derive the properties of a bigger, more complex system from the properties and interactions of its constituent simpler parts.

Reason: This approach is called unification and is at the heart of physics.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

371. Which year was declared as International Year of Physics?

a) 2002 b) 2003 c) 2005 d) 2007

372. If V denotes the potential difference across the plates of a capacitor C, the dimensions of CV^2 are:

a) not expressible in [MLT] b) $[MLT^{-2}]$ c) $[M^2LT^{-1}]$ d) $[ML^2T^{-2}]$

373. In the expression $P = El^2 m^{-5} G^{-2}$, whose E, m, I and G denote energy, mass, angular momentum and gravitational constant respectively, the dimensions of physical quantity P are:

a) $[MLT^0]$ b) $[M^2LT^{-1}]$ c) $[M^0L^0T^0]$ d) $[M^0LT^{-2}]$

374. A physical quantity of the dimensions of length that can be formed out of c, G and $\frac{e^2}{4\pi\varepsilon_0}$ is : [c is velocity of light, G is universal constant of gravitation, e is charge]

a) $e^2\left[G\frac{e^2}{4\pi\varepsilon_0}\right]^{1/2}$ b) $\frac{1}{c^2}\left[\frac{e^2}{G4\pi\varepsilon_0}\right]^{1/2}$ c) $\frac{1}{c^2}G\frac{e^2}{4\pi\varepsilon_0}$ d) $\frac{1}{c^2}\left[G\frac{e^2}{4\pi\varepsilon_0}\right]^{1/2}$

375. Of the following quantities, which one has dimension different from the remaining three?

a) Energy per unit volume b) Force per unit area

c) Product of voltage and charge per unit volume d) Angular momentum

376. The SI unit of pole strength is:

a) Am^2 b) Am c) Am^{-1} d) Am^{-2}

377. A student writes the escape velocity as: $v_c = \sqrt{\frac{GM}{R^2}}$ The equation is:
a) dimensionally incorrect b) dimensionally correct c) numerically correct
d) both (a) and (c)

378. With usual notation, amongst the following, the one which does not represent the dimensions of time is:
a) $\frac{L}{R}$ b) RC c) $\sqrt{LC}$ d) $\frac{1}{\sqrt{LC}}$

379. A student when discussing the properties of a medium (except vacuum) writes: velocity of light in vacuum = velocity of light in medium. This formula is:
a) dimensionally correct b) dimensionally incorrect c) numerically incorrect
d) both (a) and (c)

380. Which of the following units denotes the dimensions $[ML^2/Q^2]$, where Q denotes the electric charge?
a) weber (Wb) b) Wb/m^2 c) henry (H) d) H/m^2

381. The sun's angular diameter is measured to be 1920". The distance of the sun from the earth is 1.496×10^{11}m. What is the diameter of the sun?
a) 1.39×10^9m b) 1.39×10^{10}m c) 1.39×10^{11}m d) 1.39×10^{12}m

382. Two quantities A and Bhave different dimensions. Which mathematical operation may be physically meaningful:
a) A/B b) A + B c) A - B d) A = B

383. Which of the following is the name of a physical quantity?
a) Parsec b) Fermi c) Energy d) Light year

384. The dimensional formula for kinetic energy is:
a) $[M^2L^2T]$ b) $[ML^2T^{-2}]$ c) $[M^0L^{-1}]$ d) $[ML^2T]$

385. The accuracy of a clock is one part in 10^{10}. The maximum difference between two such clocks operating for 10^{10} seconds is:
a) 1 s b) 5 s c) 10 s d) 10^{10} s

386. If P, Q, R are physical quantities, having different dimensions, which of the following combinations can never be a meaningful quantity?
a) $\frac{(P-Q)}{R}$ b) PQ - R c) $\frac{PQ}{R}$ d) $\frac{(PR-Q^2)}{R}$

387. Two India born American scientists who were awarded Nobel Prize are:
a) S. Bose and Narlikar b) E.C.G. Sudarshan and Bhagwantam
c) C.V. Raman and H.J. Bhabha d) S. Chandrashekhar and A. Salam

388. If the error in the measurement of radius of a spherc is 2%, then the error in the determination of volume of the sphere will be ___________.
a) 45 b) 6% c) 8% d) 2%

389. Which of the following is unitless quantity?

a) Pressure gradient b) Displacement gradient c) Force gradient
d) Velocity gradient

390. Solar constant may be defined as the amount of solar energy received per em 2 per minute. The dimensions of solar constant is:
a) $[ML^{2}T^{-3}]$ b) $[ML^{0}T^{-1}]$ c) $[ML^{0}T^{-2}]$ d) $[M^{1}L^{0}T^{-3}]$

391. The sum of the numbers 436.32, 227.2 and 0.301 in appropriate significant figures i
a) 663.821 b) 664 c) 663.8 d) 663.82

392. Which of the following is the smallest unit?
a) millimetre b) angstrom c) fermi d) metre

393. Rocket propulsion is based on the principle of:
a) nuclear fusion b) nuclear fission c) Newton's laws of motion
d) thermodynamics

394. If $V = \sqrt{\frac{\gamma P}{\rho}},$ then dimensions of γ are:
a) $[M^{0}L^{0}T^{0}]$ b) $[M^{0}L^{0}T^{-1}]$ c) $[M^{1}L^{0}T^{0}]$ d) $[M^{0}L^{1}T^{0}]$

395. Which of the following physical quantities has neither units nor dimensions?
a) Relative velocity b) Relative density c) Angle d) Energy

396. The respective number of significant figures for the numbers 6.320, 6.032, 0.0006032 are
a) 3,4,8 b) 4,4,8 c) 4,4,4 d) 4,3,4

397. What is the range of the gravitational force?
a) 10^{-2} m b) 10^{-15} m c) Infinite d) 10^{-10} m

398. The relative density of lead is 11.3. Its density in SI unit is
a) 1.13×10^{3} b) 1.13×10^{2} c) 1.13×10^{4} d) 11.3

399. The frequency of vibration f of a mass m suspended from a spring of spring constant k is given by a relation of the type $f = Cm^{x}k^{y}$, where C is a dimensionless constant. The values of x and y are _____________
a) $x = \frac{1}{2}, y = \frac{1}{2}$ b) $x = -\frac{1}{2}, y = -\frac{1}{2}$ c) $x = \frac{1}{2}, y = -\frac{1}{2}$ d) $x = -\frac{1}{2}, y = \frac{1}{2}$

400. **Assertion:** The basic laws of electromagnetism govern all electric and magnetic phenomena.
Reason: The attempts to unify fundamental forces of nature reflect the quest for unification.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false.   d) If both assertion and reason are false.

Ravi Maths Tuition Centre

Time : 180 Mins **KINEMATICS' 1** **Marks : 546**

1. If the body is moving in a circle of radius r with a constant speed v, its angular velocity is:
   a) $\frac{v^2}{r}$ b) vr c) $\frac{v}{r}$ d) $\frac{r}{v}$
2. If a particle moves in a circle describing equal angles in equal times, its velocity vector:
   a) Remains constant b) Changes in magnitude c) Changes in direction
   d) Changes both in magnitude and direction
3. If the velocity of a particle is $u = At + Bt^2$, where A and B are constants, then the distance travelled by it between 1 s and 2 s :
   a) A/2 + B/3 b) 3/2A + 4B c) 3A + 7B d) 3/2A + 7/3B
4. A particle of unit mass undergoes one dimensional motion such that its velocity varies according to $u(x) = \beta x^{-2n}$, where β and n are constants and x is the position of the particle. The acceleration of the particle as a function of x is given by:
   a) $-2\beta^2 x^{2n+1}$ b) $-2n\beta^2 e^{-4n+1}$ c) $-2n\beta^2 x^{2n-1}$ d) $-2n\beta^2 x^{-4n-1}$
5. A stone falls freely under gravity. It covers distances h_1, h_2 and h_3 in the first 5 seconds, the next 5 seconds and the next 5 seconds respectively. The relation between h_1, h_2 and h_3 is :
   a) $h_1 = 2h_2 = 3h_3$ b) $h_1 = \frac{h_2}{3} = \frac{h_3}{5}$ c) $h_2 = 3h_1$ and $h_3 = 3h_2$ d) $h1 = h_2 = h_3$
6. A particle covers half of its total distance with speed u_1 and the rest half distance with speed u_2 Its average speed during the complete journey is :
   a) $\frac{v_1 v_2}{v_1+v_2}$ b) $\frac{2v_1 v_2}{v_1+v_2}$ c) $\frac{2v_1 v_2^2}{v_1^2+v_2^2}$ d) $\frac{v_1+v_2}{2}$
7. A boy standing at the top of a tower of 20m height drops a stone. Assume $g = 10\ m/s^2$, the velocity with which it hits the ground is :
   a) 10.0 m/s b) 20.0 m/s c) 40.0 m/s d) 5.0 m/s
8. A man of 50 kg mass is standing in a gravity free space at height of 10m above the floor. He throws a stone of 0.5 kg mass downwards with speed of 2 m/s. When the stone reaches the floor the distance of the man above the floor will be :
   a) 9.9 m b) 10.1 m c) 10.0 m d) 20 m
9. A bus is moving with a speed of 10 m/s on a straight road. A scooterist wishes to overtake the bus in 100s. If the bus is at a distance of 1 km from the scooterist, with what speed should the scooterist chase the bus?
   a) 40 m/s b) 25 m/s c) 10 m/s d) 20 m/s
10. A particle starts its motion from rest under the action of a constant force. If the distance covered in first 10 seconds is S_1 and that covered in the first 20 seconds is S_2, then

    ____

    a) $S_2 = 3S_1$ b) $S_2 = 4S_1$ c) $S_2 = S_1$ d) $S_2 = 2S_1$

11. The distance travelled by a particle starting from rest and moving with an acceleration $\frac{4}{3}$ m /s^2 in the third second is :
a) 6 m b) 4 m c) $\frac{10}{3}$ m d) $\frac{19}{3}m$
12. A particle is moving in a straight line with a constant acceleration. It changes its velocity from 10 m/s to 20 m/s, while passing through a distance 135m in t seconds. The value of t is :
a) 10 b) 1.8 c) 12 d) 9
13. A particle moves along a straight line OX. At a time t (in second) the distance x (in meters) of the particle is given by x = 40 + 12t - t^3. How long would the particle travel before coming to rest?
a) 24 m b) 40 m c) 56 m d) 16 m
14. Two bodies are standing at the ends A and B of a ground where AB = a. The boy at B starts running in a direction perpendicular to AB with velocity υ_1. The boy at A starts running simultaneously with velocity υ and catches the other boy in a time t, where t is:
a) $\frac{a}{\sqrt{v^2 v_1^2}}$ b) $\sqrt{\frac{a^2}{v^2-v_1^2}}$ c) $\frac{a}{v-v_1}$ d) $\frac{a}{v+v_1}$
15. The displacement x of a particle varies with time t, x = ae$^{-\alpha t}$ + be$^{\beta t}$, where a, b, α and β positive constants. The velocity of the particle will :
a) go on decreasing with time b) be independent of α and β c) drop to zero when α = β
d) go on increasing with time
16. A police jeep is chasing with, velocity of 45km/h thief in another jeep moving with velocity 153 km/h. Police fires a bullet with muzzle velocity of 180 m/s. The velocity, it will strike the jeep of the thief is:
a) 150 m/s b) 27 m/s c) 450 m/s d) 250 m/s
17. A body falls from a height h = 200 m at New Delhi. The ratio of distance travelled in each 2 s during t = 0 to t = 6 seconds of the journey is :
a) 1 : 4 : 9 b) 1 : 2 : 4 c) 1 : 3 : 5 d) 1 : 2 : 3
18. The acceleration due to gravity on the planet A is 9 times the acceleration due to gravity on planet B. A man jumps to a height of 2m on the surface of A. What is the height of jump by the same person on the planet B?
a) 18 m b) 6 m c) $\frac{2}{3}m$ d) 219 m
19. The displacement of a particle is given by y = a + bt + ct^2 - dt^4. The initial velocity and acceleration are respectively:
a) b, -4d b) -b,2c c) b,2c d) 2c,-4d
20. From the top of a tower, a particle is thrown vertically downwards with a velocity of 10 m/s The ratio of the distance, covered by it in the 3rd and 2nd second is (Take g = 10 m/s^2) :
a) 5 : 7 b) 7: 5 c) 3 : 6 d) 6 : 3
21. The displacement of a particle, moving in a straight line, is given by s = 2t^2+2t+4 where s is in metres and t in seconds. The acceleration of the particle is:
a) 2m/s^2 b) 4 m/s^2 c) 6 m/s^2 d) 8 m/s^2
22. Which of the following is a one dimensional motion?
a) Landing of an aircraft b) Earth revolving around the sun
c) Motion of wheels of a moving train d) Train running on a straight track

23. A 150 m long train is moving with a uniform velocity of 45 km/h. The time taken by the train to cross a bridge of length 850 meters is :
a) 56 sec b) 68 sec c) 80 sec d) 92 sec

24. A particle is constrained to move on a straight line path. It returns to the starting point after 10 sec. The total distance covered by the particle during this time is 30 m. Which of the following statements about the motion of the particle is false?
a) Displacement of the particle is zero b) Average speed of the particle is 3 m/s
c) Displacement of the particle is 30 m d) Both (a) and (b)

25. The relation 3t = $\sqrt{3x}+6$ describes the displacement of a particle in one direction where x is in metres and t in sec. The displacement, when velocity is zero, is :
a) 24 metres b) 12 metres c) 5 metres d) Zero

26. A car moving with a speed of 40 km/h can be stopped by applying brakes after atleast 2 m. If the same car is moving with a speed of 80 km/h, what is the minimum stopping distance?
a) 8 m b) 2 m c) 4 m d) 6 m

27. The position x of a particle varies with time t as x = $at^2 - bt^3$. The acceleration of the particle will be zero at time t equal to :
a) $\frac{a}{b}$ b) $\frac{2a}{3b}$ c) $\frac{a}{3b}$ d) Zero

28. A particle experiences a constant acceleration for 20 sec after starting from rest. If it travels a distance S_1 in the first 10 see and a distance S_2 in the next 10
sec, then
a) $S_1 = S_2$ b) S1 = $\frac{S_2}{3}$ c) S1 = $\frac{S_2}{2}$ d) S1 = $\frac{S_2}{4}$

29. The coordinates of a moving particle at any time are given by x = at^2 and y = at^2. The speed of the particle at any moment is :
a) 2t (a+b) b) 2t$\sqrt{a^2-b^2}$ c) $t\sqrt{a^2-b^2}$ d) $2t\sqrt{a^2-b^2}$

30. If a car at rest accelerates uniformly to a speed of 144km/h in 20 s. Then it covers a distance of
a) 20 m b) 400 m c) 1440 m d) 2880 m

31. A truck and a car are moving with equal velocity. On applying the brakes both will stop after certain distance, then
a) Truck will cover less distance before rest b) Car will cover less distance before rest
c) Both will cover equal distance d) None

32. A ball is dropped on the floor from a height of 10m. It rebounds to a height of 2.5 m. If the ball is in contact with the floor for 0.01 sec, the average acceleration during contact is :
a) 2100 $\frac{m}{sec^2}$ downwards b) 2100 $\frac{m}{sec^2}$ upwards c) 1400 $\frac{m}{sec^2}$ d) 700 $\frac{m}{sec^2}$

33. A stone dropped from the top of the tower touches the ground in 2 sec. The height of the tower is about:
a) 25 m b) 40 m c) 20 m d) 160 m

34. A body dropped from a height h with an initial speed zero, strikes the ground with a velocity 3 km/h. Another body of .same mass is dropped from the same height h with an initial speed -u = 4 km/h. Find the final velocity of second body with which it strikes the ground:
a) 3 km/h b) 4 km/h c) 5 km/h d) 12 km/h

35. Water drops fall at regular intervals from a tap which is 5m above the ground. The third drop is leaving the tap at the instant the first drop touches the ground. How far above the ground is the second drop at that instant:
a) 2.50 m b) 3.75 m c) 4.00 m d) 1.25 m

36. Three different objects of mass m_l, m_2, m_3 are allowed to fall from rest and from the same point O along three different frictionless paths. The speeds of the three objects on reaching the ground will be in the ratio of :
a) $m_l : m : m_3$ b) $m_l : 2m_2 : m_3$ c) 1 : 1 : 1 d) $\frac{1}{m_1} : \frac{1}{m_2} : \frac{1}{m_3}$

37. A particle moves along a straight line such that its displacement at any time 't' is given by s = (t^3- $6t^2$+3t+4) meters. The velocity when the acceleration is zero is :
a) 3 m/s b) - 12 m/s c) 42 m/s d) -9 m/s

38. A body starts from rest. What is the ratio of the distance travelled by the body during the 4^{th} and 3^{rd} second.
a) 7/5 b) 5/7 c) 7/3 d) 3/7

39. A train of 150 meter long is going towards north direction at speed of 10m/s. A parrot flies at the speed of 5m/s towards south direction parallel to the railway track. The time taken by the parrot to cross the train is :
a) 12 sec b) 8 sec c) 15 sec d) 10 sec

40. A bus travelling the first one third distance at a speed of 10 km/h, the next one third at 20 km/h and the last one-third at 60 km/h. The average speed of the bus is:
a) 9 km/h b) 16 km/h c) 18 km/h d) 48 km/h

41. The displacement-time graph for two particles A and B are straight lines inclined at angles of 30^0 and 600 with the time axis. The ratio of velocities 60^0 with the time axis. The ratio of velocities of υ_A : υ_B is :
a) 1 : 2 b) 1 : $\sqrt{3}$ c) $\sqrt{3}$: 1 d) 1 : 3

42. An athlete completes one round of a circular track of radius R in 40 sec. What will be his displacement at the end of 2 min. 20 sec?
a) Zero b) 2R c) 2πT d) 7πR

43. A body is released from a great height and falls freely towards the earth. Another body is released from the same height exactly one second later. The separation between the two bodies, two seconds after the release of me second body is :
a) 4.9 m b) 9.8 m c) 19.6 m d) 24.5 m

44. A car moving on a horizontal road may be thrown out of the road in taking a turn :
a) By the gravitational force b) Due to lack of sufficient centripetal force
c) Due to rolling frictional force between tyre and road d) Due to the reaction of the ground

45. Certain neutron stars are believed to be rotating at about 1 rev/sec. If such a star has a radius of 20km, the acceleration of an object on the equator of the star will be :
a) 20 x 10^8 m/sec^2 b) 8 x 10^5 m/sec^2 c) 120 x 10^5 m/sec^2 d) 4 x 10^8 m/sec^2

46. A particle P is moving in a circle of radius 'a' with a uniform speed υ. C is the centre of the circle and AB is a diameter. When passing through B the angular velocity of P about A and C are in the ratio :
a) 1 : 1 b) 1 : 2 c) 2 : 1 d) 4 : 1

47. A cyclist taking turn bends inwards while a car passenger taking same turn is thrown outwards. The reason is :
a) Car is heavier than cycle b) Car has four wheels while cycle has only two
c) Difference in the speed of the two
d)
Cyclist has to counteract the centrifugal force while in the case of car only the passenger is thrown by this force

48. The relation between time t and distance x is $t = \alpha x^2 + \beta x$, where α and β are constants. The retardation is (v is the velocity) :
a) $2\alpha\beta v^3$ b) $2\beta^2 v^3$ c) $2\alpha v^3$ d) $2\beta v^3$

49. An electron starting from rest has a velocity that increases linearly with the time that is $\upsilon = kt$, where $k = 2\ m/sec^2$. The distance travelled in the first 3 seconds will be :
a) 9 m b) 16 m c) 27 m d) 36 m

50. A point moves with uniform acceleration and υ_1 , υ_2 and υ_3 denote the average velocities in the three successive intervals of time t_1, t_2, and t_3. Which of the following relations is correct?
a) $(\upsilon_1-\upsilon_2) : (\upsilon 2 - \upsilon 3) = (t_1-t_2) : (t_2+t_3)$ b) $(\upsilon_1-\upsilon_2) : (\upsilon 2 - \upsilon 3) = (t_1+t_2) : (t_2+t_3)$
c) $(\upsilon_1-\upsilon_2) : (\upsilon 2 - \upsilon 3) = (t_1-t_2) : (t_1 t_3)$ d) $(\upsilon_1-\upsilon_2) : (\upsilon 2 - \upsilon 3) = (t_1-t_2) : (t_2-t_3)$

51. The initial velocity of a particle is u (at t = 0) and the acceleration is given by at. Which of the following relation is valid:
a) $\upsilon = u + at^2$ b) $\upsilon = u + at^2/2$ c) $\upsilon = u + at$ d) $\upsilon = u$

52. An object is projected upwards with a velocity of 100 m/s. It will strike the ground after (approximately)
a) 10 s b) 20 s c) 15 s d) 5 s

53. Tworacing cars of masses m_1 and m_2 are moving in circles of radii r_l and r_2 respectively. Their speeds are such that each makes a complete circle in the same duration of time t. The ratio of the angular speed of the first to the second car is :
a) $m_1 : m_2$ b) $r_1 : r_2$ c) 1 : 1 d) $m_1 r_1 : m_2 r_2$

54. Body of mass m is moving in a circle of radius r with a constant speed υ. The force on the body is $\frac{mv^2}{r}$ and is directed towards the centre. What is the work done by this force in moving the body over half the circumference of the circle :
a) $\frac{mv^2}{\pi r}$ b) Zero c) $\frac{mv^2}{r^2}$ d) $\frac{\pi r^2}{mv^2}$

55. A stone of mass m is tied to a string of length 1and rotated in a circle with a constant speed υ. If the string is released, the stone flies:
a) Radially outward b) Radially inward c) Tangentially outward
d) With an acceleration $\frac{mv^2}{l}$

56. A motor cyclist going round in a circular track at constant speed has :
a) Constant linear velocity b) Constant acceleration c) Constant angular velocity
d) Constant force

57. The initial velocity of the particle is 10 m/sec and its retardation is $\frac{1}{5}$ x g. The distance moved by particle in 5^{th} second of its motion is :
a) 1 m b) 19 m c) 50 m d) 75 m

58. The displacement x of a particle along a straight line at time t is given by $x = a_0 + a_1 t + a_2 t^2$ .The acceleration of the particle is :
a) a_o b) a_1 c) $2a_2$ d) a_2

59. Two bodies of different masses m_a and m_b are dropped from two different heights a and b. The ratio of the time taken by the two to cover these distances are :
a) a : b b) b : a c) $\sqrt{a} : \sqrt{b}$ d) $a^2 : b^2$

60. A stone is just released from the window of a train moving along a horizontal straight track. The stone will hit the ground following a :
a) Straight path b) Circular path c) Parabolic path d) Hyperbolic path

61. A toy car with charge q moves on a frictionless horizontal plane surface under the influence of a uniform electric field E. Due to the force qE, its velocity increases from 0 to 6 m/s in one second duration. At that instant the direction of the field is reversed. The car continues to move for two more seconds under the influence of this field. The average velocity and the average speed of the toy car between 0 to 3 seconds are respectively.
a) 2 m/s, 4 m/s b) 1m/s, 3 m/s c) 1 m/s, 3.5m/s d) 1.5m/s, 3 m/s

62. Preeti reached the metro station and found that the escalator was not working. She walked up the stationary escalator in time t_1. On other days, if she remains stationary on the moving escalator, then the escalator takes her up in time t_2. The time taken by her to walk up on the moving escalator will be:
a) $\frac{t_1+t_2}{2}$ b) $\frac{t_1 t_2}{t_1-t_2}$ c) $\frac{t_1 t_2}{t_1+t_2}$ d) t_1-t_2

63. Particle moves so that its position vector is given by vector $\vec{r} = \cos\omega t\,\hat{x} + \sin\omega t\,\hat{y}$ where ω is a constant. Which of the following is true?
a) Velocity is perpendicular to vector rand acceleration is directed towards the origin.
b) Velocity is perpendicular to vector rand acceleration is directed away from the origin.
c) Velocity and acceleration both are perpendicular to vector r
d) Velocity and acceleration both are parallel to vector r

64. A ship A is moving westward with a speed of 10 km/h and a ship B 100 km south of A, is moving northwards with a speed of 10 km/h. The time after which the distance between them becomes shortest is:
a) $10\sqrt{2}$ h b) 0 h c) 5 h d) 5 $\sqrt{2}$ h

65. A projectile is fired from the surface of the earth with a velocity of 5 m/s and angle 9 with the horizontal. Another projectile fired from another planet with a velocity of 3 m/s at the same angle follows a trajectory which is identical with the trajectory of the projectile fired from the earth. The value of the acceleration due to gravity on the planet is (in m/sz) (given g = 9.8 m/sz)
a) 3.5 b) 5.9 c) 16.3 d) 110.8

66. A projectile is fired at an angle of 45° with the horizontal. Elevation angle of the projectile at its highest point as seen from the point of projection is:
a) 60° b) $\tan^{-1}\frac{1}{2}$ c) tan-1 $\frac{\sqrt{3}}{2}$ d) 45°

67. A particle has initial velocity and acceleration $2\hat{i} + 4\hat{j}$ and $0.4\hat{i} + 3\hat{j}$ respectively. Its speed after 10 s is:
a) 7 unit b) 7 $\sqrt{2}$ unit c) 8.5 unit d) 10 unit

68. A ball is dropped from a high rise platform at t=0 starting from rest. After 6 seconds another ball is thrown downwards from the same platform with a speed v. The two balls meet at t=18s. What is the value of v? ($g=10m/s^2$)
a) 75 m/s b) 55 m/s c) 40 m/s d) 60 m/s

69. If a vector $2\hat{i}+3\hat{j}+8\hat{k}$ is perpendicular to the vector $4\hat{i}+4\hat{j}+\alpha\hat{k}$. Then the value of l is :
a) -1 b) 1/2 c) -1/2 d) 1

70. The angle between the vectors A and B is 9. The value of the triple product A.(BxA) is :
a) A^2B b) Zero c) $A^2B\sin\theta$ d) $A^2B\cos\theta$

71. Astone ties·to the end of a string 1mlong is whirled in a horizontal circle with a constant speed. If the stone makes 22 revolutions in 44 seconds, what is the magnitude and direction of acceleration of the stone :
a) $\pi^2/4ms^{-2}$ and direction along the radius towards the centre
b) π^2ms^{-2} and direction along the radius away from the centre
c) π^2ms^{-2} and direction along the radius towards the centre
d) π^2ms^{-2} and direction along the tangent to the circle

72. If a_r and a_t represent radial and tangential accelerations, the motion of a particle will be uniformly circular if:
a) $a_r=0$ and $a_t=0$ b) $a_r=0$ but $a_t\neq0$ c) $a_r\neq0$ but $a_t=0$ d) $a_r\neq0$ and $a_t\neq0$

73. The vector sum of two forces is perpendicular to their vector differences. In that case, the forces
a) Are equal to each other in magnitude b) Are not equal to each other in magnitude
c) Cannot be predicted d) Are equal to each other

74. One car moving on a straight road covers one third of the distance with 20 km/hr and the rest with 60 km/hr. The average speed is :
a) 40 km/hr b) 8 0km/hr c) $46\frac{2}{3}$ km/hr d) 36 km/hr

75. A boat crosses a river with a velocity of 8 km/h. If the resulting velocity of boat is 10 km/h then the velocity of river water is :
a) 4 km/h b) 6 km/h c) 8 km/h d) 10 km/h

76. Two particles of mass M and m are moving in a circle of radii Rand T. If their time-periods are same, what will be the ratio of their linear velocities?
a) MR: mr b) M: m c) R: r d) 1 : 1

77. If $|\vec{A}+\vec{B}|=|\vec{A}|+|\vec{B}|$ then angle between $\vec{A}$ and $\vec{B}$ will be:
a) 90° b) 120° c) 0° d) 60°

78. What is the value of linear velocity, if $\vec{\omega}=3\hat{i}-2\hat{j}+3\hat{k}$ and $\vec{r}=5\hat{i}-6\hat{j}+6\hat{k}$
a) $6\hat{i}-2\hat{j}+3\hat{k}$ b) $4\hat{i}-13\hat{j}+6\hat{k}$ c) $4\hat{i}-13\hat{j}+6\hat{k}$ d) $-18\hat{i}-13\hat{j}+2\hat{k}$

79. Two bodies of mass 10 kg and S kg moving in concentric orbits of radii Rand r such that their periods are the same. Then the ratio between their centripetal acceleration is :
a) $\frac{R}{r}$ b) $\frac{r}{R}$ c) $\frac{R^2}{r^2}$ d) $\frac{r^2}{R^2}$

80. A particle moves with a velocity $6\hat{i} - 4\hat{j} + 3\hat{k}$ m/s under the influence of a constant force $\vec{F} = 20\hat{i} + 15\hat{j} - 5\hat{k}$. The instantaneous power applied to the particle is :
a) 35 J/s b) 45 J/s c) 25 J/s d) 195 J/s

81. The maximum speed of a car on a road turn of radius 30 m, if the coefficient of friction between the tyres and the road is 0.4, will be :
a) 10.84m/sec b) 9.84m/sec c) 8.84m/sec d) 6.84m/sec

82. If a unit vectoris represented by $0.5\hat{i} + 0.8\hat{j} + c\hat{k}$ then the value of 'c' is :
a) 1 b) $\sqrt{0.11}$ c) $\sqrt{0.01}$ d) $\sqrt{0.39}$

83. Aperson aiming to reach the exactly opposite point on the bank of a stream is swimming with a speed of 0.5m/s at an angle of 120° with the direction of flow of water. The speed of water in the stream is :
a) 1 m/s b) 0.4 m/s c) 0.25 m/s d) 0.433 m/s

84. A 500kg car takes a round turn of radius 50m with a velocity of 36 km/hr. The centripetal force is :
a) 250 N b) 750 N c) 1000 N d) 1200 N

85. Aboat is moving with a velocity $3\hat{i} + 4\hat{j}$ with respect to ground. The water in the river is moving with a velocity $3\hat{i} + 4\hat{j}$ with respect to ground. The relative velocity of the boat with respect to water is:
a) $8\hat{j}$ b) $6\hat{i} - 8\hat{j}$ c) $6\hat{i} + 8\hat{j}$ d) $5\sqrt{2}$

86. A particle is moving in a horizontal circle with constant speed. It has constant:
a) Velocity b) Acceleration c) Kinetic energy d) Displacement

87. The magnitude of vector A, B and C are respectively 12, 5 and 13 units and A + B = C, then the angle between A and B is :
a) 0 b) π c) π/2 d) π/4

88. A bullet is fired from a canon with velocity 500 m/s. If the angle of projection is 15°andg =10 m/s^2. Then the range is :
a) 25×10^3m b) 12.5×10^3m c) 50×10^2m d) 25×10^2m

89. An airplane is flying horizontally with a velocity of 600 km/h at a height of 1960 m. When it is vertically at a point A on the ground, a bomb is released from it. The bomb strikes the ground at point B. The distance AB is :
a) 1200 m b) 0.33 km c) 3.33 km d) 33 km

90. A particle moves in a circular orbit under the action of a central attractive force inversely proportional to the distance 'r'. The speed of the particle is:
a) Proportional to r^2 b) Independent of r c) Proportional to r d) Proportional to 1/ r

91. The torque of the force $\vec{F} = (2\hat{i} - 3\hat{j} + 4\hat{k})N$ acting at the point $\vec{r} = (3\hat{i} + 2\hat{j} + 3\hat{k})m$ about the origin be:
a) $6\hat{i} - 6\hat{j} + 12\hat{k}$ b) $17\hat{i} - 6\hat{j} - 13\hat{k}$ c) $-6\hat{i} + 6\hat{j} - 12\hat{k}$ d) $-17\hat{i} + 6\hat{j} + 13\hat{k}$

92. A particle of mass m is describing a circular path of radius r with uniform speed. If L is the angular momentum of the particle about the axis of the circle, the kinetic energy of the particle is given by:
a) L^2/mr^2 b) $L^2/2mr^2$ c) $2L^2/mr^2$ d) mr^2L

93. If the sum of two unit vectors is a unit vector, then magnitude of difference is :
a) $\sqrt{2}$ b) $\sqrt{3}$ c) $1\sqrt{2}$ d) $\sqrt{5}$

94. A body is whirled in a horizontal circle of radius 20 cm. It has angular velocity of 10 rad/s. What is its linear velocity at any point on circular path :
a) 10 m/s b) 2 m/s c) 20 m/s d) 0.2 m/s

95. A boy aims a gun at a bird from a point, at a horizontal distance of 100m. If the gun can impart a velocity of 500 m/s to the bullet At what height above the bird must he aim his gun in order to hit it (take g = $10 m/s^2$)
a) 20 cm b) 10 cm c) 50 cm d) 100 cm

96. The position vector of a particle is $\vec{r} = (a\,cos\,\omega\,t)\hat{i} + (a\,sin\,\omega\,t)\hat{j}$. The velocity of the particle is:
a) Parallel to the position vector b) Perpendicular to the position vector
c) Directed towards the origin d) Directed away from the origin

97. Five equal forces of 10 N each are applied at one point and all are lying in one plane. If the angles between them are equal, the resultant force will be:
a) zero b) 10 N c) 20 N d) $10\sqrt{2}$ N

98. When a body moves with a constant speed along a circle:
a) No work is done on it b) No acceleration is produced in the body
c) No force acts on the body d) Its velocity remains constant

99. A sphere of mass m is tied to end of a string of length 1 and rotated through the other end along a horizontal circular path with speed v. The work done in full horizontal circle is :
a) 0 b) $\left(\frac{mv^2}{l}\right).2\pi l$ c) mg.2πl d) $\left(\frac{mv^2}{l}\right).(l)$

100. Given vector $\vec{A} = 2\hat{i} + 3\hat{j}$ the angle between $\vec{A}$ and y-axis is:
a) $\sin^{-1}\frac{2}{3}$ b) $\cos^{-1}\frac{2}{3}$ c) $\tan^{-1}\frac{3}{2}$ d) $\tan^{-1}\frac{2}{3}$

101. Forces F_1 and F_2 act on a point mass in two mutually perpendicular directions. The resultant force on the point mass will be:
a) F_1+F_2 b) F_1-F_2 c) $\sqrt{F_1^2+F_2^2}$ d) $F_1^2+F_2^2$

102. Two forces, each of magnitude F have a resultant of the same magnitude F. The angle between the two forces is :
a) 45^o b) 120^o c) 150^o d) 60^o

103. If $|V_1+V_2|= |V_1- V_2|$ and V_2 is finite, then:
a) V_1 is parallel to V_2 b) $V_1=V_2$ c) $V_1$and V_2 are mutually perpendicular d) $|V_1|=|V_2|$

104. A motor cyclist moving with a velocity of 72 km/ hour on a flat road takes a turn on the road at a point where the radius of curvature of the road is 20 meters. The acceleration due to gravity is 10 m/sec^2. In order to avoid skidding, he must not bend with respect to the vertical plane by an angle greater than:
a) $\theta=\tan^{-1}6$ b) $\theta=\tan^{-1}2$ c) $\theta=\tan^{-1}25.92$ d) $\theta=\tan^{-1}4$

105. Following sets of three forces act on a body. Whose resultant cannot be zero?
a) 10,10,10 b) 10,10,20 c) 10,20,23 d) 10,20,40

106. Two vectors $\vec{A}$ and $\vec{B}$ lie in a plane, another vector $\vec{C}$ lies outside this plane, then the resultant of these three vectors i.e., $\vec{A}+\vec{B}+\vec{C}$.
a) Can be zero b) Cannot be zero c) Lies in the plane containing $\vec{A}+\vec{B}$
d) Lies in the plane containing $\vec{C}$

107. A particle is simultaneously acted by two forces equal to 4 N and 3 N. The net force on the particle is:
a) 7 N b) 5 N c) 1 N d) Between 1 N and 7 N

108. Component of a vector is:
a) always less than its magnitude b) always greater than its magnitude
c) always equal to its magnitude d) none of the above

109. Which of the following is a scalar quantity?
a) Work b) Displacement c) Velocity d) Acceleration

110. Which of the following is a vector quantity?
a) Temperature b) Surface tension c) Calorie d) Force

111. If $\vec{A}\times\vec{B}=\vec{B}\times\vec{A}$ then the angle between $\vec{A}$ and $\vec{B}$ is:
a) π b) $\pi/3$ c) $\pi/2$ d) $\pi/4$

112. A body is projected with a velocity $\vec{v}=(3\hat{i}+4\hat{j})$ m/s. The maximum height attained by the body is:(g = 10m/s ^{2})
a) 0.8 m b) 8 m c) 80 m d) 800 m

113. A physical quantity which has a direction:
a) must be a vector b) may be a vector c) may be both scalar and vector
d) none of the above

114. Which of the following physical quantities are represented by axial vectors?
a) Displacement b) Force c) Velocity d) Torque

115. Which of the following physical quantities are represented by polar vectors?
a) Displacement b) Angular velocity c) Angular momentum d) Torque

116. The flight of a bird can be an example of:
a) dot product of vectors b) cross product of vectors c) composition of vectors
d) triangle law of vector addition

117. Which of the following operations make no sense in case of scalars and vectors?
a) Multiplying any vector by a scalar b) Adding a component of vector to the same vector
c) Multiplying any two scalars d) Adding a scalar to a vector of the same dimensions

118. The minimum number of vectors of equal magnitude required to produce a zero resultant is:
a) 2 b) 3 c) 4 d) more than 4

119. What is the maximum number of components into which a vector can be split?
a) 2 b) 3 c) 4 d) Infinite

120. What is the maximum number of rectangular components into which a vector can be split in space?
a) 2 b) 3 c) 4 d) Infinite

121. What is the maximum number of rectangular components into which a vector can be split in its own plane?
a) 2 b) 3 c) 4 d) Infinite

122. The vector sum of the forces of 10 newton and 6 newton can be:
a) 2N b) 8N c) 18N d) 20N

123. Vector sum of two forces of 10 N and 6 N cannot be :
a) 4N b) 8N c) 12N d) 2N

124. Keeping the banking angle same, to increase the maximum speed with which a vehicle can travel on the curved road by 10%, the radius of curvature of the road has to be changed from 20 m to :
a) 16 m b) 18 m c) 24.2 m d) 30.5 m

125. The vectors $\vec{A}$ and $\vec{B}$ are such that $|\vec{A}+\vec{B}| = |\vec{A}-\vec{B}|$ then the angle between the two vectors $\vec{A}$ and $\vec{B}$ will be:
a) 0° b) 60° c) 90° d) 180°

126. The vectors $\vec{A}$ and $\vec{B}$ are such that $\vec{A}+\vec{B}=\vec{C}$ and $A^2+B^2 = C^2$. If θ is the angle between positive directions $\vec{A}$ and $\vec{B}$ then mark the correct alternative:
a) $\theta=0^o$ b) $\theta=\frac{\pi}{2}$ c) $\theta=\frac{2\pi}{3}$ d) $\theta=\pi$

127. If $=\vec{A}=\vec{B}+\vec{C}$ and the magnitudes of $\vec{A}, \vec{B}$ and $\vec{C}$ are 5, 4 and 3 units respectively, the angle between $\vec{A}$ and $\vec{C}$ is:
a) $\cos^{-1}\left(\frac{3}{5}\right)$ b) $\cos^{-1}\left(\frac{4}{5}\right)$ c) $\frac{\pi}{2}$ d) $\sin^{-1}\left(\frac{3}{4}\right)$

128. If $\vec{A}.\vec{B}=|\vec{A}\times\vec{B}|$ then angle e between vectors $\vec{A}$ and $\vec{B}$ is:
a) 0 b) $\frac{\pi}{4}$ c) $\frac{\pi}{2}$ d) π

129. If two numerically equal forces P and P acting at a point produce a resultant force of magnitude P itself, then the angle between the two original forces is:
a) 0^o b) 60^o c) 90^o d) 120^o

130. Angular momentum is:
a) axial vector b) polar vector c) scalar d) none of these

131. A force vector applied on a mass is represented as $\vec{F}=6\hat{i}-8\hat{j}+10\hat{k}$ and the mass accelerates with 1 m/s ^{2}. What will be the mass of the body?
a) $10\sqrt{2}$kg b) $2\sqrt{10}$kg c) 10kg d) 20kg

132. Find the torque of a force $\vec{F}=-3\hat{i}+\hat{j}+5\hat{k}$ acting at the point $\vec{r}=7\hat{i}+3\hat{j}+\hat{k}$:
a) $14\hat{i}-38\hat{j}+16\hat{k}$ b) $4\hat{i}+4\hat{j}+6\hat{k}$ c) $-14\hat{i}+38\hat{j}-16\hat{k}$ d) $-21\hat{i}+3\hat{j}+5\hat{k}$

133. Let $\vec{A}$ = $\hat{i}\ A\cos\theta+\hat{j}A\sin\theta,$ be any vector. Another vector $\vec{B}$ which is normal to $\vec{A}$ is:
a) $\hat{i}$B $\cos\theta+\hat{j}$B $\sin\theta$ b) $\hat{i}$B $\sin\theta+\hat{j}$B $\cos\theta$ c) $\hat{i}$B$\sin\theta-\hat{j}$B$\cos\theta$ d) $\hat{i}$A$\cos\theta-\hat{j}$A$\sin\theta$

134. The magnitudes of vectors $\vec{A}, \vec{B}$ and $\vec{C}$ are respectively 12 5 and 13 units and $\vec{A}+\vec{B}$ = $\vec{C}$, then the angle between $\vec{A}$ and $\vec{B}$ is:
a) 0 b) π c) π d) $\frac{\pi}{4}$

135. The angle between two vectors $2\hat{i}+3\hat{j}+\hat{k}$ and $-3\hat{i}+6\hat{k}$ is :
a) 0° b) 45° c) 60° d) 90°

136. The sum of two forces acting at a point is 16 N. If the resultant force is 8 N and its direction is perpendicular to minimum force, then the forces are:
a) 6 N and 10 N b) 8 N and 8 N c) 4 N and 12 N d) 2 N and 14 N

137. If vectors $\vec{P}, \vec{Q}$ and $\vec{R}$ have agnitudes 5, 12 and 13 units and $\vec{P}+\vec{Q}=\vec{R}$, the angle between $\vec{Q}$ and $\vec{R}$ is:
a) $\cos^{-1}$ (5/12) b) $\cos^{-1}$ (5/13) c) $\cos^{-1}$ (12/13) d) $\cos^{-1}$ (2/13)

138. Which of the following does not depend on the choice of the co-ordinate system?
a) $\vec{P}+\vec{Q}+\vec{R}$ b) $(P_x + Q_x + R_x)\hat{i}$ c) $P_x\hat{i}+Q_y\hat{j}+R_z\hat{k}$ d) None of these

139. What is the component $3\hat{i}+4\hat{j}$ along $\hat{i}+\hat{j}$?
a) $\frac{1}{2}(\hat{i}+\hat{j})$ b) $\frac{3}{2}(\hat{i}+\hat{j})$ c) $\frac{5}{2}(\hat{i}+\hat{j})$ d) $\frac{7}{2}(\hat{i}+\hat{j})$

140. What can be the angle between $\vec{P}+\vec{Q}$ and $\vec{P}-\vec{Q}$?
a) 0° only b) 90° only c) 180° only d) Between 0° and 180°

141. When the following three forces of 50 dyne, 30 dyne and 15 dyne act on a body, then the body is:
a) at rest b) moving with uniform velocity c) in equilibrium
d) moving with an acceleration

142. A particle is moving eastward with a velocity of 5 m/s. In 10 seconds, the velocity changes to 5 m/s northwards. The average acceleration in this time is:
a) $1/\frac{1}{\sqrt{2}}$ m/sec^2 (towards north-west) b) $1/\sqrt{2}$ m/sec^2 (towards north-east)
c) $1/\sqrt{2}$m/sec^2 (towards north-west) d) $\frac{1}{\sqrt{2}}$ m/sec^2 (towards north)

143. If $\vec{A}+\vec{B}=\vec{C}$ and A + B = C, then the angle between $\vec{A}$ and $\vec{B}$ is: If
$\vec{A}+\vec{B}=\vec{C}$ and A + B = C, then the angle between $\vec{A}$ and $\vec{B}$ is:
a) 0 b) π/4 c) π/2 d) π

144. An aircraft executes a horizontal loop with a speed of 150 m/s with its wings banked at an angle of 12°. The radius of the loop is : (g= 10m/s^2)
a) 10.6 km b) 9.6 km c) 7.4 km d) 5.8 km

145. If the magnitude of sum of two vectors is equal to the magnitude of difference of the two vectors, the angle between these vectors is:
a) 0° b) 90° c) 45° d) 180°

146. $\vec{A}+\vec{B}=\vec{C}$ and A = B = C, then what should be the angle between $\vec{A}$ and $\vec{B}$?
a) 0 b) π/3 c) 2π/3 d) π

147. At what angle the two vectors of magnitudes (A + B) and (A - B) must act, so that the resultant is $\sqrt{A^2+B^2}$?
a) $cos^{-1}\frac{A^2-B^2}{A^2+B^2}$ b) $cos^{-1}\frac{A^2+B^2}{B^2-A^2}$ c) $cos^{-1}\frac{A^2-B^2}{2(A^2+B^2)}$ d) $cos^{-1}\frac{A^2+B^2}{2(B^2-A^2)}$

148. Resultant of two vectors $\vec{A}$ and $\vec{B}$ is inclined at 45° to either of them. What is the magnitude of resultant?

a) A+B b) A-B c) $\sqrt{A^2+B^2}$ d) $\sqrt{A^2-B^2}$

149. Given that $\vec{A}+\vec{B}+\vec{C}=0$ .Which of the following options is correct?

a) $|\vec{A}|+|\vec{B}|=\vec{C}$ b) $|\vec{A}+\vec{B}|=\vec{C}$ c) $|\vec{A}|-|\vec{B}|=\vec{C}$ d) $|\vec{A}-\vec{B}|=\vec{C}$

150. If $\vec{A}\times\vec{B}$ =0 and $\vec{A}.\vec{B}$ = - AB, then angle between $\vec{A}$ and $\vec{B}$ is:

a) zero b) π/4 c) π/2 d) π

Ravi Maths Tuition Centre

Time : 1 Mins **LAWS OF MOTION 1 1** **Marks : 1617**

1. (A) Static friction is self adjusting force
   (R) The magnitude of static friction is less than the applied force.
   a) If both assertion and reason are true and reason is the correct explanation of assertion.
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion.
   c) If assertion is true but reason is false. d) If both assertion and reason are false.
   e) If assertion is false but reason is true
2. A thin horizontal circular disc is rotating about a vertical axis passing through its centre. An insect is at rest at a point near the rim of the disc. The insect now moves along a diameter of the disc to reach its other end. During the journey of the insect the angular speed of the disc:
   a) remains unchanged b) continuously decreases c) continuously increases
   d) first increases and then decreases
3. A body of mass 1 kg is moving in a vertical circular path of radius 1 m. The difference between the kinetic energies at the highest and lowest position is:
   a) 20 J b) 10 J c) $4\sqrt{5}$ J d) $10(\sqrt{5}-1)$ J
4. (A) A man in a closed cabin falling freely does not experience gravity.
   (R) Inertial and gravitational mass have equivalence.
   a) If both assertion and reason are true and reason is the correct explanation of assertion.
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion.
   c) If assertion is true but reason is false. d) If both assertion and reason are false.
   e) If assertion is false but reason is true
5. (A) A bird alights on a stretched wire depressing it slightly. The increase in tension of the wire is more than the weight of the bird.
   (R) The tension must be more than the weight as its component balances the weight.
   a) If both assertion and reason are true and reason is the correct explanation of assertion.
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion.
   c) If assertion is true but reason is false. d) If both assertion and reason are false.
   e) If assertion is false but reason is true
6. A child sits stationary at one end of a long trolley moving uniformly with a speed von a smooth horizontal floor. If the child gets up and runs about on the trolley in any manner, what is the speed of the centre of mass of the (trolley + child) system?
   a) Increases b) Remains constant c) Decreases d) None of these

7. A circular disc of moment of inertia 1_t is rotating in a horizontal plane, about its symmetry axis, with a constant angular speed ω_i Another disc of moment of inertia I_b is dropped coaxially onto the rotating disc. Initially the second disc has zero angular speed. Eventually both the discs rotate with a constant angular speed ω_f. The energy lost by the initially rotating disc to friction is:

a) $\frac{1}{2}\frac{I_b^2}{(I_t+I_b)}\omega_i^2$ b) $\frac{1}{2}\frac{I_t^2}{(I_t+I_b)}\omega_i^2$ c) $\frac{I_b-I_t}{(I_t+I_b)}\omega_i^2$ d) $\frac{1}{2}\frac{I_bI_t}{(I_t+I_b)}\omega_i^2$

8. A cord is bound round the circumference of a wheel of radius R. The axis of the wheel is horizontal and moment of inertia about it is 1. A weight mg is attached to the end of the cord and falls from rest. After falling through distance h, the angular velocity of the wheel will be:

a) $\left[\frac{2gh}{I+mr}\right]^{1/2}$ b) $\left[\frac{2mgh}{I+mr^2}\right]^{1/2}$ c) $\left[\frac{2mgh}{I+2m}\right]^{1/2}$ d) $\sqrt{2gh}$

9. A machine gun fires n bullets per second and the mass of each bullet is m: If v is the speed of each bullet, then the force exerted on the machine gun is:

a) mng b) mnv c) mnvg d) (mnv) /g

10. The moment of inertia about an axis of a body which is rotating with angular velocity 1 radian per second is numerically equal to:

a) one-fourth of its rotational kinetic energy b) half of the rotational kinetic energy
c) rotational kinetic energy d) twice the rotational kinetic energy

11. A particle is moving along a circular path. The angular velocity, linear velocity, angular acceleration and centripetal acceleration of the particle at any instant respectively are $\vec{\omega}, \vec{v}, \vec{\alpha}$ and $\vec{a_c}$ Which of the following relations is not correct?

a) $\vec{\omega}\perp\vec{v}$ b) $\vec{\omega}\perp\vec{\alpha}$ c) $\vec{\omega}\perp\vec{a_c}$ d) $\vec{v}\perp\vec{a_c}$

12. (A) The driver in a vehicle moving with a constant speed on a straight road is in a non-inertial frame of reference.

(R) A reference frame in which Newton's laws of motion are applicable is non-inertial.

a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

13. Tyres are inflated to the required value to save fuel. Because of this:

a) normal reaction is increased b) normal reaction is decreased
c) contact area is increased d) contact area is decrease

14. A passenger getting down from a moving bus, falls in the direction of the motion of the bus. This is an example for

a) second law of motion b) third law of motion c) inertia of rest d) inertia of motion

15. A merry-go-round, made of a ring-like platform of radius R and mass M, is revolving with angular speed ω . A person of mass M is standing on it. At one instant, the person jumps off the round, radially away from the centre of the round. The speed of the round afterwards is

a) 2ω b) ω c) $\frac{\omega}{2}$ d) 0

16. Which one of the following statements is incorrect?
    a) Rolling friction is smaller than sliding friction
    b) Limiting value of static friction is directly proportional to normal reactions
    c) Frictional force opposes the relative motion
    d) Coefficient of sliding friction has dimensions of length
17. If the smoothness of surfaces in contact is increased, the force of friction:
    a) must decrease b) must increase c) may decrease d) none of these
18. (A) In a rigid body the magnitude oflinear velocity of any point is given by the product of angular velocity $\omega$with the distance of that point from the instantaneous axis of rotation.
    (R) Instantaneous axis is an imaginary axis about the motion of a rigid body in combined translation and rotation motion can be taken as pure rotation.
    a) If both assertion and reason are true and reason is the correct explanation of assertion.
    b)
    If both assertion and reason are true but reason is not the correct explanation of assertion.
    c) If assertion is true but reason is false. d) If both assertion and reason are false.
    e) If assertion is false but reason is true.
19. The solid cylinder is rolling without slipping on a plane having inclination θ and the coefficient of static friction μ_s The relation between θ and μ_s is
    a) $\tan\theta > 3\mu_s$ b) $\tan\theta \le 3\mu_s$ c) $\tan\theta < 3\mu_s^2$ d) none of these
20. (A) A wheel moving down a perfectly frictionless inclined plane will undergo slipping (not rolling motion).
    (R) For perfect rolling motion, work done against friction is zero.
    a) If both assertion and reason are true and reason is the correct explanation of assertion.
    b)
    If both assertion and reason are true but reason is not the correct explanation of assertion.
    c) If assertion is true but reason is false. d) If both assertion and reason are false.
    e) If assertion is false but reason is true.
21. A mass of 1 kg is suspended by means of a thread. The system is (i) lifted up with an acceleration of 4.9 m s^{-2} (ii) lowered with an acceleration of 4.9 m s^{-2}. The ratio of tension in the first and second case is
    a) 3:1 b) 1:2 c) 1:3 d) 2:1.
22. What will be the maximum speed of a caron a road turn of radius 30 m, if the coefficient of friction between the tyres and the road is 0.4?
    a) 10.84m/s b) 9.84m/s c) 8.84m/s d) 6.84m/s
23. A toy-cart is tied to the end of an unstretched string of length a. When revolved, the toy-cart moves in a horizontal circle of radius 2a with a time period T. Now the toy-cart is speeded up until it moves in a horizontal circle of radius 3a with a period T'. If Hooke's law holds, then:
    a) T' = T b) T' = $\frac{3}{2}$T c) T' = $\frac{\sqrt{3}}{2}T$ d) T' = $\sqrt{\frac{3}{2}}T$

24. A force of 2 kg is applied at one end of a spring balance kept horizontally and an equal force of 2 kg is applied at the other end in the opposite direction, simultaneously. Then the reading on the spring balance is:
a) 2 kgf b) 4 kgf c) 0 kgt d) 1 kgt
25. A block of mass m is placed on a surface with a vertical cross section given by $y = x^3/6$. If the coefficient of friction is 0.5, the maximum height above the ground at which the block can be placed without slipping is
a) 1/2 m b) 1/6 m c) 2/3 m d) 1/3 m
26. (A) All scalar physical quantities have no direction.
(R) The magnitude of a vector may be a negative scalar.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.
27. A shell of mass 200 g is fired by a gun of mass 100 kg. If the muzzle speed of the shell is 80 m S^{-1}, then the recoil speed of the gun is
a) 16 cm S^{-1} b) 8 cm S^{-1} c) 8 m S^{-1} d) 16 m S^{-1}
28. (A) A ladder is more likely to slip when a person is near the top when he is near the bottom.
(R) The friction between the ladder and floor decreases as he climbs up.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.
29. Rolling friction:
a) is independent of velocity b) varies with velocity c) increases with velocity
d) decreases with velocity
30. A block of mass m is connected to another block of mass M by a spring (massless) of spring constant k. The blocks are kept on a smooth horizontal plane. Initially the blocks are at rest and the spring is unstretched. Then a constant force F starts acting on the block of mass Mto pull it. Find the force ofthe block of mass m:
a) $\frac{MF}{(m+M)}$ b) $\frac{mF}{M}$ c) $\frac{(M+m)F}{m}$ d) $\frac{mf}{(m+M)}$
31. An automobile travelling with a speed of 60 kmlh, can brake to stop within a distance of 20 m. If the car is going twice as fast, i. e. , 120 kmlh, the stopping distance will be:
a) 20 m b) 40 m c) 60 m d) 80 m
32. If an inclined plane is made slowly horizontal by reducing its inclination with horizontal, the component of weight parallel to the plane of block resting on the inclined plane:
a) remains same b) increases c) decreases d) first increases and then decreases
33. A wheel is rotating at 900 rpm about its axis when the power is cut-off. It comes to rest in one minute. The angular retardation (assuming it to be uniform) (in radian/see^2) is:
a) $\pi/2$ b) $\pi/4$ c) $\pi/6$ d) $\pi/8$

34. A sphere cannot roll on:
a) a smooth horizontal surface b) a rough horizontal surface c) a smooth inclined surface
d) a rough inclined surface

35. Two blocks A and B of masses 10 kg and 15 kg are placed in contact with each other rest on a rough horizontal surface as shown in the figure. The coefficient of friction between the blocks and surface is 0.2. A horizontal force of 200 N is applied to block A. The acceleration of the system is

a) 4 ms^{-2} b) 6 ms^{-2} c) 8 ms^{-2} d) 10 ms^{-2}

36. A flywheel of mass 50 kg and radius of gyration about its axis of rotation of 0.5 m is acted upon by a constant torque of 12.5 N-m. Its angular velocity at t = 5 see is:
a) 2.5 rad/sec b) 5 rad/sec c) 7.5 rad/sec d) 10 rad/sec

37. Conservation of momentum in a collision between particles can be understood from
a) conservation of energy. b) Newton's first law only c) Newton's second law only.
d) both Newton's second and third law.

38. A motorcycle is travelling on a curved track of radius 500m if the coefficient of friction between road and tyres is 0.5.The speed avoiding skidding will be:
a) 50 m/s b) 75 m/s c) 25 m/s d) 35 m/s

39. (A) Newton's second law indicates that when a net force acts on an object, it must accelerate.
(R) When two or more forces are applied to an object, it must accelerate.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

40. Work done in moving a body up an inclined rough plane (μ) of length s will be:
a) mg (sin θ - μ cos θ)s b) mg (sin θ - μ cos θ)s c) mg (μ sin θ - cos θ)s
d) mg (sin θ - μ cos θ)s

41. The motion of particle of mass m is given by Y = ut + $\frac{1}{2}$ gt^2. The force acting on the particle is :
a) mg b) $\frac{mu}{t}$ c) 2mg d) $\frac{2mu}{t}$

42. A rope of negligible mass is wound round a hollow cylinder of mass 3 kg and radius 40 cm. If the rope is pulled 'with a force of 30 N, then the angular acceleration produced in the cylinder is :
a) 15 rad S^{-2} b) 20 rad S^{-2} c) 25 rad s^{-2} d) 30 rad s^{-2}

43. A rocket of mass 120 kg is fired in the gravity-free space. It ejects gases with velocity 600 m s^{-1} at the rate of 1 kg/so What will be the initial acceleration of the rocket? what is the initial thrust on the rocket?
a) 60 N b) 120 N c) 600 N d) 1200 N

44. A person of mass M is pulling a box of mass m on a horizontal rough surface. The force applied by him is horizontal. The coefficient of friction between the shoes of the man and the floor is f.land that between the box and the floor is u'. In which of the cases given ahead will he certainly fail to slide the box?

a) M > m,$\mu > \mu'$ b) M < m,$\mu > \mu'$ c) M > m.$\mu < \mu'$ d) M < m,$\mu < \mu'$

45. (A) A particle is moving with constant speed on a straight line in XY plane. Its angular momentum about origin is constant.

(R) The moment of momentum is zero when particle moves with uniform velocity

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

46. Two bodies of masses 2 kg and 4 kg are moving with velocities 2 mls and 10 mls respectively towards each other due to mutual gravitational attraction. What is the velocity of their centre of mass?

a) 5.3ms^{-1} b) 6.4ms^{-1} c) Zero d) 8.1ms^{-1}

47. Assertion: The moment of inertia of a rigid body reduces to its minimum value, when the axis of rotation passes through its centre of gravity.

Reason : The weight of a rigid body always acts through its centre of gravity

a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

48. The linear velocity of a particle on the equator is nearly: (radius of the earth is 4000 miles)

a) zero b) 10 mile/hr c) 100 mile/hr d) 1000 mile/hr

49. (A) In order to stop a car in shortest distance on a horizontal road, one should apply the brakes hard enough to just preventing slipping.

(R) The coefficient of static friction is larger than the coefficient of kinetic friction.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true

50. The angular momentum of a moving body remains constant if:

a) net external force is applied b) net pressure is applied c) net external torque is applied

d) net external torque is not applied

51. Two identical balls A and B having velocities of 0.5 m/s and - 0.3 m/s respectively collide elastically in one dimension. The velocities of B and A after the collision respectively will be :

a) -0.3 m/s and 0.5 m/s b) 0.3 m/s and 0.5 m/s c) -0.5 m/s and 0.3 m/s

d) 0.5 m/s and -0.3 m/s

52. An automobile engine develops 100 kW when rotating at a speed of 1800 rpm. The torque delivered by the engine is :

a) $\frac{10^2}{6\pi}$ N m b) $\frac{10^4}{6\pi}$ N m c) $\frac{10^6}{6\pi}$ N m d) $\frac{10^8}{6\pi}$ N m

53. A balloon has 8 gram of air. A small hole is pierced into it. The air escapes at a uniform rate of 7 em s^{-1}. If the balloon shrinks in 5.6 seconds then the average force acting on the balloon is:
a) 10^{-4} N b) 10^{-2} dyne c) 56 dyne d) 10^{-6} N

54. velocities of two blocks in the centre of mass frame just after the kick are respectively given by:
a) 4 m/s, 10 m/s b) 10 m/s, 4 m/s c) 4 m/s, -10 m/s d) 10 m/s, -10 m/s

55. (A) The torque ($\tau = I\alpha$) can be applied only about two points:
(i) centre of mass (ii) instantaneous centre of rotation.
(R) The equation $\alpha_{cm} = \alpha R$ can always be applied in case of pure rolling.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

56. Which of the following is a self adjusting force
a) Static friction b) Rolling friction c) Sliding friction d) Dynamic friction

57. (A) In rolling, all points of a rigid body have the same linear speed.
(R) The rotational motion does not effect the linear velocity of rigid body.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

58. A heavy ball is thrown on a rough horizontal surface in such a way that it slides with a speed Vo initially without rolling. It will roll without sliding when its speed falls to:
a) (2/7) Vo b) (3/7) Vo c) (5/7) Vo d) (7/5) Vo

59. (A) When a particle moves in a circle with a uniform speed, its velocity and acceleration both changes.
(R) The centripetal acceleration in circular motion is dependent on angular velocity of the body.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

60. A body is under the action of two equal and oppositely directed forces and the body is rotating with constant acceleration. Which of the following cannot be the separation between the lines of action of the forces?
a) 1 m b) 0.4 m c) 0.25 m d) Zero

61. A ring of radius 0.5 m and mass 10 kg is rotating about its diameter with angular velocity of 20 rad/s. Its KE is:
a) 10 J b) 100 J c) 500 J d) 1000 J

62. A body of mass 5 kg starts from the origin with an initial velocity $\vec{u}$ = (30$\hat{i}$ +40$\hat{j}$) m S^{-1}. If a constant force (-6$\hat{i}$ - 5$\hat{j}$) N acts on the body, the time in which the y-component of the velocity becomes zero is :
a) 5 s b) 20 s c) 40 s d) 80 s

63. If a car is being driven on a circular path, in which of the following circumstances it will not slip:
a) $\frac{mv^2}{r} \geq \mu mg$ b) $\frac{mv^2}{r} = \mu mg$ c) $\frac{mv^2}{r} \leq \mu mg$ d) $\frac{\mu}{r} = \mu g$

64. A particle is projected along the line of greatest slope up a rough plane inclined at an angle of 45° with the horizontal. If the coefficient of friction is $\frac{1}{2}$, their retardation is:
a) $\frac{g}{2\sqrt{2}}$ b) $\frac{g}{\sqrt{2}}$ c) $\frac{g}{\sqrt{2}}\left(1-\frac{1}{2}\right)$ d) $\frac{g}{\sqrt{2}}\left(1+\frac{1}{2}\right)$

65. A truck, weighing 8000 kg, is moving along a track with negligible friction at 1.8 m s^{-1} with the engine turn off when it begins to rain hard. The raindrops fall vertically with respect to the ground. The speed of the truck, when it has collected 1000 kg of rain water, is:
a) 1.6 ms^{-1} b) 10 ms^{-1} c) 3 ms^{-1} d) 9 ms^{-1}

66. (A) The slope of momentum versus time curve gives us the acceleration.
(R) Acceleration is given by the rate of change of momentum.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

67. A pendulum is swinging in an elevator. Its period will be greatest when the elevator is:
a) moving upwards at constant speed b) moving downwards
c) moving downwards at constant speed d) accelerating downwards

68. A particle performs uniform circular motion with an angular momentum L. If the frequency of particle's motion is doubled and its kinetic energy halved, the angular momentum becomes:
a) 2L b) 4L c) L/2 d) L/4

69. (A) A sphere rolling on a rough horizontal surface with constant velocity then it start going up on a smooth inclined plane. Rotational kinetic energy remains constant on inclined surface.
(R) Rotational kinetic energy decreases if torque due to friction opposes angular velocity of the sphere
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion isfalse but reason is true.

70. A round uniform body of radius R, mass M and moment of inertia I rolls down (without slipping) an inclined plane making an angle θ with the horizontal. Then its acceleration is:
a) $\frac{gsin\theta}{1-MR^2/I}$ b) $\frac{gsin\theta}{1+IIMR^2}$ c) $\frac{gsin\theta}{1+MR^2/I}$ d) $\frac{gsin\theta}{1-IMR^2}$

71. It is found that I$\vec{A}+\vec{B}$I= I$\vec{A}$ I.This necessarily implies:

a) $\vec{B} = 0$ b) $\vec{A}, \vec{B}$ are antiparallel c) $\vec{A}, \vec{B}$ are parallel d) $\vec{A}.\vec{B} = 0$

72. Forces of 1 N and 2 N act along the lines x = 0 and y = O. The equation of the line along which the resultant lies is given by:

a) d - y = 0 b) y - 2x = 0 c) 2y - x = 0 d) y + x = 0

73. A particle tied to a string of negligible weight and length l is swung in a horizontal circular path with constant angular velocity having time period T. If the string length is shortened by 1/2 while the particle is in motion, the time period is:

a) 4T b) 2T c) $\frac{T}{2}$ d) $\frac{T}{4}$

74. Which motion does not require force to maintain it?

a) Uniform circular motion b) Elliptical motion c) Uniform straight line motion d) Projectile motion

75. A very flexible uniform chain of mass M and length L is suspended vertically so that its lower end just touches the surface of a table. When the upper end of the chain is released, it falls with each link coming to rest the instant it strikes the table. The force exerted by the chain on the table at the moment when ypart of the chain has already rested on the table is:

a) $3\frac{M}{L}yg$ b) $\frac{M}{L}yg$ c) $2\frac{M}{L}yg$ d) None of these

76. If $F_1 + F_2 + F_3 = 0$, then

a) $F_1 > F_2$ b) $F_2 > F_3$ c) $F_3 > F_1$ d) None of these

77. An impulse is supplied to a moving object with the force at an angle of 120° with the velocity vector. What is the angle between the impulse and the change in momentum?

a) 0^0 b) 30^0 c) 60^0 d) 120^0

78. To maintain a rotor at a uniform angular speed of 100 rad s^{-1} an engine needs to transmit torque of 100 N m. The power of the engine is :

a) 10 kW b) 100 kW c) 10 MW d) 100 MW

79. A solid sphere of mass 2 kg rolls up a 30° incline with an initial speed of 10 m/s. The maximum height reached by the sphere is: (Take g = 10 rn/s^2)

a) 3.5 m b) 7.0 m c) 10.5 m d) 14.0 m

80. A coin is of mass 4.8 kg and radius one metre. It is rolling on a horizontal surface without sliding with angular velocity 600 rotations/min. What is the total kinetic energy of the coin?

a) 360 J b) 1440 π^2 J c) 4000 π^2J d) 600 π^2J

81. A steam of water flowing horizontally with a speed of 25 m S^{-1} gushes out of a tube of cross-sectional area 10^{-3} m^2, and hits at a vertical wall nearby. What is the force exerted on the wall by the impact of water?

a) 125 N b) 625 N c) -650 N d) - 1125 N

82. An elevator weighing 6000kg is pulled upward by a cable with an acceleration of $5ms^{-2}$.Takingg to be $10ms^{-2}$,then the tension in the cable is:

a) 6000 N b) 9000 N c) 60000 N d) 90000 N

83. An object placed on a ground is in stable equilibrium. If the object is given a slight push, then initially the position of centre of gravity:

a) moves nearer to ground b) rises higher above the ground c) remains as such d) may remain at same level

84. A bullet comes out of the barrel of a gun oflength 2 m with a speed of80 m/s. The average acceleration ofthe bullet is

a) 1.6 m/s^2 b) 160 m/s^2 c) 1600 m/s^2 d) 16 m/s^2

85. A 140 g ball, in horizontal flight with a speed V_1 of 39.0 mis, is struck by a bat. After leaving the bat, the ball travel in the opposite direction with speed V_2 =39.0 m/s. If the impact time $\triangle$t for the ball-bat collision is 1.20 ms, what average net force acts on the ball?

a) 1308 N b) 1090 N c) 9100 N d) 980 N

86. A 500 kg boat is 9 m long and is floating without motion on still water. A man of mass 100 kg is at one end and ifhe runs to the other end of the boat and stops, the displacement of the boat is:

a) 1.5 m in the direction of displacement of the man

b) 0.75 m in the direction of displacement of the man

c) 1.5 m in the direction opposite to the displacement of the man

d) 0.75 m in the direction opposite to the displacement of the man

87. If the earth suddenly stops revolving and all its rotational KE is used up in raising its temperature and if s is taken to be the specific heat of the earth's material, the rise of temperature of the earth will be: (R = radius ofthe earth and (ω = its angular velocity)

a) $\frac{R^2\omega^2}{5Js}$ b) $\frac{R^2\omega^2}{5J}$ c) $\frac{R^2\omega}{5Js}$ d) $\frac{R^2\omega^2}{5s}$

88. A solid sphere of radius R is rolling with velocity u on a smooth plane. The total kinetic energy of the sphere is:

a) $\frac{7}{10}$mv^2 b) $\frac{3}{4}$mv^2 c) $\frac{1}{2}$mv^2 d) $\frac{1}{4}$mv^2

89. A sphere of diameter 0.2 m and mass 2 kg is rolling on an inclined plane with velocity u = 0.5 rnls . The kinetic energy of the sphere is:

a) 0.1 J b) 0.3 J c) 0.5 J d) 0.42 J

90. A meter scale is moving with uniform velocity. This implies:

a)

the force acting on the scale is zero, but a torque about the centre of mass can act on the scale

b)

the force acting on the scale is zero and the torque acting about centre of mass of the scale is also zero

c) the total force acting on it need not be zero but the torque on it is zero

d) neither the force nor the torque need to be zero

91. A block released from rest from the top of a smooth inclined plane of inclination 45°, takes time t to reach the bottom. The same block released from rest, from top of a rough inclined plane of same inclination takes time 2t to reach the bottom. The coefficient of friction is:

a) 0.75 b) 0.5 c) 0.25 d) 0.4

92. A wheel with an initial angular velocity ω_0 reaches an angular velocity of 5ω_0 while it turns through an angle of 6 rad. Its uniform angular acceleration α is:

a) $1/3\omega_0^2 rad/sec^2$ b) $2/3\omega_0^2 rad/sec^2$ c) $2\omega_0^2 rad/sec^2$ d) $4\omega_0^2 rad/sec^2$

93. A car is moving in a circular horizontal track of radius 10m with a constant speed of 10 m/sec. A plumb bob is suspended from the roof of the car by a light rigid rod of length 1.00 m. The angle made by the rod with the track is:
a) zero b) 30^o c) 45^o d) 60^o

94. Assertion: An external force is required to keep a body in motion.
Reason: If the net external force is zero, a body at rest continues to remain at rest and a body in motion continues to move with a uniform velocity.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

95. (A) The dot product of one vector with another vector of different dimensions may be a scalar or a vector.
(R) If the product of two vectors is a scalar, then product is called cross product.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

96. A projectile is thrown in the upward direction making an angle of 60° with the horizontal direction with a velocity of 147 ms^{-1} .Then the time after which its inclination with the horizontal is 45°, is:
a) 15 s b) 10.98 s c) 5.49 s d) 2.745 s

97. A body of mass m slides down an incline and reaches the bottom with a velocity v. If the same mass was in the form of a ring which rolls down this incline, the velocity of the ring at the bottom would have been:
a) v b) $\sqrt{2}v$ c) $v/\sqrt{2}$ d) $\left(\sqrt{2/5}\right)v$

98. 300 J of work is done in sliding a 2 kg blockup an inclined plane of height 10 m. Taking g = 10 m/s^2, work done against friction is ___________
a) 100J b) 0 c) 1000J d) 200J

99. A couple produces
a) purely translational motion b) purely rotational motion
c) both translational and rotational motion d) no motion

100. A raindrop of mass 0.2 g is falling with a uniform velocity of 25 ern s^{-1} . Its weight will be: (g = 10m s^{-2})
a) Zero b) 0.02 N c) 0.002 N d) 0.2 N

101. A particle of mass m is moving with a uniform velocity v_1. It is given an impulse such that its velocity becomes v_2. The impulse is equal to ___________
a) $m\left[\left|v_2\right| - \left|v_1\right|\right]$ b) $\frac{1}{2}m\left(v_2^2 - v_1^2\right)$ c) $m\left(v_1 + v_2\right)$ d) $m\left(v_2 - v_1\right)$

102. A disc and a hoop (ring) of the same mass and size roll down an inclined plane simultaneously. The object which reaches the bottom of the incline first is:
a) hoop b) disc c) both the hoop and the disc d) none of these

103. Two cars C_1 and C_2 of masses M_1 and M_2 have similar tyres. Given that M1 >M2 and initially both the cars are moving with the same speed. Let the minimum stopping distance for them be x_l and x_2, then:
a) $x_1 = x_2$ b) $x_1 < x_2$ c) $x_1 > x_2$ d) none of these

104. Bullets of 0.03 kg mass each hit a plate at the rate of 200 bullets per second, with a velocity of 50 mlsec and reflect back with a velocity of 30 m s^{-l}. The average force acting on the plate (in Newton) is:
a) 120 b) 180 c) 300 d) 480

105. A ring of radius R is rotating with an angular speed ω_0 about a horizontal axis. It is placed on a rough horizontal table. The coefficient of kinetic friction is μ_kThe time after which it starts rolling is
a) $\frac{\omega_0 \mu_k R}{2g}$ b) $\frac{\omega_0 g}{2\mu_k R}$ c) $\frac{\omega_0 g}{2\mu_k R}$ d) $\frac{\omega_0 R}{2\mu_k g}$

106. The mass of a bicycle rider along with the bicycle is 100 kg. He wants to cross over a circular turn of radius 100 m with a speed of 10 m S^{-1}. If the coefficient of friction between the tyres and the road is 0.6, the frictional force required by the rider to cross the turn, is :
a) 300 N b) 600 N c) 1200 N d) 150 N

107. Physical independence of force is a consequence of ____________
a) third law ofmotion b) second law of motion c) first law of motion d) All of these

108. A ball is thrown from a roof top at an angle 45° above the horizontal. It hits the ground a few seconds later. At what point during its motion, does the ball have greatest speed?
a) At the highest point b) At the starting point c) At the point where it touches the ground
d) None of the above

109. Two blocks of masses 10 kg and 20 kg are connected by a massless string and are placed on a smooth horizontal surface as shown in the figure. If a force F = 600 N is applied to 10 kg block, then the tension in the string is

a) 100 N b) 200 N c) 300 N d) 400 N

110. (A) The spin angular velocity of a star is greatly enhanced when it collapses under gravitational pull and become a neutron star.
(R) According to law of conservation of angular momentum there is increase in angular velocity of collapsing star.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion isfalse but reason is true.

111. (A) Two vectors are equal when their magnitude and direction both are equal.
(R) For any two vectors $\vec{A}$ and $\vec{B}$, if angle between them is $\frac{\pi}{4}$rad, then $\vec{A} \times \vec{B} = \vec{A}.\vec{B}$.

a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

112. The instantaneous angular position of a point on a rotating wheel is given by the equation θ(t) = $2t2^3 - 6t^2$. The torque on the wheel becomes zero at
a) t = 1 s b) t = 0.5 s c) t= 0.25 s d) t = 2 s

113. A body under the action ofa force $\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$, acquires an acceleration of 1 m/s^2. The mass of this body must be ____________
a) 10kg b) 20kg c) $10\sqrt{2}$kg d) $2\sqrt{10}$ kg

114. The angular velocity of the body changes from ω_1 to ω_2 without applying torque but by changing moment of inertia. The initial radius of gyration to the final radius of gyration is:
a) $\omega_2 : \omega_1$ b) $\omega_2^2 : \omega_1^2$ c) $\sqrt{\omega_2} : \sqrt{\omega_1}$ d) $\frac{1}{\omega_2} : \frac{1}{\omega_1}$

115. The ratio of the radii of gyration of a circular disc about a tangential axis in the plane of the disc and of a circular ring of the same radius about a tangential axis in the plan of the ring is:
a) $\sqrt{3} : \sqrt{5}$ b) $\sqrt{12} : \sqrt{3}$ c) $1 : \sqrt{3}$ d) $\sqrt{5} : \sqrt{5}$

116. (A) A projectile is thrown with an initial velocity of $\vec{u} = u_x\hat{i} + u_y\hat{j}$ If horizontal (X-direction) range is maximum then $u_x = u_y$.
(R) For maximum horizontal range angle of projection must be 45°.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

117. The centre of mass of a body
a) lies always at the geometrical centre b) lies always inside the body
c) lies always outside the body d) may lie within or outside the body

118. (A) In rotation motion all points of a rigid body have the same linear speed.
(R) Rotational motion does not affect the linear velocity of particles of the rigid body
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is falase but reason is true.

119. Assertion: Static friction is a self-adjusting force upto its limit μ_s N where μ_s is the coefficient of static friction.
Reason: One can use the equation is $f_s = \mu_s$ N only when the maximum value of static friction comes into play.

a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

120. A shell is fired from a cannon, it explodes in mid air, its total ____________
a) momentum increases b) momentum decreases c) KE increases d) KE decreases

121. A cyclist bends while taking turn to:
a) reduce friction b) generate required centripetal force c) reduce apparent weight
d) reduce speed

122. what is the state of motion when the man stops climbing?
a) $\vec{u}rel. > 0$ b) $\vec{u}rel. < 0$ c) $\vec{u}rel. or \vec{V} = 0$ d) None of these

123. A block of mass m is placed on a smooth wedge of inclination q. The whole system is accelerated horizontally so that the block does not slip on the wedge. The force exerted by the wedge on the block (g is acceleration due to gravity) will be ___________
a) mg/cos θ b) mg cos θ c) mg/sin θ d) mg

124. tension in the string is if both the masses are equal, then the mass on the plane, i. e. , mass m_1 :
a) moves upwards b) moves downwards c) remains stationary d) nothing can be said

125. (A) Force of friction increases when surfaces in contact are highly smooth.
(R) When surfaces are highly polished, intermolecular forces come into play and friction force increases.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

126. A particle performs uniform circular motion with an angular momentum L If the angular frequency of the particle is doubled and kinetic energy is halved, its angular momentum becomes:
a) 4L b) 2L c) L/2 d) L/4

127. A second's pendulum is mounted in a rocket. Its period of oscillation decreases when the rocket
a) Comes down with uniform acceleration b) Moves up with a uniform velocity
c) Moves round the earth in a geostationary orbit d) Moves up with uniform acceleration

128. (A) A disc is rolling ona rough horizontal surface without slipping. The velocity of centre of mass is v. The other points on the disc lie on a circular arc having same speed v.
(R) When a disc is rotating without sliding on a rough horizontal surface the magnitude of velocities of all the points at a distance r from point of contact is same.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If assertion is true but reason is false.

e) If assertion isfalse but reason is true.

129. The moments of inertia of two rotating bodies A and B are I_A and I_B ($IA > I_B$). If their angular momenta are equal, then

a) Kinetic energy of A = Kinetic energy of B b) Kinetic energy of A > Kinetic energy of B

c) Kinetic energy of A < Kinetic energy of B

d) Kinetic energy of the two bodies cannot be compared with the given data

130. The rate of mass of the gas emitted from rear of a rocket is initially 0.1 kg/sec. If the speed of the gas relative to the rocket is 50 mlsec and mass of the rocket is 2 kg, then the acceleration of the rocket (in m/sec ^{2}) is:

a) 5 b) 5.2 c) 2.5 d) 25

131. (A) If $\vec{P}.\vec{Q} = |\vec{P} \times \vec{Q}|$ then angle between $\vec{P}$ and $\vec{Q}$ is π/2.

(R) If angle between $\vec{P}$ and $\vec{Q}$is π/2, then dot product is zero.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

132. A block of mass m rests on a rough inclined plane. The coefficient of friction between the surface and the block is μ. At what angle of inclination θ of the plane to the horizontal will the block just start to slide down the plane?

a) $\theta=\tan^{-1}\mu$ b) $\theta=\cos^{-1}\mu$ c) $\theta=\sin^{-1}\mu$ d) $\theta=\sec^{-1}\mu$

133. A body with mass 5 kg is acted upon by a force $\vec{F} = (-3\hat{i} + 4\hat{j})$ N. If its initial velocity at t = 0 is $\vec{u} = (6\hat{i} - 12\hat{j})$ m s^{-1}, the time at which it will just have a velocity along the y-axis is

a) 0 b) 10 s c) 2 s d) 15 s

134. A ball is travelling with uniform translatory motion. This means that

a) it is at rest

b) the path can be a straight line or circular and the ball travels with uniform speed

c)

all parts of the ball have the same velocity (magnitude and direction) and the velocity is constant

d)

the centre of the ball moves with constant velocity and the ball spins about its centre uniformly

135. A 7 kg object is subjected to two forces (N) $\overrightarrow{F_1} = 20\hat{i} + 30\hat{j}$ and $\overrightarrow{F_2} = 8\hat{i} - 5\hat{j}$. The magnitude of resulting acceleration in m/s^2 will be :

a) 5 b) 4 c) 3 d) 2

136. A uniform metre stick of mass M is hinged at one end and supported in a horizontal direction by a string attached to the other end. What should be the initial acceleration (in rad/sec^2) of the stick if the string is cut?

a) $\frac{3}{2}g$ b) g c) 3g d) 4g

137. A spherical ball of mass 20 kg is stationary at the top of a hill of height 100 m. It rolls down a smooth surface to the ground, then climbs up another hill of height 30 m and finally rolls down to a horizontal base at a height of 20 m above the ground. The velocity attained by the ball is:
a) 40 m/s b) 20 m/s c) 10 m/s d) 10 $\sqrt{3}$m/s

138. For the same total mass which of the following will have the largest moment of inertia about an axis passing through the centre of gravity and perpendicular to the plane of the body?
a) A disc of radius a b) A ring of radius a c) A square lamina of side 2a
d) Four rods forming square of side 2a

139. A bucket tied at the end of a 1.6 m long string is whirled in a vertical circle with constant speed. What should be the minimum speed so that the water from the bucket does not spill when the bucket is at the highest position?
(Takeg = 10 m s^{-2})
a) 4 ms^{-1} b) 6.25 ms^{-1} c) 16 ms^{-1} d) None of these

140. A sphere of mass M rolls without slipping on an inclined plane of inclination θ. What should be the minimum coefficient of friction, so that the sphere rolls down without slipping?
a) $\frac{2}{5}tan\theta$ b) $\frac{2}{7}tan\theta$ c) $\frac{5}{7}tan\theta$ d) $tan\theta$

141. A 6000 kg rocket is set for a vertical firing. If the exhaust speed is 1000 m s^{-1}, the gas ejected per second to supply thrust needed to overcome the weight of the rocket is:
a) 117.6 kg/s b) 58.8 kg/s c) 6 kg/s d) 178.4 kg/s

142. A block of mass m is placed on a smooth inclined plane of inclination e with the horizontal. The inclined plane is accelerated horizontally so that the block does not slide down. what should be acceleration of the inclined Plane?
a) g sin θ b) g cos θ c) g tan θ d) None of these

143. Pick out the wrong statement:
a) Newton's laws of motion hold good for both inertial and non-inertial frames
b) During explosion, linear momentum is conserved
c) Area under force-time graph gives the magnitude of impulse
d) Force of friction is zero when no driving force is applied
e) The apparent weight of a lift moving upwards with uniform velocity, equals its true weight

144. Two rings of the same radius and mass are placed such that their centres are at a common point and their planes are perpendicular to each other. The moment of inertia of the system about an axis passing through the centre and perpendicular to the plane of one of the rings is: (mass of the ring = m, radius = r)
a) (1/2) mr^2 b) mr^2 c) (3/2) mr^2 d) $2mr^2$

145. An annular ring with inner and outer radii R_1 and R_2 is rolling without slipping with a uniform angular speed. The ratio of the forces experienced by the two particles situated on the inner and outer parts of the ring, i. e., F_1/F_2, is:
a) 1 b) R_1/R_2 c) R_2/R_1 d) $(R_1/R_2)^2$

146. A square plate of side l has mass per unit area μ Its moment of inertia about an axis passing through the centre and perpendicular to its plane is:

a) $\frac{\mu l^2}{12}$ b) $\frac{\mu l^2}{6}$ c) $\frac{\mu l^4}{12}$ d) $\frac{\mu l^2}{6}$

147. If momenta of two particles of a system are given by: $\vec{P}_1 = 2\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{P}_2 = -\hat{i} + 2\hat{j} + 3\hat{k}$, then the angle made by the direction of motion of the system with x-axis is:
a) $\cos^{-1}(1)$ b) $cos^{-1}(1)\sqrt{36/38}$ c) 45^{o} d) $cos^{-1}(1)\sqrt{1/38}$

148. Figure shows a man of mass 55 kg standing stationary with respect to a horizontal conveyor belt that is accelerating with 1 m s^{-2}. The net force acting on the man is

a) 35 N b) 45 N c) 55 N d) 65 N

149. For which of the following does the centre of mass lie outside the body?
a) A pencil b) A shotput c) A dice d) A bangle

150. (A) If rod is thrown upward with initial angular velocity and velocity of centre of mass then its linear momentum change but angular velocity remains same.
(R) Torque on rod about centre of mass due to gravitational force is zero.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If assertion is true but reason is false.
e) If assertion is false but reason is true.

151. The length of an elastic string is xwhen the tension is 5 N. Its length is ywhen the tension is 7 N. What will be its length, when the tension is 9 N?
a) 2x + y b) 2y - x c) 7y - 5x d) 7y + 5x

152. Two circular discs A and B are of equal masses and thicknesses but made of metal with densities d_A and d_B ($d_A > d_B$) If their moments of inertia about an axis passing through their centres and perpendicular to circular faces be 1_A and I_B , then:
a) $I_A = I_B$ b) $I_A > I_B$ c) $I_A < I_B$ d) $I_A \geq I_B$

153. A ring of mass 0.8 kg and radius 0.1 m makes $\frac{5}{\pi}$ rotations per second about axis perpendicular to its plane through centre. Calculate angular momentum and kinetic energy of ring:
a) 0.08 kg-m^2 /s, 0.2 J b) 0.85 kg-m^2 /s, 0.2 J c) 0.85 kg-m^2 /s, 0.4 J
d) 0.08 kg-m^2/s, 0.4 J

154. A weightless ladder, 20 ft long rests against a frictionless wall at an angle of 60° with the horizontal. A 150 pound man is 4 ft from the top of the ladder. A horizontal force is needed to prevent it from slipping. Choose the correct magnitude from the following:
a) 19.5 pounds b) 10.0 pounds c) 17.3 pounds d) 15.5 pounds

155. (A) The centre of mass of an electron and proton, when released moves faster towards proton.
(R) Electron is heavier than proton.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion isfalse but reason is true.

156. (A) If $|\vec{P}+\vec{Q}| = |\vec{P}-\vec{Q}|$,then $\vec{P}$ must be perpendicular to $\vec{Q}$.
(R) The above relation will hold even when $\vec{Q}$ is a null vector.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

157. Which of the following statements is true?
a) More force is required to start a motion than to maintain it against friction.
b) Less force is required to start a motion than to maintain it against friction.
c) Equal force is required to start a motion and to maintain it against friction.
d) None of the above

158. A monkey of mass 30 kg climbs a rope which can withstand a maximum tension of 360 N. The maximum acceleration which this rope can tolerate for the climbing of monkey is: ($g = 10\ ms^{-2}$)
a) $2\ ms^{-2}$ b) $3\ ms^{-2}$ c) $4\ ms^{-2}$ d) $5\ ms^{-2}$

159. (A) For a body in uniform circular motion. the centripetal force is required.
(R) The body in circular motion changes its direction everywhere.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

160. A ring of mass 0.3 kg and radius 0.1 m and a solid cylinder of mass 0.4 kg and of the same radius are given the same KE and released simultaneously on a flat horizontal surface such that they begin to roll as soon as released towards a wall which is at the same distance from the ring and cylinder. Which will reach the wall first?
a) Ring b) Cylinder c) Both ring and cylinder d) None of these

161. A body moves along a circular path of radius 10m and the coefficient of friction is 0.5. What should be its angular velocity (in rad/sec) if it is not to slip from the surface? (Take $g = 9.8m\ s^{-2}$)
a) 10 b) 5 c) 0.1 d) 0.7

162. A person slides freely down a frictionless inclined plane while his bag falls down vertically from the same height. The final speeds of the man (v_M) and the bag (v_B) should be such that:
a) $u_M < u_B$ b) $u_M = u_B$ c) they depend on the masses d) $u_M > u_B$

163. Which one of the following is not a conservative force?
a) Gravitational force b) Electrostatic force between two charges
c) Magnetic force between two magnetic dipoles d) Frictional force
e) Force between nucleons

164. Vehicles are streamlined to reduce

a) static friction b) kinetic friction c) fluid friction d) sliding friction

165. The moment of inertia of a body depends upon
a) mass of the body b) axis of rotation of the body c) shape and size of the body
d) all of these

166. The particles attract each other and are permitted to move towards each other along the line joining their centres of mass. At a particular moment of time their speeds arev and 2v. What is the speed, if their common centre of mass at this instant?
a) Zero b) 1.5v c) v d) 3v

167. Certain neutron stars (extremely dense stars) are believed to be rotating at about 1 rev/so If such a star has a radius of 20 km, the acceleration of an object on the equator of the star will be:
a) $20 \times 10^3 m/s^2$ b) $120 \times 10^3 m/s^2$ c) $8 \times 10^5 m/s^2$ d) $4 \times 10^8 m/s^2$

168. The normal component of acceleration of a particle in circular motion is due to:
a) speed of the particle b) change in direction of velocity
c) change in the magnitude of velocity d) rate of change of acceleration

169. A solid sphere rolls down an inclined plane and its velocity at the bottom is V_1. The same sphere slides down the plane (without friction) and its velocity at the bottom is V_2. Which of the relations given below is correct?
a) $v_1 = v_2$ b) $v_1 = \sqrt{\frac{5}{7}}v_2$ c) $v_1 = \sqrt{\frac{7}{5}}v_2$ d) None of these

170. It is easier to roll a barrel than pull it along the road. This statement is:
a) false b) true c) uncertain d) not possible

171. A Diwali rocket is ejecting 0.05 kg of gases per second at a velocity of 400 m/sec. The accelerating force on the rocket is :
a) 20 dynes b) 22 dynes c) 20 N d) 1000 N

172. A body of mass 0.4 kg starting at origin at t = 0 with a speed of 10 m S^{-1} in the positive x-axis direction is subjected to a constant F = 8 N towards negative x-axis. The position of the body after 25 s is :
a) -6000 m b) -8000 m c) +4000 m d) +7000 m

173. Generally the mass of a fly wheel is concentrated in its rim Why?
a) To decrease the moment of inertia b) To increase the moment of inertia
c) To obtain stable equilibrium d) To obtain a strong wheel

174. A horizontal force, just sufficient to move a body of mass 4 kg lying on a rough horizontal surface, is applied on it. The coefficients of static and kinetic friction between the body and the surface are 0.8 and 0.6 respectively. If the force continues to act even after the block has started moving, the acceleration of the block (in metre per sec^2) is: ($g = 10 m/s^2$)
a) 1/4 b) 1/2 c) 2 d) 4

175. Two carts of masses 200 kg and 300 kg on horizontal rails are pushed apart. Suppose the coefficient of friction between the carts and the rails are same. If the 200 kg cart travels a distance of 36m and stops, then the distance traveled by the cart weighing 300 kg is :
a) 32 m b) 16 m c) 24 m d) 12 m

176. A bullet is fired from a gun. The force on the bullet is given by: F = 600^{-2} x 10^5 t. Where F is in newton and 1 in second. The force on the bullet becomes zero as soon as it leaves the barrel. What is the average impulse imparted to the bullet?
a) 9 N^{-s} b) Zero c) 0.9 N^{-s} d) 1.8 N^{-s}

177. A lift weighing 1000 kg is moving upwards with an acceleration of 1 m/s2. The tension in the supporting cable is ____________
a) 980N b) 10800N c) 9800N d) 8800N

178. The coefficient of friction between the tyres and the road is 0.1. The maximum speed with which a cyclist can take a circular turn of radius 3 m without skidding is
(Take g = 10 m S^{-2})
a) $\sqrt{15}$m s^{-1} b) $\sqrt{3}$ m s^{-1} c) $\sqrt{30}$ m s^{-1} d) $\sqrt{10}$ m s^{-1}

179. A sphere of mass m is tied to the end of a string of length l and rotated through the other along a horizontal circular path with speed v. The work done in full horizontal circle is:
a) zero b) $\frac{Mv^2}{l} \times 2\pi l$ c) mg· 2πl d) $\frac{Mv^2}{l} \times l$

180. A particle with position vector $\vec{r}$ has a linear momentum p. Which of the following statements is true in respect of its angular momentum Labout the origin?
a) L acts along p b) L acts along r c) L is maximum when p and r are parallel
d) L is maximum when p is perpendicular to r e) L is minimum when p is perpendicular to r

181. A body rolls down an inclined plane. If its kinetic energy of rotation is 40% of its kinetic energy of translation, then the body is:
a) solid cylinder b) solid sphere c) disc d) ring

182. A closed tube partly filled with water lies in a horizontal plane. Ifthe tube is rotated about perpendicular bisector, the moment of inertia of the system:
a) increases b) decreases c) remains constant d) depends on sense of rotation

183. A particle has initial velocity $(2\hat{i} + 3\hat{j})$ and acceleration $(2\hat{i} + 3\hat{j})$ The magnitude of velocity after 10 seconds will be :
a) 5 units b) 9 units c) 9√2 units d) 5√2 units

184. A cricket player catches a ball of mass 10^{-1} kg, moving with a velocity of 25 m s^{-1}. Ifthe ball is caught in 0.1 s, the force of the blow exerted on the hand of the player is:
a) 4 N b) 25 N c) 40 N d) 250 N

185. Which of the following statements is not true regarding the Newton's third law of motion?
a) To every action there is always an equal and opposite reaction
b) Action and reaction act on the same body.
c) There is no cause-effect relation between action and reaction.
d) Action and reaction forces are simultaneous forces

186. (A) A ladder is more apt to slip, when you are high up on it than when you just begin to climb.
(R) At the high up on a ladder the torque is large and on climbing up the torque is small.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

187. Which of the following statements is correct?

a) For a general translation motion, momentum $\vec{p}$ and velocity $\vec{v}$ need not parallel.

b)

For a general rotational motion, angular momentum $\vec{L}$i and angular velocity $\vec{w}$ always be parallel.

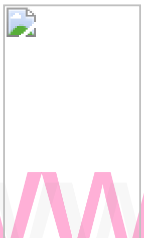
c) For a general translation motion, acceleration $\vec{a}$ and velocity $\vec{v}$ are always parallel.

d)

For a general rotational motion, angular momentum $\vec{L}$ and angular velocity $\vec{w}$ need not be parallel.

188. A disc and a sphere of same radius but different masses roll off on two inclined planes of the same altitude and length. Which one of the two objects gets to the bottom of the plane first?
a) Disc b) Sphere c) Both reach at the same time d) Depends on their masses

189. Three blocks with masses m, 2m and 3m are connected by strings as shown in the figure. After an upward force F is applied on block m, the masses move upward at constant speed v. What is the net force on the block of mass 2m? (g is the acceleration due to gravity)

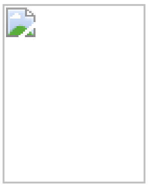


a) 2m b) 3m c) 6m d) zero

190. (A) To unscrew a rusted nut we need a wrench with longer arm.
(R) Wrench with longer arm reduces the torque of the arm.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

191. Assertion: The terms action and reaction in the third law of motion stand for simultaneous mutual forces between a pair of bodies.
Reason: In this context action always precede or cause reaction.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

192. A monkey of mass 40 kg climbs an massless rope which can stand a maximum tension of 500 N. In which of the following cases will the rope break? (Take g = 10 m s^{-2})



a) The monkey climbs up with an acceleration of 5 m s^{-2}.
b) The monkey climbs down with an acceleration 5 m s^{-2}.
c) The monkey climbs up with a uniform speed of 5 ms^{-1}
d) The monkey falls down the rope freely under gravity.

193. A weightless thread can bear tension upto 37 N. A stone of mass 500 g is tied to it and revolved in a circular path of radius 4 m in a vertical plane. If g = 10 ms $^{-2}$ then, the maximum angular velocity of the stone will be:
a) 2 rad s^{-1} b) 4 rad s^{-1} c) 8 rad s^{-1} d) 16 rad s^{-1}

194. (A) A cyclist always bends inwards while negotiating a curve.
(R) y bending he lowers his centre of gravity
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

195. Moment of inertia of a uniform horizontal cylinder of mass M about an axis passing through its edge and perpendicular to the axis of the cylinder when its length is 6 times its radius R is:
a) $\frac{39MR^2}{4}$ b) $\frac{39MR}{4}$ c) $\frac{49MR}{4}$ d) $\frac{49MR^2}{4}$

196. Two bodies of mass 10 kg and 2 kg are moving with velocities $2\hat{i}-7\hat{j}+3\hat{k}$ and $-10\hat{i}+35\hat{j}-3\hat{k}$ m/s respectively. The velocity of their centre of mass is:
a) $2\hat{i}$ m/s b) $2\hat{k}$ m/s c) $(2\hat{j}+2\hat{k})$ m/s d) $(2\hat{i}+2\hat{j}+2\hat{k})$ m/s

197. A thin rod of mass m and length 2/ is made to rotate about an axis passing through its centre and perpendicular to it. Ifits angular velocity changes from 0 to coin time t, the torque acting on it is:
a) $\frac{ml^2\omega}{12t}$ b) $\frac{ml^2\omega}{3t}$ c) $\frac{ml^2\omega}{t}$ d) $\frac{4ml^2\omega}{3t}$

198. In a bicycle the radius of rear wheel is twice the radius of front wheel. If I_F and r_r are the radius, V_F and v_r are the speeds of top most points of wheel, then:
a) $v_r = 2u_F$ b) $u_F = 2u_r$ c) $u_F = u_r$ d) $u_F > u_r$

199. Which of the following statements is true for the planets orbiting around the sun?
a)
Their velocity increases when 'they are nearest to the sun in accordance with the conservation of angular momentum.
b)
Their velocity decreases when they are nearest to the sun in accordance with the conservation of angular momentum.

c) Areal velocity of the planet varies with time to conserve the energy.
d)
Areal velocity of the planet is directly proportional to the distance of the planet from the sun.

200. (A) If the sum of the two unit vectors is also a unit vector, then magnitude of their difference is root of three.
(R) To find resultant of two vectors, we use square law.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

201. A bucket full of water is revolved in vertical circle of 2 m. What should be the maximum time-period of revolution so that water does not fall of f the bucket?
a) 1 sec b) 2 sec c) 3 sec d) 4 sec

202. (A) A horse has to apply more force to start a cart than to keep it moving.
(R) The coefficient of static friction is greater than the coefficient of kinetic friction.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

203. (A) For projection angle $\tan^{-1}(4)$, the horizontal range and the maximum height of a projectile are equal.
(R) The maximum range of projectile is directly proportional to square of velocity and inversely proportional to acceleration due to gravity.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

204. Starting fiom rest, a body slides dovm a 45^{o} inclined plane in twice the time it takes to slide down the same distance in the absence of friction. The coefficient of friction between the body and the inclined piane is ___________
a) 0.80 b) 0.75 c) 0.25 d) 0.33

205. A disc revolves with a speed $33\frac{1}{3}$ rev/min, and has a radius of 15 cm. Two coins A 3 and B are placed at 4 cm and 14 cm away from the centre of the disc. If the coefficient of friction between the coins and the disc is 0.15, which of the coins will revolve with the record?
a) A b) B c) Both A and B d) Neither A nor B

206. Which of the following is NOT an illustration of Newton's third law?
a) Flight of a jet plane b) A cricket player lowering his hands while catching a cricket ball
c) Walking on floor d) Rebounding of a rubber ball

207. A lift with its load has a mass of 2000 kg. It is supported by a steel cable. Find the tension in the cable when it accelerates downwards with uniform acceleration of 1 m/s^2.

a) 19600 N b) 17600 N c) 18500 N d) 19100 N

208. A wheel, initially at rest, is rotated with a uniform angular acceleration. The wheel rotates through an angle θ_1 in the first one second and through an additional angle θ_2 in the next one second. The ratio θ_2/θ_1 is:

a) 4 b) 3 c) 2 d) 1

209. A block of mass m is placed on a smooth inclined plane of inclination e with the horizontal. The inclined plane is accelerated horizontally so that the block does not slide down. What is the vertical force exerted by the inclined plane on the block?

a) mg sin θ b) mg cos θ c) mg d) None of these

210. A car is moving on a circular level road of curvature 300 metres. If the coefficient of friction is 0.3 and acceleration due to gravity is 10m/s^2, the maximum speed the car can have is:

a) 30 km/hr b) 81 km/hr c) 108 km/hr d) 162 km/hr

211. if μ_k is the coefficient of kinetic friction, μ_r the coefficient of rolling friction and μ_s the coefficient of static friction then generally:

a) $\mu_s > \mu_r > \mu_k$ b) $\mu_s > \mu_k > \mu_r$ c) $\mu_s < \mu_k < \mu_r$ d) $\mu_s < \mu_k > \mu_r$

212. From a given sample of a uniform wire, two circular loops P and Qare made, P of radius randQofradius nr.Ifthe M.I. of Q about its axis is 4 times that of P about its axis (assuming wire diameter much smaller, than either radius), the value of n is:

a) $(4)^{2/3}$ b) $(4)^{1/3}$ c) $(4)^{1/2}$ d) $(4)^{1/4}$

213. (A) In uniform circular motion of a body. its linear speed remains constant.

(R) Total acceleration of the body has no radial component.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

214. Suppose a rocket with an initial mass M$_0$ expels a mass $\triangle$m in the form of gases in time $\triangle$ t, then the mass of the rocket after time tis:

a) M$_0$ b) $M_0 + \frac{\triangle m}{\triangle t}$ c) $M_0 - \frac{\triangle m}{\triangle t}$ d) $M_0 - \frac{\triangle m}{\triangle t} t$

215. A solid cylinder of mass M and radius R rotates about its axis with angular speed ω. Its rotational kinetic energy is

a) $\frac{1}{2}MR^2\omega^2$ b) $MR^2\omega^2$ c) $\frac{1}{4}MR^2\omega^2$ d) $\frac{1}{8}MR^2\omega^2$

216. A car is negotiating a curve of radius 150 m with a speed of 15 ms $^{-1}$. The angle through which the pendulum suspended from the top of the ceiling would deviate is: (g=10 ms^{-2})
a) tan $^{-1}$ (3/20) b) tan $^{-1}$ (5/16) c) tan $^{-1}$ (4/15) d) tan $^{-1}$ (3/16)

217. A 100 N force acts horizontally on a block of 10 kg placed on a horizontal rough surface of coefficient of friction p = 0.5. If the acceleration due to gravity (g) is taken as 10 ms^{-2}, the acceleration of the block (in ms^{-2})is _____________
a) 2.5ms^2 b) 10ms^2 c) 5ms^2 d) 7.5ms^2

218. (1) Centre of gravity of a body is the point at which the weight of the body acts.
(2) Centre of mass coincides with the centre of gravity if the earth is assumed to have infinitely large radius.
(3) To evaluate the gravitational field intensity due to any body at an external point, the entire mass of the body can be considered to be concentrated at its centre of gravity
(4) The radius of gyration of any body rotating about an axis is the length of the perpendicular dropped from the centre of gravity of the body to the axis
Which one of the following pairs of statements is correct?
a) (1) and (4) b) (1) and (2) c) (2) and (3) d) (3) and (4)

219. A ball is dropped from a spacecraft revolving around the earth at a height of 120 km. What will happen to the ball?
a) It will continue to move with velocity u along the original orbit of spacecraft.
b) It will move with the same speed tangentially to the spacecraft.
c) It will fall down to the earth gradually. d) It will go very far in space.

220. (A) When a stone attached to the string just rotates in a vertical circle, its apparent weight is zero at the highest point.
(R) At the highest point, the apparent weight is equal to mg minus tension in string.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

221. If the earth were to suddenly contract to lln th of its present radius without any change in its mass, the duration (in hrs.) of the new day will be nearly:
a) 24/n b) 24n c) 24/n^2 d) 24n^2

222. When a horse pulls a wagon, the force that causes the horse to move forward is the force:
a) the ground exerts on it b) it exerts on the ground c) the wagon exerts on it
d) it exerts on the wagon

223. A body is projected upwards with a kinetic energy of 100 J. Taking the friction of air into account, when it returns to the earth, its kinetic energy will be:
a) 100 J b) < 100 J c) > 100 J d) none of these

224. The moment of inertia of a thin circular disc about an axis passing through its centre and perpendicular to its plane is I. Then, the moment of inertia of the disc about an axis parallel to its diameter and touching the edge of the rim is:
a) I b) 2I c) $\frac{3}{2}I$ d) $\frac{5}{2}I$

225. (A) The shafts of motors are provided with ball bearings.
(R) The rolling friction is less than sliding friction.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

226. (A) Two similar trains are moving along the equatorial line with the same speed but in opposite direction. They will exert equal pressure on the rails.
(R) In uniform circular motion, the magnitude of acceleration remains constant but the direction continuously changes.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

227. A weightless thread can support tension upto 30 N. A stone of mass 0.5 kg is tied to it and is revolved in a circular path of radius 2m in a vertical plane. If g =10ms^{-2}, then the maximum angular velocity of the stone will be:
a) 5 rad/s b) $\sqrt{30}$ rad/s c) $\sqrt{60}$ rad/s d) 10 rad/s

228. If a cicketer catches a ball of mass 150 gm moving with a veiocity of 20 m/s, then he experiences a force of ________ (Time taken to complete the catch is 0.1 sec)
a) 300N b) 30N c) 3N d) 0.3N

229. (A) The passengers sitting in a bus fall backward, whenthe bus suddenly starts moving.
(R) Every body has the inability to change by itself, its state of rest.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

230. The moment of inertia of a uniform semicircular disc of mass M and radius rabout a line perpendicular to the plane of disc through the centre is:
a) Mr^2 b) $\frac{1}{2}$Mr^2 c) $\frac{1}{4}$Mr^2 d) $\frac{2}{5}$Mr^2

231. A block of mass 10 kg is in contact against the inner wall of a hollow cylindrical drum of radius 1m. The coefficient of fuction between the block and the inner wall of the cylinder is 0.1. The minimum angular velocity needed for the cylinder to keep the block stationary when the cylinder is vertical and rotating about its axis, will be________ (g = 10 m/s^2)
a) 10 rad/s b) 10 rad/s c) 10p rad/s d) $\sqrt{10}$ rad/s

232. Two particles of mass 1 kg and 3 kg have position vector $2\hat{i} + 3\hat{j} + 4\hat{k}$ and $-2\hat{i} + 3\hat{j} - 4\hat{k}$ respectively. The centre of mass has a position vector
a) $2\hat{i} + 3\hat{j} - 2\hat{k}$ b) $\hat{i} + 3\hat{j} - 2\hat{k}$ c) $-\hat{i} + 3\hat{j} + 2\hat{k}$ d) $-\hat{i} + 3\hat{j} - 2\hat{k}$

233. A meter stick of mass 400 gm is pivoted at one end and displaced through an angle of 60°. The increase in its potential energy is:
a) 2 J b) 3 J c) 0 J d) 1 J

234. Two discs one of density 7.2 g/cm^3 and the other of density 8.9 gm/cm^3 , are of same mass and thickness. Their moments of inertia are in the ratio:
a) $\frac{8.9}{7.2}$ b) $\frac{7.2}{8.9}$ c) (8.9 x 7.2) :1 d) 1: (8.9 x 7.2)

235. When two surfaces are coated with a lubricant, then they:
a) stick to each other b) slide upon each other c) roll upon each other d) none of these

236. A cyclist is riding with a speed of 27 km h $^{-1}$. As he approaches a circular turn on the road of radius 80 m, he applies brakes and reduces his speed at a constant rate of 0.5 ms $^{-1}$. The magnitude of the net acceleration of the cyclist is:
a) 0.86 ms^{-2} b) 0.43 ms^{-2} c) 1.24 ms^{-2} d) 1.76 ms^{-2}

237. (A) In uniform circular motion, acceleration is time-dependent.
(R) In uniform circular motion, tangential force acting on the body is time-dependent.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

238. A rocket has a mass of 100 kg. 90% of this is fuel. It ejects fuel vapours at the rate of 1 kg/see with a velocity of 500 m/sec relative to the rocket. It is supposed that the rocket is outside the gravitational field. The initial upthrust on the rocket when it just starts moving upwards is:
a) Zero b) 500 N c) 1000 N d) 2000 N

239. The driver of a car suddenly sees a broad wall in front of him. He should
a) break sharply b) turn sharply c) both (a) and (b) d) none of these

240. Assertion: The centre of mass of a body may lie where there is no mass.
Reason: The centre of mass has nothing to do with the mass
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

241. The z component of the angular momentum of a particle whose position vector is $\vec{r}$ with components x, y and z and linear momentum is $\vec{P}$ with components P_x ,P_y and p_z is :
a) $xp_y - yp_z$ b) $yp_z - zp_y$ c) $zp_x - xp_z$ d) $xp_y + yp_x$

242. If the tension in the cable of 1000 kg elevator is 1000 kg weight, the elevator:
a) is accelerating upwards b) is accelerating downwards c) may be at rest or accelerating
d) may be at rest or in uniform motion

243. (A) Two projectiles of masses m and 4m when projected with same initial velocity vector have different ranges.
(R) The horizontal range of a projectile depends on mass of the body.

a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

244. (A) The centre of mass of a proton-proton system when released from their respective positions, remains at rest.
(R) The centre of mass of a system move only when external force (s) is (are) applied on the system.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

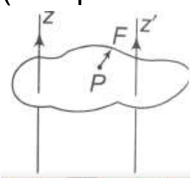
245. 4000 kg rocket is set for firing. If the exhaust speed is 1000 m s^{-1}, the mass to be ejected per second to just overcome gravitational pull (g = 10 m s^{-2}) is:
a) 20 kg b) 10 kg c) 5 kg d) 40 kg

246. The motion of the centre of mass of system of two particles is not affected by the internal forces:
a) irrespective of their directions b) only when they act along the line joining the particles
c) only when the forces are perpendicular to each other
d) when the angle between the lines of action of the forces lies between 0° and 90°

247. A wheel having a rotational inertia of 0.20 kg-m^2 rotates at 360 rpm about a vertical axis. What is the angular speed of the wheel when a torque of -1 N-m is applied about the same axis for 3.0 sec?
a) 12.68 rad/sec b) 22.68 rad/sec c) 32.68 rad/sec d) 42.68 rad/sec

248. Assertion: If there are no external forces, the centre of mass of a double star moves like a free particle.
Reason: If we go to the centre of mass frame, then we find that the two stars are moving in a circle about the centre of mass, which is at rest
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

249. Figure shows a lamina in x, y plane. Two axes z and z' pass perpendicular to its plane. A force F acts in the plane of lamina at point P as shown. Which of the following statements is correct? (The point P is closer to z' axis than the z- axis)



a) Torque τ caused by F about z axis is along $\hat{k}$.

b) Torque τ caused by F about z' axis is along $-\hat{k}$.

c) Torque caused by F about z axis is greater in magnitude than that about z' axis.
d) Total torque is given by $\tau = \tau + \tau'$

250. The breaking force of a string is 16 kgf. The maximum frequency at which a body of mass $\frac{1}{2}$ Kg can be whirled in a horizontal smooth plane ($g = \pi^2 ms^{-2}$) with $\frac{1}{2}$ m of that string is:
a) 10 b) 5 c) 4 d) 8

251. A ring of mass m and radius r is melted and then moulded into a sphere. The moment of inertia of the sphere will be:
a) more than that of the ring b) less than that of the ring c) equal to that of the ring
d) none of the above

252. In uniform circular motion:
a) both velocity and acceleration are constant
b) acceleration and speed are constant but velocity changes
c) both acceleration and velocity change d) both acceleration and speed are constant

253. The value of T_1 is:
a) 1 N b) 5 N c) 8 N d) 10 N

254. A particle of mass M is moving in a horizontal circle of radius R with uniform speed V. When it moves from one point to a diametrically opposite point, its:
a) kinetic energy changes by $\frac{MV^2}{4}$ b) momentum does not change
c) momentum changes by 2MV d) kinetic energy changes by MV^2

255. (A) Moment of inertia of a rigid body is not unique.
(R) Moment of inertia of a rigid body depends on the distribution of mass about the axis of rotation.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

256. (A) Action and reaction in Newton's third law cannot cancel each other.
(R) Action and reaction act on different bodies.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

257. A water fountain on the ground sprinkles water all around it. If the speed of water coming out of the fountain is v, the total area around the fountain that gets wet is :
a) $\pi\frac{v^2}{g}$ b) $\pi\frac{v^4}{g^2}$ c) $\frac{\pi v^4}{2g^2}$ d) $\pi\frac{v^2}{g^2}$

258. If a spherical ball rolls on a table without slipping. The fraction of its total energy associated with rotational energy is:
a) 3/5 b) 2/7 c) 2/5 d) 3/7

259. When a mass is rotating in a plane about a fixed point its angular momentum is directed along
a) the radius b) the tangent the orbit c) the line at angle of 45° to the plane of rotation
d) the axis of rotation

260. When the axle rotates in a sleeve, the friction involved in the process is:
a) sliding b) rolling c) limiting d) none of these

261. A door 1.6 m wide requires a force of 1 N to be applied at the free end to open or close it. The force that is required at a point 0.4 m distant from the hinges for opening or closing the door is:
a) 1.2 N b) 3.6 N c) 2.4 N d) 4 N

262. The position of the centre of mass of a cube of uniform density will be at:
a) edge of a cube b) the centre of one face
c) the centre of the intersection of diagonals of one face
d) the geometric centre of the cube

263. A cylinder is rolling over a surface. Which points on it move rectilinearly?
a) All points on the curved surface of the cylinder
b) All points on the flat surfaces of the cylinder c) All points on the axis of the cylinder
d) None of the above

264. A dog weighing 5 kg is standing on a flat boat so that it is 10m from the shore. The dog walks 4 m on the boat towards the shore and then halts. The boat weighs 20 kg and one can assume that there is no friction between it and the water. How far is the dog from the shore at the end of this time ?
a) 3.2m b) 0.8m c) 10m d) 6.8m

265. A bicycle is travelling northwards and so its angular momentum points towards west. In what direction should the cyclist apply a torque to turn left?
a) West b) South c) East d) North

266. (A) The apparent weight of a body in an elevator moving with some downward acceleration is less than the actual weight of body.
(R) Some part of the weight is spent in producing downward acceleration, when body is in elevator.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

267. A body is sliding down a rough inclined plane. The coefficient offriction between the body and the plane is 0.5. The ratio of the net force required for the body to slide down and the normal reaction on the body is 1 : 2. Then the angle of the inclined plane is:
a) 15^0 b) 30^0 c) 45^0 d) 60^0

268. A 100 kg gun fires a ball of 1 kg horizontally from a cliff of height 500 m. It falls on the ground at a distance of 400 m from the bottom of the cliff. The recoil velocity of the gun is (Take g = 10 m S^{-2})
a) $0.2ms^{-1}$ b) $0.4ms^{-1}$ c) 0.6 m S^{-1} d) 0.8 m S^{-1}

269. A force produces an acceleration of 4 m s^{-2} in a body of mass ml kg and the same force produces an acceleration of 6 m s^{-2} in another body of mass m2. If the same force is applied to (m_1 + m_2), then the acceleration will be:
a) 10 m s^{-2} b) 2 m s^{-2} c) 2.4 m s^{-2} d) 5.4 m s^{-2}

270. In the question number 66, if wheel starts from rest, what is the kinetic energy of the wheel when 2 m of the cord is unwound?
a) 20 J b) 25 J c) 45 J d) 50 J

271. A body is moving with uniform velocity of 2 m s^{-1} on a rough level surface. The frictional force on it is 10 N. If the body moves with velocity 4 m s^{-1}, the force of friction will be:
a) 2.5 N b) 5 N c) 10 N d) 20 N

272. A parachutist of weight W strikes the ground with his legs fixed and comes to rest with an upward acceleration of magnitude 3 g. Force exerted on him by the ground during landing is:
a) 2 W b) 3 W c) 4 W d) Zero

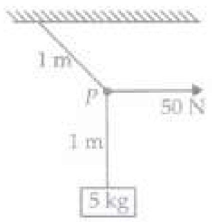
273. (A) Whenever a particle moves in a circular path with uniform speed, an acceleration exists which is directed towards the centre.
(R) The net acceleration of a particle in circular motion is always radially inward.
a) If assertion is false but reason is true.
b) If both assertion and reason are true and reason is the correct explanation of assertion.
c) If both assertion and reason are true but reason is not the correct explanation of assertion.
d) If assertion is true but reason is false. e) If both assertion and reason are false.

274. If a gymnast, sitting on a rotating stool with his arms outstretched, suddenly lowers his arms:
a) the angular velocity increases b) his moment of inertia increases
c) the angular velocity remains same d) the angular momentum increases

275. If a cyclist moving with a speed of 4.9 m/s on a level road can take a sharp circular turn of radius 4 m, then coefficient of friction between the cycle tyres and road is:
a) 0.41 b) 0.51 c) 0.61 d) 0.71

276. A block slides with a velocity of 10 mls on a rough horizontal surface. It comes to rest after covering a distance of 50 metres. If g is 10 m/sec^2, then the coefficient of dynamic friction between the block and the surface is:
a) 0.1 b) 1 c) 10 d) 5

277. A block of mass 5 kg is suspended by a massless rope of length 2 m from the ceiling. A force of 50 N is applied in the horizontal direction at the midpoint P of the rope, as shown in the figure.
The angle made by the rope with the vertical in equilibrium is (Take g = 10 m s^{-2})



a) 30° b) 40° c) 60° d) 45°

278. A rigid spherical body is spinning around an axis without any external torque. Due to change in temperature, the volume increases by 1%. Its angular speed:

a) will increase approximately by 1% b) will decrease approximately by 1%
c) will decrease approximately by 0.67% d) will decrease approximately by 0.33%

279. The friction may be classified as:
a) gravitational interaction b) electrical interaction c) magnetic interaction
d) nuclear interaction

280. A uniform force of $3\hat{i}+\hat{j}$ newton acts on a particle of mass 2 kg. Hence the particle is displaced from position $2\hat{i}+\hat{k}$ metre to position $4\hat{i}+3\hat{j}-\hat{k}$ metre. The work done by the force on the particle is:
a) 9 J b) 6 J c) 13 J d) 15 J

281. (A) Angle of repose is equal to the angle of limiting friction.
(R) When the body is just at the point of motion, the force of friction in this stage is called limiting friction.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

282. If a cyclist doubles his speed while negotiating a curve, how does the tendency to overturn vary?
a) Remains unchanged b) Doubled c) Halved d) Quadrupled

283. (A) The path of one projectile as seen from another projectile is a striaght line.
(B) Relative acceleration of one projectile W.r.t. another projectile is zero.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

284. A constant force acting on a body of mass of 5 kg change its speed from 5 m S^{-1} to 10 m S^{-1} in 10 s without changing the direction of motion. The force acting on the body is
a) 1.5 N b) 2 N c) 2.5 N d) 5 N

285. A sphere of mass m and radius r rolls on a horizontal plane without slipping with the speed u. Now, if it rolls up vertically, the maximum height it would attain will be:
a) $3u^2/4g$ b) $5u^2/2g$ c) $7u^2/10g$ d) $u^2/2g$

286. A projectile is moving at 60 m/sec at its highest point where it breaks into two equal parts due to an internal explosion. One part moves up vertically at 50 m/sec with respect to the ground. The other part will move at:
a) 110 m/sec b) 120 m/sec c) 130 m/sec d) $10\sqrt{61}$ m/sec

287. A satellite in force-free space sweeps stationary interplanetary dust at a rate (dMldt) = au. The acceleration of satellite is:
a) $-2av^2/M$ b) $-av^2/M$ c) $-2av^2/2M$ d) $-av^2$

288. Two particles of masses m_1 and m_2 are connected by a rigid massless rod of length r to constitute a dumb-bell which is free to move in the plane. The moment of inertia of the dumb-bell about an axis perpendicular to the plane passing through the centre of mass is:

a) $\frac{m_1 m_2 r^2}{(m_1+m_2)}$ b) $(m_1 + m_2) r^2$ c) $\frac{m_1 m_2 r^2}{(m_1-m_2)}$ d) $(m_1 - m_2) r^2$

289. (A) Many great rivers flow toward the equator. The sediments that they carry increases the time of rotation of the earth about its own axis.

(R) The angular momentum of the earth about its rotation axis is conserved.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

290. A particle of mass 0.2 kg is moving in a circle of radius 1m with f = (2/ π)see -I, then its angular momentum is:

a) 0.8 kg - m^2/s b) 2 kg - m^2/sec c) 8 kg - m^2/s d) 16 kg - m^2/sec

291. If the angles of projection of a projectile with same initial velocity exceed or fall short of 45° by equal amounts a, then the ratio of horizontal ranges is:

a) 1 : 2 b) 1 : 3 c) 1 : 4 d) 1 : 1 e) 1 : $\sqrt{2}$

292. When a body slides down from rest along a smooth inclined plane making an angle of 30° with the horizontal, it takes time 20 s. When the same body slides down from rest along a rough inclined plane making the same angle and through the same distance, it takes time 20p s, where p is some number greater than 1. The coefficient of friction between the body and the rough plane is

a) $\mu = \left(1 - \frac{1}{p^2}\right)\frac{1}{\sqrt{3}}$ b) $\mu = \sqrt{1 - \frac{1}{9p^2}}$ c) $\mu = (1 - p^2)\frac{1}{\sqrt{3}}$ d) $\mu = \sqrt{1 - 9p^2}$

293. A block of mass 50 kg slides over a horizontal distance of 1m. If the coefficient of friction between their surfaces is 0.2, then work done against friction is:

a) 98 J b) 72 J c) 56 J d) 34 J

294. Assertion: The position of centre of mass does not depend upon the reference frame.

Reason: Centre of mass depends only upon the rest mass of the body.

a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

295. A balloon with mass 'z' is descending down with an acceleration 'a' (where a < g). How much mass should be removed from it so that it starts moving up with an acceleration 'a'?

a) $\frac{2ma}{g+a}$ b) $\frac{2ma}{g-a}$ c) $\frac{ma}{g+a}$ d) $\frac{ma}{g-a}$

296. Two identical solid cylinders run a race starting from rest at the top of an inclined plane. If one cylinder slides and the other rolls:

a) the sliding cylinder will reach the bottom first with greater speed

b) the rolling cylinder will reach the bottom first with greater speed

c) both will reach the bottom simultaneously with the same speed

d) both will reach the bottom simultaneously but with different speeds

297. A phonograph turn-table rotating at 78 rev/min slows down and stops in 30 see after the motor is turned off. Then the revolutions made by it in this time are:

a) 19.5 b) 39 c) 78 d) 156

298. A balloon of mass M is descending at a constant acceleration a. When a mass m is released from the balloon it starts rising with the same acceleration a. Assuming that its volume does not change, what is the value of m?

a) $\left[\frac{a}{a+g}\right]M$ b) $\left[\frac{2a}{a+g}\right]M$ c) $\left[\frac{a+g}{a}\right]M$ d) $\left[\frac{a+g}{2a}\right]M$

299. A cord is tied to a pail of water and the pail is swung in a vertical circle of radius 4 m and g = 9 ms $^{-2}$. The minimum velocity of the pail at the highest point of the circle, if no water is to spill from the pail, is:

a) 7 ms^{-1} b) 6 ms^{-1} c) 10 ms^{-1} d) 3 ms^{-1}

300. (A) If the effect of air resistance is neglected, all objects fall with the same acceleration.

(R) The gravitational force is same on each object.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true

301. A body of mass M hits normally a rigid wall with velocity v and bounces back with the same velocity. The impulse experienced by the body is ________

a) MV b) 1.5MV c) 2MV d) zero

302. A monkey of mass 20 kg is holding a vertical rope. The rope will not break when a mass of 25 kg is suspended from it but will break if the mass exceeds 25 kg. What is the maximum acceleration with which the monkey can climb up along the rope?

a) 2.5m/s^2 b) 5m/s^2 c) 10m/s^2 d) 25m/s^2

303. Assertion: There is no appreciable change in the position of the body during the action of the impulsive force.

Reason: In case of impulsive force the time of action of the force is very short.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

304. A flywheel rotating at 420 rpm slows down at a constant rate of 2 rad s^{-2}. The time required to stop the flywheel is :

a) 22 s b) 11 s c) 44 s d) 12 s

305. A disc is rotating with angular velocity $\vec{\omega}$ about its axis. A force acts at a point whose position vector with respect to the axis of rotation is The power associated with the torque due to the force is given by

a) $(\vec{r}x\vec{F}).\vec{\omega}$ b) $(\vec{r}x\vec{F})x\vec{\omega}$ c) $\vec{r}x(\vec{F}x\vec{\omega})$ d) $\vec{r}x(\vec{F}.\vec{\omega})$

306. A rupee coin, starting from rest rolls down a distance of Im on a plane inclined at an angle of 30° with the horizontal. Assuming that g = 9.81 m s^{-2}, time taken is:
a) 0.32 s b) 0.48 s c) 0.78 s d) 1.0 s

307. (A) Comets move around the sun in eJliptical orbits. The gravitational force on the comet due to the sun is not normal to the comet's velocity but the work done by the gravitational force over every complete orbit of the comet is zero.
(R) Gravitational force is a non-conservative force.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

308. A raw egg and a hard boiled egg are made to spin on a table with the same angular speed about the same axis. The ratio of the time taken by the two to stop is:
a) = 1 b) < 1 c) < 1 d) none of these

309. A monkey is descending from the branch of a tree with constant acceleration. If the breaking strength is 75% of theweight of the monkey, the minimum acceleration with which monkey can slide down without breaking the branch is ___________
a) g b) $\frac{3g}{4}$ c) $\frac{g}{4}$ d) $\frac{g}{2}$

310. The moment of inertia of a disc of mass M and radius R about an axis, which is tangential to the circumference of the disc and parallel to the diameter is:
a) $\frac{3}{2}MR^2$ b) $\frac{2}{3}MR^2$ c) $\frac{5}{2}MR^2$ d) $\frac{4}{5}MR^2$

311. A solid cylinder of mass 20 kg and radius 20 cm rotates about its axis with a angular speed 100 rad s^{-1}. The angular momentum of the cylinder about its axis is :
a) 40 J s b) 400 J s c) 20 J s d) 200 J s

312. A cyclist moves on a circular track of radius 100 metre. If the coefficient of friction is 0.2, then the maximum speed with which the cyclist can take a turn without leaning inwards is:
a) 9.8 ms^{-1} b) 1.4 ms^{-1} c) 140 ms^{-1} d) 14.0 ms^{-1}

313. Mass is distributed uniformly over a thin triangular plate and positions of two vertices are given by (1,3) and (2, - 4). What is the position of 3rd vertex if centre of mass o the plate lies at the origin?
a) (1,-2) b) (-2,4) c) (-3,1) d) (1,2)

314. Two equal and opposite forces act on a rigid body at a certain distance. Then:
a) the body is in equilibrium b) the body will rotate about its centre of mass
c) the body may rotate about any point other than its centre of mass
d) the body cannot rotate about its centre of mass

315. The coefficient of static friction, m_3, between block A of mass 2 kg and the table as shown in the figure is 0.2. What would be the maximum mass value of block B so that the two blocks do not move? The string and the pulley are assumed to be smooth and massless.
a) 0.4kg b) 2.0kg c) 4.0kg d) 0.2kg

316. A person is standing on a rotating table with metal spheres in his hands. Ifhe withdraws his hands to his chest, then the effect on his angular velocity will be

a) increase b) decrease c) remain same d) can't say

317. A police jeep is chasing with velocity of 45 km/h, a thief in another jeep moving with velocity of 153 km/h. Police fires a bullet with muzzle velocity of 180 m/s. The velocity with which it will strike the jeep of the thief, is:
a) 150 m/s b) 27 m/s c) 450 m/s d) 250 m/s

318. A rod of mass M and length L is suspended freely from its end and it can oscillate in the vertical plane about the point of suspension. It is pulled to one side and then released. It passes through the equilibrium position with angular speed ω. What is its kinetic energy while passing through the mean position?
a) $ML^2\omega^2$ b) $ML^2\omega^2/4$ c) $ML^2\omega^2/6$ d) $ML^2\omega^2/12$

319. A body is acted on by a force toward a point. The magnitude of the force is inversely proportional to the square of the distance. The path of body wil lbe:
a) ellipse b) hyperbola c) circle d) parabola

320. what is the time taken by the eM to hit the ground?
a) 2s b) $\sqrt{2}$ s c) 1 s d) $\frac{1}{2}s$

321. A block A of mass m_1 rests on a horizontal table. A light string connected to it passes over a frictionless pulley at the edge of table and from its other end another block B of mass m_2 is suspended. The coefficient of kinetic fliction between the block and the table is m_k. When the block A is sliding on the table, the tension in the string is ____________
a) $\frac{(m_2-\mu k m_1)g}{(m_1+m_2)}$ b) $\frac{m_1 m_2(1+\mu_k)g}{(m_1+m_2)}$ c) $\frac{m_1 m_2(1-\mu_k)g}{(m_1+m_2)}$ d) $\frac{(m_2+\mu_k m_1)g}{(m_1+m_2)}$

322. A heavy uniform chain lies on a horizontal table top. If the coefficient of friction between the chain and the table surface is 0.25, then the maximum fraction of the length of the chain, that can hang over one edge of the table is:
a) 20% b) 25% c) 35% d) 15%

323. A solid sphere rolls down without slipping on a 30° inclined plane. If g = 10m/s^2 , the acceleration of the rolling sphere is:
a) 5 ms^{-2} b) $\frac{7}{25}ms^{-2}$ c) $\frac{25}{7}ms^{-2}$ d) $\frac{15}{7}ms^{-2}$

324. (A) Newton's first law is not merely a special case (a = 0) of the second law (F = ma) .

(R) Newton's first law defines the frame from where Newton's second law $\vec{F} = m\vec{a}$ is applicable.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

325. A box is placed on an inclined plane and has to be pushed down. The angle of inclination is:
a) equal to angle of friction b) more than angle of friction c) equal to angle of repose
d) less than angle of repose

326. A loop rolls down on an inclined plane. The fraction of its total kinetic energy that is associated with the rotational motion is:

a) 1 : 2 b) 1 : 3 c) 1 : 4 d) 2 : 3

327. what is the minimum velocity of the centre of mass in its path?
a) 10 ms^{-1} b) 5 ms^{-1} c) $5\sqrt{2}ms^{-1}$ d) $10\sqrt{2}ms^{-1}$

328. A disc revolves in a horizontal plane at a steady rate of 3 rad/s. A coin will remain on the disc if kept at a distance of 20 cm from the axis of rotation. The coefficient of friction is: (g = n^2ms^{-2})
a) 0.5 b) 0.3 c) 0.20 d) 0.72

329. When a bus suddenly takes a turn, the passengers are thrown outwards because of :
a) Inertia of motion b) Acceleration of motion c) Speed of motion d) Both (b) and (c)

330. A body subjected to three concurrent forces is found to be in equilibrium. The resultant of any two forces
a) is equal to third force b) is opposite to third force c) is collinear with the third force
d) all of these

331. A solid sphere rolls down two different inclined planes of same height, but of different inclinations. In both cases:
a) speed and time of descent will be same
b) speed will be same, but time of descent will be different
c) speed will be different, but time of descent will be same
d) speed and time of descent both are different

332. If a person with a spring balance and a body hanging from it goes up and up in an aeroplane, then the reading of the weight of the body as indicated by the spring balance will:
a) go on increasing b) go on decreasing c) first increases and then decreases
d) remain the same

333. (A) A body X is dropped from the top of a tower. At the same time, another body Y is thrown horizontally from the same position with a velocity u. Both bodies will reach the ground at the same time.
(R) Horizontal velocity has no effect motion in the vertical direction.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

334. A horse pulls the cart. Which of the following forces makes the cart move?
a) Force exerted by the horse on the cart b) Force exerted by the ground on the cart
c) Force exerted by the ground on the horse d) Force exerted by the horse on the ground

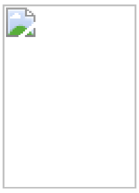
335. (A) An athlete runs some distance, before taking a long Jump.
(R) It is due to inertia of motion.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

336. A stone of mass m is tied to a string of length l and rotated in a circle with a constant speed v, if the string is released, the stone flies:

a) radially outward b) radially inward c) tangentially outward d) with an acceleration $\frac{mv^2}{l}$

337. The height y and the distance x along the horizontal plane of a projectile on a certain planet (with no surrounding atmosphere) are given by: y = (8t - 5t^2) metre and x = 6t metre, where t is in seconds. The velocity of projection is:
a) 8 m/s b) 6 m/s c) 10 m/s d) not obtained from the data

338. Two blocks A and B of masses 3m and m respectively are connected by a massless and inextensible string. The whole system is suspended by a massless spring as shown in figure. The magnitudes of acceleration of A and B immediately after the string is cut, are respectively:



a) g,$\frac{g}{3}$ b) $\frac{g}{3}$,g c) g,g d) $\frac{g}{3},\frac{g}{3}$

339. (A) If there is no external torque on a body about its centre of mass, then the velocity of the centre of mass remains constant.
(R) The linear momentum of an isolated system remains constant.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

340. Of the two eggs which have identical sizes, shapes and weights, one is raw and other is half boiled. The ratio between the moment of inertia of the raw to the half boiled egg about central axis is:
a) = 1 b) > 1 c) < 1 d) not comparable

341. A body of mass 100 g is sliding from an inclined plane of inclination e = 30°. What is the frictional force experienced if μ=1.7?
a) $1.7 \times \sqrt{2} \times \frac{1}{\sqrt{3}}N$ b) $1.7 \times \sqrt{3} \times \frac{1}{2}N$ c) $1.7 \times \sqrt{3}N$ d) $1.7 \times \sqrt{3} \times \frac{1}{\sqrt{2}}N$

342. A body of mass M and radius R is rolling horizontally without slipping with speed u. It then rolls up a hill to a maximum height h. If = $h = 5v^2/6g,$ what is the M.I. of the body?
a) $\frac{1}{2}MR^2$ b) $\frac{2}{3}MR^2$ c) $\frac{3}{4}MR^2$ d) $\frac{2}{5}MR^2$

343. Four bodies of masses 2,3,5 and 8 kg are placed at the four corners of a square of side 2 m. The position of eM will be:

a) $\left(\frac{8}{9}, \frac{13}{9}\right)$ b) $\left(\frac{7}{9}, \frac{11}{9}\right)$ c) $\left(\frac{11}{9}, \frac{13}{9}\right)$ d) $\left(\frac{11}{9}, \frac{8}{9}\right)$

344. Three blocks of masses m$_1$, m$_2$ and m$_3$ kg are placed in contact with each other on a frictionless table. A force F is. the force experienced by mass m$_2$ is:

a) F b) $\frac{Fm_1}{m_1+m_2}$ c) $\frac{F\left(m_2+m_1\right)}{m_2+m_2+m_3}$ d) $\frac{F\left(m_2+m_3\right)}{m_1+m_2+m_3}$

345. A reference frame attached to the earth:
a) is an inertial frame by definition
b) cannot be an inertial frame because the earth is revolving round the sun
c) is an inertial frame because Newton's laws are applicable
d) is an inertial frame because the earth is rotating about its own axis.

346. A body of mass m is tied to one citd. of a spring and whirled round in a horizontal plane with a constant angular velocity. The elongation in the spring is 5 cm. The original length of spring is:
a) 16 cm b) 15 cm c) 14 cm d) 13 cm

347. The moment of inertia of a circular disc of radius 2 m and mass 1 kg about an axis passing through its centre of mass is 2 kg-m^2. Its moment of inertia about an axis parallel to this axis and passing through its edge (in kg-m^2) is:
a) 10 b) 8 c) 6 d) 4

348. A small block slides down from the top of a hemisphere of radius r. It is assumed that there is no friction between the block and the hemisphere. At what height, h will the block lose contact with the surface of sphere?
a) $\frac{r}{3}$ b) $\frac{2r}{3}$ c) $\frac{r}{2}$ d) $\frac{r}{4}$

349. A particle is moving along a circular path of radius 2 m with uniform speed of 5 m s^{-1}. What will be the change in velocity when the particle completes half of the revolution?
a) Zero b) 10 ms^{-1} c) $10\sqrt{2}$ms^{-1} d) $\frac{10}{\sqrt{2}}ms^{-1}$

350. Two bodies A and B have masses M and m respectively, where M >m and they are at a distance d apart. Equal force is applied to them so that they approach each other. The position where they hit each other is:
a) nearer to B b) nearer to A c) at equal distance from A and B d) cannot be decided

351. A block of mass 1 kg lies on a horizontal surface in a truck. The coefficient of static friction between the block and the surface is 0.6. If the acceleration of the truck is 5 m S^{-2}. The frictional force acting on the block is
a) 10 N b) 5 N c) 2.5 N d) 20 N

352. A thin uniform circular disc of mass M and radius R is rotating in a horizontal plane about an axis passing through its centre and perpendicular to the plane with angular velocity ω. Another disc of same mass but half the radius is gently placed over it coaxially. The angular speed of the composite disc will be:
a) $\frac{5}{4}\omega$ b) $\frac{4}{5}\omega$ c) $\frac{2}{5}\omega$ d) $\frac{5}{2}\omega$

353. A disc of moment of inertia I_1 is rotating freely with angular velocity ω_1 when a second, non-rotating disc with moment of inertia I_2 is dropped on it gently the two then rotate as a unit. Then the total angular speed is:
a) $\frac{I_1\omega_1}{I_2}$ b) $\frac{I_2\omega_1}{I_1}$ c) $\frac{I_1\omega_1}{I_2+I_1}$ d) $\frac{(I_1+I_2)\omega_1}{I_2}$

354. It is easier for a swimmer jumping into water from a height to describe a loop in the air by:
a) pulling the arms and legs closer b) spreading the arms and legs
c) keeping the arms and legs straight d) none of the given methods

355. A bullet of mass 40 g moving with a speed of 90 m S^{-1} enters a heavy wooden block and is stopped after a distance of 60 cm. The average resistive force exerted by the block on the bullet is

a) 180 N b) 220 N c) 270 N d) 320 N

356. A motor car is moving with speed 30 ms^{-1} on a circular path of radius 500 m. Its speed is increasing at the rate of 2 ms^{-2}; what will be its resultant acceleration?

a) 2.5 ms^{-2} b) 2.7 ms^{-2} c) 2 ms^{-2} d) 4.5 ms^{-2}

357. A lift is moving upwards with a uniform velocity u in which a block of mass m is lying. The frictional force offered by the block, when coefficient of friction is μ, will be:

a) zero b) mg c) μmg d) 2 μmg

358. A thin hollow cylinder is free to rotate about its geometrical axis. It has a mass of 8 kg and a radius of 20 cm. A rope is wrapped around the cylinder. What force must be exerted along the rope to produce an angular acceleration of 3 rad/sec^2?

a) 8.4 N b) 5.8 N c) 4.8 N d) None of these

359. A projectile of mass 30 kg is shot vertically upwards with an initial velocity of 10 m/s. After 5 s, it explodes into two fragments, one of which having a mass of 20 kg is travelling vertically with a velocity of 150 m/s. What is the velocity of the other fragment at that instant?

a) -15 m/s b) 15 m/s c) Zero d) None of these

360. A bullet is fired from a gun. The force on the bullet is given by F = 600-2 $\times$ 10^5 t where, F is newton and / in second. The force on the bullet becomes zero as soon as it leaves the barrel. What is the average impulse imparted to the bullet?

a) 8N-s b) 0 c) 0.9N-s d) 1.8N-s

361. A uniform disc of mass m and radius R is rolling down a rough inclined plane which makes an angle 30° with the horizontal. If the coefficients of static and kinetic friction are each equal to μ and the only forces, acting are gravitational and frictional, then the magnitude of the frictional force acting on the disc is:

a) (mg/3) upwards b) (mg/3) downwards c) (mg/6) upwards d) (mg/6) downwards

362. A solid cylinder of mass M and radius R rolls down an inclined plane without slipping. The speed of its centre of mass when it reaches the bottom is: (h is the height of inclined plane)

a) $\sqrt{2gh}$ b) $\sqrt{\frac{4}{3}gh}$ c) $\sqrt{\frac{4}{3}gh}$ d) $\sqrt{4g/h}$

363. (A) A cyclist always bends inwards while negotiating a curve.

(R) By bending, cyclist lowers his centre of gravity.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

364. A stone of mass m tied to a string of length l is rotating along a circuiar path with constant speed v. The torque on the stone is:

a) mlv b) mv/l c) mv^2/l d) mv^2l e) zero

365. Moment of inertia of ring about its diameter is I. Then, moment of inertia about an axis passing through centre perpendicular to its plane is:

a) 2I b) $\frac{I}{2}$ c) $\frac{3}{2}I$ d) I

366. A thick walled hollow sphere has outer radius R. It rolls down an inclined plane without slipping and its speed at the bottom is v. If the inclined plane is frictionless and the sphere slides down without rolling, its speed at the bottom will be 5 v /4. What is the radius of gyration of the sphere?

a) $\frac{R}{\sqrt{2}}$ b) $\frac{R}{2}$ c) $\frac{3R}{4}$ d) $\frac{\sqrt{3}R}{4}$

367. A uniform sphere of mass 200 gm rolls without slipping on a plane surface so that its centre moves at a speed of 2.00 cm/see, Its KE is:

a) 5.6×10^{-5} J b) 5.6×10^{-4} J c) 5.6×10^{-3} J d) 5.6×10^{-2} J

368. Centre of mass of 3 particles 10 kg, 20 kg and 30 kg is at (0,0,0). Where should a particle of mass 40 kg be placed so that the combined centre of mass will be at(3, 3, 3)?

a) (0,0,0) b) (7.5,7.5,7.5) c) (1,2,3) d) (4,4,4)

369. A circular racetrack of radius 300 m is banked at an angle of 15°. The coefficient of friction between the wheels of a race car and the road is 0.2. The optimum speed of the race car to avoid wear and tear on its tyres is

(Take tan 15° = 0.27, g = 10 m S^{-2})

a) $10\sqrt{3}ms^{-1}$ b) $9\sqrt{10}ms^{-1}$ c) $\sqrt{10}ms^{-1}$ d) $2\sqrt{10}ms^{-1}$

370. A girl press her physics text book against a rough vertical wall with her hand. The direction of the frictional force on the book exerted by the wall is

a) downwards b) upwards c) out from the wall d) into the wall

371. A ring is rolling on a surface without slipping. What is the ratio of its translational to rotational kinetic energies?

a) 5 : 7 b) 2 : 5 c) 2 : 7 d) 1:1

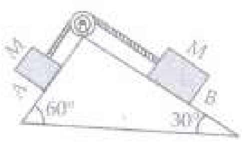
372. An inclined plane makes an angle of 30° with the horizontal. A ring rolling down this inclined plane from rest without slipping has a linear acceleration equal to:

a) 2g/3 b) g/2 c) g/3 d) g/4

373. The maximum safe speed of a vehicle over a curved road of radius 150 m is 10 ms $^{-1}$. If the width of road is 7.5 m, the height of the outer edge is:

a) 0.25 m b) 0.50 m c) 0.35 m d) 0.60 m

374. Two blocks each of mass M are resting on a frictionless inclined plane as shown in figure. Then



a) The block A moves down the plane b) The block B moves down the plane.

c) Both the blocks remain at rest d) Both the blocks move down the plane

375. A flywheel rolls down on an inclined plane. At any instant of time, the ratio of rotational kinetic energy to total kinetic energy is:

a) 1 : 2 b) 3 : 1 c) 4 : 3 d) 1 : 3

376. Two particles of equal mass have velocities $\vec{v_1} = 2\hat{i}ms^{-1}$ and $\vec{v_2} = 2\hat{j}ms^{-1}$ first particle has an acceleration $\vec{a_1} = (3\hat{i} + 3\hat{j})ms^{-2}$ while the acceleration of the two particle is zero. The center of mass of the two particles moves in a path of :
a) straight line b) parabola c) circle d) ellipse

377. All the magnitudes of which of the following can be treated as vectors?
a) Angular displacement b) Average angular velocity c) Instantaneous angular velocity
d) None of the above

378. An elevator and its load weigh a total of 1600 lb. If the elevator, originally moving downwards at 20 ftlsec is brought to rest with constant acceleration in a distance of 50 ft , then tension T in the supporting cable is given by:
a) 1800 poundal b) 1800 pound force c) 57600 pound force d) none of these

379. A rocket of initial mass 1500 kg ejects gas at a constant rate of 10 kg/s with a relative speed of 5 km/s. What is the acceleration of the rocket 50 seconds after the blast, neglecting gravity?
a) 10 ms^{-2} b) 25 ms^{-2} c) 50 ms^{-2} d) 100 ms^{-2}

380. An aircraft executes a horizontal loop at a speed of 720 km h^{-i} with its wings banked at 15°. What is the radius of the loop?
(Take g = 10 m S^{-2}, tan 15° = 0.27)
a) 14.8 km b) 14.8 m c) 29.6 km d) 29.6 m

381. A book of mass 0.5 kg has its length 75 ern and breadth 25 cm. Then the moment of inertia about an axis perpendicular to the book and passing through the centre of gravity ofthc book is:
a) $\frac{10}{289} kg - m^2$ b) $\frac{282}{10} kg - m^2$ c) $\frac{10}{384} kg - m^2$ d) $\frac{10}{483} kg - m^2$

382. (A) A sphere is placed such that is its centre is at origin of coordinate system. If I_x and I_y be the moment of inertia about x-axis and y-axis respectively then moment of inertia about z-axis is $I_x + I_y$.
(R) For any body according to perpendicular axis theorem $i_z = I_x + I_y$.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

383. A child is standing at one end of a long trolley moving with a speed v on a smooth horizontal floor. If the child starts running towards the other end of the trolley with a speed u, the centre of mass of the system (trolley + child) will move with a speed
a) zero b) (v + u) c) (v-u) d) v

384. The earth (mass = 6 x 10^{24}kg) revolves around the sun with an angular velocity of 2 x 10^{-7} radian/see in a circular orbit of radius 1.5 x 10^8 km. The force exerted by the sun, on the earth is:
a) 6 x 10^{19} N b) 18 x 10^{25} N c) 36 x 10^{21} N d) 27 x 10^{39} N

385. A block of mass I kg is placed on a truck which accelerates with an acceleration 5 m/s^2. The coefficient of static friction between the block and the truck is 0.6. The frictional force acting on the block is:
a) 5 N b) 6 N c) 5.88 N d) 4.6 N

386. A body of mass 10 kg is moving with a constant velocity of 10 m/s. When a constant force acts for 4 s on it, it moves with a velocity 2 m/s in the opposite direction. The acceleration produced in it is:
a) 3 m/s^2 b) -3 m/s^2 c) 0.3 m/s^2 d) -0.3 m/s^2

387. Assertion: The moment after a stone is released out of an accelerated train, there is no horizontal force or acceleration on the stone.
Reason: Force on a body at a given time is determined by the situation at the location of the body at that time.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

388. A batsman hits back a ball straight in the direction of the bowler without changing its initial speed of 12 m/s If the mass of the ball is 0.15 kg, find the impulse imparted to the ball (assume linear motion of the ball) :
a) 1.8 Ns b) 3.6 Ns c) 3.6 Nm d) 1.8 Nm

389. When sand is poured on a rotating disc, its angular velocity will:
a) decrease b) increase c) remain constant d) none of these

390. A horizontal platform is rotating with a uniform angular velocity around a vertical axis passing through the centre. At a certain instant of time, a viscous fluid of mass m is dropped at the centre and is allowed to spread out and finally fall. The angular velocity during this period:
a) decreases continuously b) decreases initially and increases again
c) remains unaltered d) increases continuously

391. A body of mass 10 kg is acted upon by two perpendicular forces, 6 N and 8 N. The resultant acceleration of the body is :

a) 1 m s^{-2} at an angle of $\tan^{-1}\left(\frac{3}{4}\right)$ w.r.t. 8 N force.

b) 0.2 m s^{-2} at an angle of $\tan^{-1}\left(\frac{3}{4}\right)$ w.r.t. 8 N force.

c) 1 m s^{-2} at an angle of $\tan^{-1}\left(\frac{4}{3}\right)$ w.r.t. 8 N force.

d) 0.2 m s^{-2} at an angle of $\tan^{-1}\left(\frac{4}{3}\right)$ w.r.t. 8 N force.

392. A cricket mat of mass 50 kg is rolled loosely in the form ofa cylinder of radius 2 m. Now again it is rolled tightly so that the radius becomes $\frac{3}{4}$th of original value; then the ratio of moment of inertia of mat in the two cases is:
a) 1 : 3 b) 4 : 3 c) 16 : 9 d) 3 : 5

393. When a sphere rolls without slipping, the ratio of its kinetic energy of translation to its total kinetic energy is:
a) 1:7 b) 1:2 c) 1:1 d) 5:7

394. (A) Average angular velocity is a scalar quantity.
(R) Large angular displacement ($\triangle\theta$) is a scalar.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion isfalse but reason is true.

395. A body, possessing kinetic energy T, moving on a rough horizontal surface, is stopped in a distance y. The frictional force exerted on the body is:
a) Ty b) $\frac{\sqrt{T}}{y}$ c) $\frac{T}{y}$ d) $\frac{T}{\sqrt{y}}$

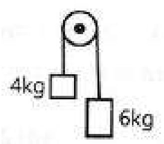
396. A crate with mass 50kg will just slide with uniform speed down a rough ramp at 30° to the horizontal. What is the coefficient of (static) friction?
a) 0.576 b) 0.987 c) 1.157 d) 2.245

397. In conservative force fields, at equilibrium, potential energy:
a) must be maximum b) must be minimum c) must be constant
d) may be maximum or minimum or constant

398. A body of mass m is moving in a circle of radius r with a constant speed u. The work done by the centripetal force in moving the body over half the circumference of the circle is:
a) mu^2r b) zero c) mu^2/r d) r^2/mu^2

399. A system consists of two identical particles. One particle is at rest and the other particle has an acceleration a. The centre of mass of the system has an acceleration of:
a) 2a b) a c) $\frac{a}{2}$ d) $\frac{a}{4}$

400. Two bodies of mass 4kg and 6kg are tied to the ends of a massless string. The string passes over a puliey which is frictionless (see figure). The acceleration of the system in terms of acceleration due to graviry (g) is ___________

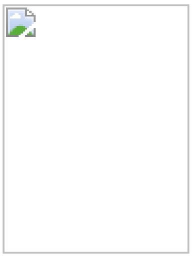


a) g/10 b) g c) g/2 d) g/5

401. A rocket of mass 100 kg bums 0.1 kg of fuel per sec. If velocity of exhaust gas is 1 kmlsec, then it lifts with an acceleration of:
a) 1000 ms^{-2} b) 100 ms^{-2} c) 10 ms^{-2} d) 1 ms^{-2}

402. The force on a rocket moving with a velocity 300 m/s is 210 N. The rate of consumption of fuel of rocket is _____________
a) 0.7 kg/s b) 1.4 kg/s c) 0.007 kg/s d) 10.7 kg/s

403. Two masses of 5 kg and 3 kg are suspended with the help of massless inextensible strings as shown in figure. The whole system is going upwards with an acceleration of 2 m s^{-2}. The tensions T_1 and T_2 are respectively (Take g = 10 m s^{-2})



a) 96 N, 36 N b) 36 N, 96 N c) 96 N, 96 N d) 36 N, 36 N

404. A car is going at a speed of 6 m/s when it encounters a 15m slope of angle 30°. The friction coefficient between the road and tyre is 0.5. The driver applies the brakes. The minimum speed of the car with which it can reach the bottom is: (g = 10 m/s ^{2})

a) 4 m/s b) 3 m/s c) 7.49 m/s d) 8.45 m/s

405. A player takes 0.1 see in catching a ball of mass 150 g moving with a velocity of 20 m/s. The force imparted by the ball on the hands of the player is:

a) 0.3 N b) 3 N c) 30 N d) 300 N

406. A stone of mass 1 kg tied to a light inextensible string of length L=$\frac{10}{3}m$ is whirling in a circular path of radius L in a vertical plane. If the ratio of the maximum to the minimum tension in the string is 4 and g = 10 m/s^2, the speed of the stone at the highest point of the circle is:

a) 20 m/s b) 10√3 m/s c) 5√2 m/s d) 10 m/s

407. where do the fragments P and Q hit the ground from the point of projection?

a) R,R b) $\frac{R}{2}, \frac{3R}{2}$ c) $R, \frac{R}{2}$ d) $\frac{R}{2}R$

408. A disc revolves in horizontal plane at a steady rate of 3 rev/so A coinjust remains on the disc ifkept at a distance of 2 cm from the axis of rotation. What is the coefficient of friction between the coin and the disc?

a) 0.5 b) 0.65 c) 0.7 d) 0.75

409. (A) In the case of free fall of the lift, the man will feel weightlessness.

(R) In free fall, acceleration of the lift is equal to acceleration due to gravity.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true

410. (A) In javelin throw, the athlete throws the projectile at an angle slightly more than 45°.

(R) The maximum range does not depend upon angle of projection.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

411. A stone of mass 1 kg, tied to the end of a string of length 1m, is whirled in a horizontal circle with a uniform angular velocity of 2 radls. The tension in the string is (in N):

a) 2 b) 1/2 c) 4 d) 1/4

412. Consider the quantities; pressure, power, energy, impulse, gravitational potential, electrical charge, temperature, area. Out of these, the only vector quantities are:
a) impulse, pressure and area b) impulse and area c) area and gravitational potential
d) impulse and pressure

413. A particle of mass 0.3 kg is subjected to a force F = - kx with k =15 N/m. What will be its initial acceleration if it is released from a point 20 em away from the origin?
a) 5 m/s^2 b) 10 m/s^2 c) 3 m/s^2 d) 15 m/s^2

414. A child is standing with his two arms outstretched at the centre of a turntable that is rotating about its central axis with an angular speed ω_0 Now, the child folds his hands back so that moment of inertia becomes 3 times the initial value. The new angular speed is
a) $3\omega_0$ b) $\frac{\omega_0}{3}$ c) $6\omega_0$ d) $\frac{\omega_0}{6}$

415. A solid sphere is rotating in free space. If the radius of the sphere is increased keeping mass same which one -of the following will not be affected?
a) Moment of inertia b) Angular momentum c) Angular velocity
d) Rotational kinetic energy

416. A solid cylinder of mass 3 kg is rolling on a horizontal surface with velocity 4 ms^{-1}. It collides with horizontal spring of force constant 200 Nm^{-1}. The maximum compression produced in the spring will be :
a) 0.7 m b) 0.2 m c) 0.5 m d) 0.6 m

417. (A) In projectile motion, the angle between the instantaneous velocity and acceleration at the highest point is 180°.
(R) At the highest point, velocity of projectile will be in horizontal direction only.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

418. (A) Mass is a property of one object alone, whereas weight results from the interaction of two objects. .
(R) If the weight is measured from a non-inertial frame, the measurement gives an apparent weight instead of the actual weight.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

419. A body of mass 2 kg is projected from the ground with a velocity of 20 m s^{-1} at an angle of 30° with the vertical. If t_1 is the time in seconds at which the body is projected and t_2 is the time in seconds at which it reaches the ground, the change in momentum (in kg ms^{-1}) during the time $(t_2 - t_1)$ is:
a) 40 b) $40\sqrt{3}$ c) $50\sqrt{3}$ d) 60

420. A woman throws an object of mass 500 g with a speed of 25 ms $^{-1}$. If the object hits a wall and rebounds with half the original speed, what is the change in momentum (in kg-ms^{-1}) of the object?
a) -12.60 b) -18.75 c) -14.28 d) -16.48

421. A particle of mass m is executing oscillations about the origin on the x-axis. Its potential energy is $U(x) = K|x|^3$, where K is a positive constant. If the amplitude of oscillation is a, then its time period T is:
a) proportional to $1/\sqrt{a}$ b) independent of a c) proportional to $\sqrt{a}$ d) proportional to $a^{3/2}$

422. The relation between the time of flight of a projectile T_f and the time to reach the maximum height t_m is :
a) $T_f = 2t_m$ b) $T_f = t_m$ c) $T_f = \frac{t_m}{2}$ d) $T_f = \sqrt{2}\,(t_m)$ e) $T_f = \frac{t_m}{\sqrt{2}}$

423. The coefficient of friction between the tyres and the road is 0.25. The maximum speed with which car can be driven round a curve of radius 40 m without skidding is: (assume g = 10 ms^{-2})
a) 40 ms^{-1} b) 20 ms^{-1} c) 15 ms^{-1} d) 10 ms^{-1}

424. (A) Cream gets separated out of milk when it is churned. It is due to gravitational force.
(R) In all circular motions. centripetal force is provided by gravitational force.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

425. A solid cylinder of mass 20 kg has length 1 m and radius 0.2 m. Then its moment of inertia (in kg-m^2) about its geometrical axis is:
a) 0.8 b) 0.4 c) 0.2 d) 20.2 e) 20.4

426. The angle of projection for which the horizontal range and the maximum height of the projectile are equal is:
a) 45° b) $\theta=\tan^{-1}(4)$ c) $\theta=\tan^{-1}(0.25)$ d) none of these

427. A body of mass m and radius r is released from rest along a smooth inclined plane of angle of inclination θ. The angular momentum of the body about the instantaneous point of contact after a time t from the instant of release is equal to:
a) mgrt $\cos\theta$ b) mgrt $\sin\theta$ c) (3/2) mrgt $\sin\theta$ d) none of these

428. The maximum force of static friction upto which body does not move is called:
a) normal reaction b) coefficient of friction c) limiting friction d) rolling friction

429. A small sphere of radius R rolls without slipping inside a large hemispherical bowl of radius R. The sphere starts from rest at the top point of the hemisphere. What fraction of the total energy is translational when the small sphere is at the bottom of the hemisphere?
a) $\frac{7}{5}$ b) $\frac{2}{7}$ c) $\frac{5}{7}$ d) $\frac{7}{10}$

430. Two blocks of masses 8 kg and 12 kg are connected at the two ends of a light inextensible string. The string passes over a frictionless pulley. The acceleration of the system is
a) $\frac{g}{4}$ b) $\frac{g}{5}$ c) $\frac{g}{8}$ d) $\frac{g}{6}$

431. With what minimum acceleration can a fireman slide down a rope whose breaking strength is $\frac{2}{5}$ of his weight?

a) 1 g b) 0.4 g c) 0.6 g d) 0.8 g

432. A ring starts to roll down the inclined plane of height h without slipping. The velocity with which it reaches the ground is:

a) $\sqrt{\frac{10gh}{7}}$ b) $\sqrt{\frac{4gh}{7}}$ c) $\sqrt{\frac{4gh}{3}}$ d) $\sqrt{2gh}$ e) $\sqrt{gh}$

433. (A) The hard boiled egg and raw egg can be distinguished on the basis of spinning of both.

(R) The moment of inertia of hard boiled egg is more as compared to raw egg.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

434. The driving side belt has a tension of 1600 N and the slack side has 500 N tension. The belt turns a pulley 40 cm in radius at a rate of 300 rpm. This pulley drives a dynamo having 90% efficiency. How many kilowatts are being delivered by the dynamo?

a) 12.4 b) 6.2 c) 24.8 d) 13.77

435. When a body is stationary:

a) there is no force acting on it b) the forces acting on it are not in contact with it

c) the combination of forces acting on it balances each other d) the body is in vacuum

436. A body of mass 20 kg is moving with a velocity of 2u and another body of mass 10 kg is moving with velocity u. The velocity of their centre of mass is:

a) 5v /3 b) 2v /3 c) v d) zero

437. A lift of mass 1000kg is moving with an acceleration of 1 m/s^2 in upward direction. Tension developed in the string, which is connected to the lift, is :

a) 9,800 N b) 10,800 N c) 10,000 N d) 11,000 N

438. A box of mass 50 kg is pulled up on an inclined plane of 12 m long and 2 m high by a constant force of 100 N from rest. It acquires a velocity of2 mls when it reaches the top of the plane. The work done against friction (in joule) is: ($g = 10m/s^2$)

a) 50 b) 100 c) 150 d) 200

439. A wire of mass m and length l is bent in the form of a circular ring, the moment of inertia of the ring about its axis is:

a) $(\frac{1}{8\pi^2})ml^2$ b) $(\frac{1}{2\pi^2})ml^2$ c) $(\frac{1}{4\pi^2})ml^2$ d) ml^2

440. (A) The direction of the friction force on an object is opposite to the actual motion (kinetic friction) or the impending motion (static friction) of the object relative to the surface with which it is in contact.

(R) Friction force always opposes the motion.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

441. The centre of mass of a body:
a) depends on the choice of co-ordinate system
b) is independent of the choice of co-ordinate system
c) mayor may not depend on the choice of co-ordinate system d) none of the above

442. A block of mass M is placed on a smooth inclined plane of inclination θ. The inclined plane itself is placed in a cabin, which is accelerating upwards at the rate a in a direction making angle θ with the horizontal. What will be the acceleration of the block down the inclined plane?
a) g sin θ - a b) g sin θ + a c) (g -a)sinθ d) (g + a) sin θ

443. A force of 50 dyne is acted on a body of mass 5g which is at rest for an interval of 3 sec; then impulse is:
a) 0.16 x 10^{-3} N-s b) 0.98 x 10^{-3} N-s c) 1.5 x 10^{-3} N-s d) 2.5 x 10^{-3} N-s

444. (A) During a turn, the value of centripetal force should be less than the limiting frictional force.
(R) The centripetal force is provided by the frictional force between the tyres and the road
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

445. The moment of inertia of a uniform rod about a perpendicular axis passing through one end is I_1. The same rod is bent into a ring and its moment of inertia about a diameter is I_2. Then, $\frac{I_1}{I_2}$ is
a) $\frac{\pi^2}{3}$ b) $\frac{2\pi^2}{3}$ c) $\frac{4\pi^2}{3}$ d) $\frac{8\pi^2}{3}$

446. A metre scale is moving with uniform velocity. This implies
a)
the force acting on the scale is zero and the torque acting about centre of mass of the scale is also zero.
b) the total force acting on it need not be zero but the torque on it is zero.
c) neither the force nor the torque need to be zero.
d)
the force acting on the scale is zero, but a torque about the centre of mass can act on the scale.

447. A machine gun fires a bullet of mass 40 g with a velocity 1200 m s $^{-1}$. The man holding it can exert a maximum force of 144 N on the gun. How many bullets can he fire per second at the most?
a) One b) Four c) two d) Three

448. (A) In circular motion, work done by centripetal force is zero.
(R) In circular motion, centripetal force is perpendicular to the displacement.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

449. A block is placed on a rough inclined plane of inclination $\theta = 30^0$ If the force to drag it along the plane is to be smaller than to lift it, the coefficient of friction μ should be less than
a) 1/2 b) $\sqrt{3}/2$ c) 2/3 d) $1/\sqrt{3}$

450. A cricket ball of mass 150 g has an initial velocity $\vec{u} = (3\hat{i} + 4\hat{j})$ ms^{-1} and a final velocity $\vec{v} = -(3\hat{i} + 4\hat{j})$ ms^{-1} after being hit. The change in momentum (final momentum - initial momentum) is (in kg ms^{-1})
a) zero b) $-(0.45\hat{i} + 0.6\hat{j})$ c) $-(0.9\hat{i} + 1.2\hat{j})$ d) $-5(\hat{i} + \hat{j})$

Ravi Maths Tuition Centre

Time : 1 Mins **LAWS Of MOTION 2 1** **Marks : 1596**

1. A ball of mass 150 g starts moving at 20 ms^{-1} and is hit by a force which acts on it for 0.1 seconds. Then, the impulsive force is:
   a) 75 N b) 300 N c) 3 N d) 30 N
2. Three concurrent co-planar forces 1 N, 2 N and 3 N acting along different directions on a body
   a) can keep the body in equilibrium if 2 N and 3 N act at right angle.
   b) can keep the body in equilibrium if 1 N and 2 N act at right angle
   c) cannot keep the body in equilibrium.
   d) can keep the body in equilibrium if 1 N and 3 N act at an acute angle.
3. A body of weight 200 N is placed on a rough horizontal plane. If the coefficient of friction between the body and the horizontal plane is 0.3, determine the horizontal force required to just slide the body on the plane.
   a) 75 N b) 84 N c) 60 N d) 55 N
4. (A) The division of a vector by another vector is not defined.
   (R) The division of a vector by a direction is not possible.
   a) If both assertion and reason are true and reason is the correct explanation of assertion.
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion.
   c) If assertion is true but reason is false. d) If both assertion and reason are false.
   e) If assertion is false but reason is true.
5. (A) In case of rolling without sliding, friction force can act in forward and backward direction both.
   (R) The angular momentum of a system will be conserved only about that point about which external angular impulse is zero.
   a) If both assertion and reason are true and reason is the correct explanation of assertion.
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion.
   c) If assertion is true but reason is false. d) If both assertion and reason are false.
   e) If assertion is false but reason is true.
6. A stone of mass 1 kg is tied to the end of 1m long string and is whirled in a vertical circle. The velocity of stone at the bottom of the circle is just sufficient to take it to the top of the circle without slackening the string. What is the tension in the string at the top of the circle? (Take g = 10m s^{-2})
   a) Zero b) 1 N c) $\sqrt{10}$ N d) 10 N
7. When a wheel rolls on a surface, the resistance offered by the surface, i.e.,rolling friction:

a) is greater than kinetic friction b) is equal to the kinetic friction
c) is negligible in comparison to kinetic friction d) none of the above

8. (A) The centre of mass of body may lie where there is no mass.
(R) Centre of mass of a body is a point, where the whole mass of the body is supposed to be concentrated.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

9. When a stone is rotated with uniform speed in horizontal plane by means ofa string the magnitude of the momentum is fixed but its direction changes. A force is needed to cause this change in momentum vector this force is provided by :
a) gravity b) our hand through the string c) both gravity and our hand through the string
d) none of the above

10. A block of mass M is held against a rough vertical wall by pressing it with a finger. If the coefficient of friction between the block and the wall is μ and the acceleration due to gravity is g, what is the minimum force required to be applied by the finger to hold the block against the wall?
a) μMg b) Mg c) $\frac{Mg}{\mu}$ d) 2μMg

11. (A) To cross the river in minimum time, swimmer should swim in perpendicular direction to the water current.
(R) Because in this case river flow helps to cross the river.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

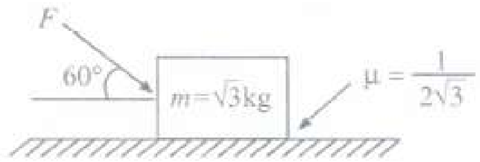
12. A rope of length 10 m and linear density of 0.5 kg/m is lying lengthwise on a smooth horizontal floor. It is pulled by a force of 25 N. The tension in the rope at a point 8 m away from the point of application is:
a) 20 N b) 15 N c) 10 N d) 5 N

13. A trolley T of mass 5 kg on a horizontal smooth surface is pulled by a load of 2 kg through a uniform rope ABC of length 2 m and mass 1 kg. As the load falls from BC = 0 to BC = 2m, its acceleration (in m/s^2) changes from:
a) $\frac{20}{6}$ to $\frac{30}{5}$ b) $\frac{20}{8}$ to $\frac{30}{8}$ c) $\frac{20}{5}$ to $\frac{30}{6}$ d) None of these

14. Two bodies of mass I kg and 3 kg have position vectors $\hat{i}+2\hat{j}+\hat{k}$ and $-3\hat{j}-2\hat{j}+\hat{k}$ respectively. The centre of mass of this system has a position vector:
a) $-2\hat{i}-\hat{j}+\hat{k}$ b) $2\hat{i}-\hat{j}+2\hat{k}$ c) $\hat{i}+\hat{j}+\hat{k}$ d) $-2\hat{i}+2\hat{k}$

15. Which one of the following cannot be explained on the basis of Newton's third law of motion?
a) Rowing of a boat in a pond b) Motion of jet in the sky
c) Rebounding of a ball from a wall d) Returning back of body, thrown above

16. What is the maximum value of the force F such that the block shown in the arrangement, does not move?



a) 20 N b) 10 N c) 12 N d) 15 N

17. From a disc of radius R and mass M, a circular hole of diameter R, whose rim passes through the centre is cut. What is the moment of inertia of the remaining part of the disc about a perpendicular axis, passing through the centre?
a) 15 $MR^2/32$ b) $13MR^2/32$ c) $11MR^2/32$ d) $9MR^2/32$

18. The slope of the smooth banked horizontal road is p. If the radius of the curve be r, the maximum velocity with which a car can negotiate the curve is given by:
a) prg b) $\sqrt{prg}$ c) p/rg d) $\sqrt{p/rg}$

19. The moment of inertia of a cylinder about its own axis is equal to its M.I. about an axis passing through its centre and perpendicular to its length. The ratio of length to radius is:
a) 1 : 2 b) $\sqrt{2}:1$ c) $1:\sqrt{2}$ d) $\sqrt{3}:1$

20. A wheel having moment of inertia 2 kg-m^2 about its vertical axis, rotates at the rate of 60 rpm about this axis. The torque which can stop the wheel's rotation in one minute would be:
a) $\frac{2\pi}{15}N-m$ b) $\frac{\pi}{12}N-m$ c) $\frac{\pi}{15}N-m$ d) $\frac{\pi}{18}N-m$

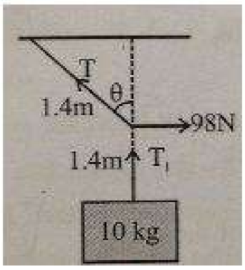
21. (A) A coin is placed on phonogram turn table. The motor is started, coin moves along the moving table.
(R) The rotating table is providing the necessary centripetal force to coin.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

22. (A) If $\vec{A} \times \vec{B} = \vec{A} \times \vec{C}$, then $\vec{C}$ need not be equal to $\vec{B}$.
(R) The cross product of two vectors depend upon the angle between them.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

23. The position of a particle is given by $\vec{r} = \hat{i} + 2\hat{j} - \hat{k}$ and its linear momentum is given by $\vec{p} = 3\hat{i} + 4\hat{j} - 2\hat{k}$ Then its angular momentum about the origin is perpendicular to :
a) x-axis b) y-axis c) z-axis d) yz-plane

24. The speed of a homogeneous solid sphere after rolling down an inclined plane of vertical height h, from rest, without sliding is:
a) $\sqrt{gh}$ b) $\sqrt{(6/5)gh}$ c) $\sqrt{(4/3)gh}$ d) $\sqrt{(10/7)gh}$

25. A machine gun is mounted on a 2000 kg vehicle on a horizontal smooth road (friction negligible). The gun fires 10 bullets per see with a velocity of 500 m/s. If the mass of each bullet be 109, what is the acceleration produced in the vehicle?
    a) 50 m/s^2 b) 25 cm/s^2 c) 25 m/s^2 d) 50 cm/s^2
26. A particle is rotating with constant angular acceleration on a circular track. If its angular velocity changes from 20π rad/s to 40π rad/s in 10 s, what are the number of revolutions that the particle has completed during this time?
    a) 100 b) 150 c) 250 d) 1000
27. Assertion: A boiled egg can be easily distinguished from a raw unboiled egg by spinning.
    Reason : The hard boiled egg has a moment of inertia which is more than that of the raw egg.
    a) If both assertion and reason are true and reason is the correct explanation of assertion
    b) If both assertion and reason are true but reason is not the correct explanation of assertion
    c) If assertion is true but reason is false d) If both assertion and reason are false
28. The time taken by the particles for collision is:
    a) 3 sec b) $\sqrt{15}$ sec c) 4 sec d) 1 sec
29. A simple pendulum is suspended from the ceiling of a stationary elevator and its period of oscillation is T. The elevator is then set into motion and the new time period is found to be longer. Then, the elevator is:
    a) accelerated upward b) accelerated downward c) moving upward with uniform speed
    d) moving downward with uniform speed
30. Which one of the following motions- on a smooth plane surface does not involve force?
    a) Accelerated motion in a straight line b) Retarded motion in a straight line
    c) Motion with constant momentum along a straight line
    d) Motion along a straight line with varying velocity e) Motion in a circle with uniform speed
31. A disc is rolling on an inclined plane. What is the ratio of its rotational KE to the total KE?
    a) 1 : 3 b) 3 : 1 c) 1 : 2 d) 2 : 1
32. Identify the correct statement for the rotational motion of a rigid body.
    a) Individual particles of the body do not undergo an accelerated motion.
    b) The centre of mass of the body remains unchanged.
    c) The centre of mass of the body moves uniformly in a circular path.
    d) Individual particles and centre of mass of the body undergo an accelerated motion.
33. Two particles A and B are projected with same speed so that the ratio of their maximum heights reached in 3 : 1. If the speed of A is doubled without altering other parameters, the ratio ofthe horizontal ranges attained by A and B is:
    a) 1 : 1 b) 2 : 1 c) 4 : 1 d) 3 :2 e) 4 : 3
34. A mass of 10 kg is suspended by a rope of length 2.8 m from a ceiling. A force of 98 N is applied at the mid-point of the rope as shown in figure. The angle which the rope makes with the vertical in equilibrium is, tension T in the string is



a) 98 b) 98/tan θ c) 98 sin θ d) 98/cos θ

35. (A) The angular velocity of any point on a rigid body is same w.r.t. any other point on the rigid body.
(R) All points on a rigid body will rotate through same angle in same time.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion isfalse but reason is true.

36. A cord of negligible mass is wound round the rim of a flywheel of mass 20 kg and radius 20 cm. A steady pull of 25 N is applied on the cord. The work done by the pull when 2 m of the cord is unwound is
a) 20 J b) 215 J c) 45 J d) 50 J

37. (A) In projectile motion, the vertical velocity of the particle is continuously decreased during its ascending motion.
(B) In projectile motion near earth surface, downward constant acceleration is present in vertical direction.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

38. The term inertia was first used by
a) Newton b) Galileo c) Aristotle d) Kepler

39. If F denotes force and 't denotes torque, then the condition for equilibrium is:
a) $\sum F \neq 0, \sum t \neq 0$ b) $\sum F \neq 0, \sum t = 0$ c) $\sum F = 0, \sum t \neq 0$ d) $\sum F = 0, \sum t = 0$

40. A body is rolling without slipping on a horizontal surface and its rotational kinetic energy is equal to the translational kinetic energy. The body is:
a) disc b) sphere c) cylinder d) ring

41. Two particles P and Q initially at rest are I m apart. P has a mass of 0.1 kg and Q has a mass of 0.3 kg. P and Q attract each other with a constant force of 10^{-2} N. No external forces act on the system. At what distance from P' s original position do the particles collide?
a) 0.25m b) 0.75m c) 0.5m d) 0.8m

42. A diwali rocket is ejecting 50 g of gas/es at a velocity of 400 mls. The acceleration force on the rocket will be:
a) 22 dyne b) 20 N c) 20 dyne d) 100 N

43. Two bodies A and B have masses M and m respectively where M > m and they are at a distance d apart. Equal force is applied to each of them so that they approach each other. The position where they hit each other is:
a) nearer to B b) nearer to A c) at equal distance from A and B d) cannot be decided

44. A stream of water flowing horizontally with a speed of 15 m S^{-1} gushes out of a tube of cross-sectional area 10^{-2} m^2, and hits a vertical wall normally. Assuming that it does not rebound from the wall, the force exerted on the wall by the impact of water is :
a) 1.25 x 10^3 N b) 2.25 x 10^3 N c) 3.25 x 10^3 N d) 4.25 x 10^3 N

45. One hollow and one solid cylinder of the same outer radius rolls down on a smooth inclined plane. The foot of the inclined plane is reached by:
a) solid cylinder earlier b) hollow cylinder earlier c) imultaneously
d) the heavier earlier irrespective of being solid or hollow

46. When a solid sphere rolls without slipping down an inclined plane making an angle θ with the horizontal, the acceleration of its centre of mass is a. If the same sphere slides without friction, its acceleration a' will be
a) $\frac{7}{2}a$ b) $\frac{5}{7}a$ c) $\frac{7}{5}a$ d) $\frac{5}{2}a$

47. A hockey player is moving northward and suddenly turns westward with the same speed to avoid an opponent. The force that acts on the player is :
a) frictional force along westward. b) muscle force along southward
c) frictional force along south-west. d) muscle force along south-west

48. Assertion: A rigid body not fixed in some way can have either pure translation or a combination of translation and rotation.
Reason: In rotation about a fixed axis, every particle of the rigid body moves in a circle which lies in a plane perpendicular to the axis and has its centre on the axis
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

49. If the normal reactional force is doubled, the coefficient of friction is
a) doubled b) halved c) not changed d) tripled

50. An object kept on a smooth inclined plane of 1 in 1 can be kept stationary relative to the incline by giving a horizontal acceleration to the inclined plane given by:
a) g sin θ b) g cos θ c) g tan θ d) none of these

51. (A) Two teams having a tug-of-war always pull equally hard on one another.
(R) The team, that pushes harder against the ground, in a tug-of-war, wins.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

52. (A) Angular momentum of a rigid body will remain conserved even when moment of inertia of body changes.
(R) Angular momentum of a rigid body does not depend upon moment of inertia of the rigid body.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

53. Two masses M_1 and M_2 are connected to the ends of a string passing over a smooth pulley. The tension in the string is T and the masses are moving with acceleration a. If the masses are interchanged, then:
a) both a and T will change b) a will change but will remain unchanged
c) T Will change but a will remian changed d) none of them will change

54. Assertion : If the head of a right handed screw rotates with the body, the screw advances in the direction of the angular velocity.
Reason: For rotation about a fixed axis, the angular velocity vector lies along the axis of rotation
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

55. Brakes stop a train in a certain distance. If the braking force is made one-fourth, the brakes will stop the train in a distance which is now:
a) half b) same c) double d) four times

56. A ball of mass 150 g moving with an acceleration 20 m/s^2 is hit by a force, which acts on it for 0.1 s. The impulsive force is ______
a) 0.5N-s b) 0.1N-s c) 0.3N-s d) 1.2N-s

57. The maximum static frictional force depends on:
a) area of surfaces in contact b) normal reaction c) direction of applied force
d) none of the above

58. (A) If the speed of a body is constant, the body cannot have a path other than a circular or straight line path.
(R) It is not possible for a body to have a constant speed in an accelerated motion.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

59. If the net external force acting on the system of particles is zero, then which of the following may vary?
a) Momentum of the system b) Kinetic energy of the system c) Velocity of centre of mass
d) Position of centre of mass

60. An iron block of sides 50 cm x 8 cm x 15 cm has to be pushed along the floor. The force required will be minimum when the surface in contact with ground is
a) 8 cm x 15 cm surface b) 50 cm x 15 cm surface c) 8 cm x 50 cm surface
d) force is same for all surfaces

61. (A) If polar ice melts, days will be shorter.
(R) Moment of inertia decreases and thus angular velocity increases.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

62. The direction of the angular velocity vector is along
a) the tangent to the circular path b) the inward radius c) the outward radius
d) the axis of rotation

63. A wet, open umbrella is held vertical and is twirled about the handle at a uniform rate of 21 revolutions in 44 second. If the rim of the umbrella is a circle of I metre in diameter and the height of the rim above the floor is 4.9 metre, then the angular speed of the umbrella is:
a) 3 radian/sec b) 1.5 radian /sec c) 1 radian / sec d) $\sqrt{2.5}$ radian / sec

64. A body of mass I kg is rotating in a vertical circle of radius 1 m. What will be the difference in its kinetic energy at the top and bottom of the circle? (g = 10 ms $^{-2}$)
a) 10 J b) 20 J c) 30 J d) 50 J

65. (A) If all particles of a system lie in a cube, the centre of mass would necessarily be in the cube.
(R) For a uniform, symmetric body, the centre of mass is necessarily within the matter of the body.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion isfalse but reason is true.

66. Analogue of mass in rotational motion is
a) moment of inertia b) torque c) radius of gyration d) angular momentum

67. A particle rests on the top of a hemisphere of radius R. Find the smallest horizontal velocity that must be imparted to the particle if it is to leave the hemisphere without sliding down it:
a) $\sqrt{gR}$ b) $\sqrt{2gR}$ c) $\sqrt{3gR}$ d) $\sqrt{5gR}$

68. A cord is bound around the circumference of a wheel of diameter 0.3 m. The axis of the wheel is horizontal. A 0.5 kg mass is attached at the end of the cord and it is allowed to fall from rest. If the weight falls 15 m in 4 see, then the linear acceleration produced in the mass after 4 see is:
a) 4.9 ms^{-2} b) 9.8 ms^{-2} c) 19.6 ms^{-2} d) 1.88 ms^{-2}

69. A solid cylinder has mass M, length L and radius R. The moment of inertia ofthis cylinder about a generator is:

a) $M\left(\frac{L^2}{12}+\frac{R^2}{4}\right)$ b) $\frac{ML^2}{4}$ c) $\frac{1}{2}MR^2$ d) $\frac{3}{2}MR^2$

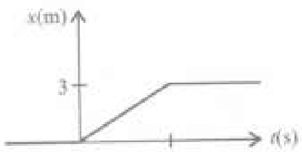
70. A man stands on a rotating platform with his arms stretched holding a 5 kg weight in each hand. The angular speed of the platform is 1.2 rev s^{-1}. The moment of inertia of the man together with the platform may be taken to be constant and equal to 6 kg m^2. If the man brings his arms close to his chest with the distance of each weight from the axis changing from 100 cm to 20 cm. The new angular speed of the platform is
a) 2 rev s^{-1} b) 3 rev s^{-1} c) 5 rev s^{-1} d) 6 rev s^{-1}

71. (A) Mass is the measure of inertia of a body in linear motion.
(R) Greater the mass, greater is the force required to change its state of rest or of uniform motion
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

72. In the first second of its flight, rocket ejects 1/60 of its mass with a velocity of 2400 ms^{-1} .The acceleration of the rocket is:
a) 19.6 ms^{-2} b) 30.2 ms^{-2} c) 40 ms^{-2} d) 49.8 ms^{-2}

73. Assertion: Friction opposes relative motion and thereby dissipates power in the form of heat.
Reason: Friction is always an undesirable force.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

74. Figure shows the position-time graph of a particle of mass 4 kg. Let the force on the particle for t < 0, 0 < t < 4 s, t > 4 s be F_l, F_2 and F_3 respectively. Then



a) $F_1 = F_2 = F_3 = 0$ b) $F_1 > F_2 = F_3$ c) $F_1 > F_2 > F_3$ d) $F_1 < F_2 < F_3$

75. For traffic moving at 60 km/h along a circular track of radius 0.1 km, the correct angle of banking is:

a) $tan^{-1}\left(\frac{60^2}{0.1}\right)$ b) $tan^{-1}\left(\frac{(50/3)^2}{100\times 9.8}\right)$ c) $\tan^{-1}(60x0.1x\ 9.8)^{1/2}$ d) $tan^{-1}\left(\frac{100\times 9.8}{(50/3)^2}\right)$

76. A person in an elevator accelerating upwards with an acceleration of 2 m s^{-2}, tosses a coin vertically upwards with a speed of 20 m s^{-1}. After how much time will the coin fall back into his hand? (Take g=10 ms^{-2})
a) $\frac{5}{3}$ s b) $\frac{3}{10}$ s c) $\frac{10}{3}$ s d) $\frac{3}{5}$ s

77. A motor cyclist going round in a circular track at a constant speed has

a) constant linear velocity b) constant acceleration
c) acceleration of constant magnitude with its direction changing d) constant force

78. Two bodies have their moments of inertia I and 2I respectively about their axis of rotation. If their kinetic energies of rotation are equal, their angular momenta will be in the ratio :
a) 1:2 b) $\sqrt{2}:1$ c) 1:$\sqrt{2}$ d) 2:1

79. A 1 kg stone at the end of 1 m long string is whirled in a vertical circle at constant speed of 4 m/sec. The tension in the string is 6 N when the stone is at: (Take g = 10 m/ sec^2)
a) top of the circle b) bottom of the circle c) halfway down d) none of these

80. (A) Inertia is the property by virtue of which the body is unable to change by itself the state of motion.
(R) The bodies do not change their state unless acted upon by an unbalanced external force
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

81. When the angle of inclination of an inclined plane is 9, an object slides down with uniform velocity. If the same object is pushed up with an initial velocity u on the same inclined plane; it goes up the plane and stops at a certain distance on the plane. Thereafter, the body:
a) slides down the inclined plane and reaches the ground with velocity' u'
b) slides down the inclined plane and reaches the ground with velocity less than' u'
c) slides down the inclined plane and reaches the ground with velocity greater than' u'
d) stays at rest on the inclined plane and will not slide down.

82. A mass M is moving with a constant velocity parallel to x-axis. Its angular momentum w.r.t. origin
a) is zero b) remains constant c) goes on increasing d) goes on decreasing

83. An initial momentum is imparted to a homogeneous cylinder, as a result of which it begins to roll without slipping up an inclined plane at a speed ofvo = 4 m s^{-1} . The plane makes an angle θ = 30° with the horizontal. What height II will the cylinder rise to? (Take g = 10m s^{-2})
a) 0.8 m b) 1.2 m c) 1.0 m d) 1.6 m

84. A body is rolling on the ground with a velocity of 1 m/s. After travelling a distance of 5 m, the body stops. The coefficient of friction is:
a) 0.00102 b) 0.0102 c) 0.102 d) 1.02

85. (A) It is more difficult to open the door by applying the force near the hinge.
(R) Torque is maximum at hinge.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

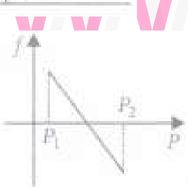
86. For a given angle of projection, if the time of flight of a projectile is doubled, the horizontal range will increase to:
a) four times b) thrice c) once d) twice

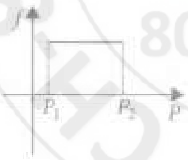
87. (A) A cyclist bends inwards from his vertical position, while turning to secure the necessary centripetal force.
(R) Friction force between the tyres and road provides him the necessary centripetal force.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

88. Three forces are acting on a particle of mass m initially in equilibrium. If the first 2 forces (R_1 and R_2) are perpendicular to each other and suddenly the third force (R_3) is removed, then the acceleration of the particle is:
a) $\frac{R_3}{m}$ b) $\frac{R_1+R_2}{m}$ c) $\frac{R_1-R_2}{m}$ d) $\frac{R_1}{m}$

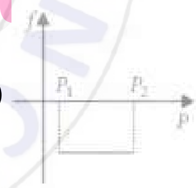
89. Two spheres of equal masses, one of which is a thin spherical shell and the other a solid, have the same moment of inertia about their respective diameters. The ratio of their radii will be:
a) 5 : 7 b) 3 : 5 c) $\sqrt{3}:\sqrt{5}$ d) $\sqrt{3}:\sqrt{7}$

90. A block of mass m is on an incline plane of angle 8. The coefficient of friction between the block and the plane μ and tan θ > μ The block is held stationary by applying a force P parallel to the plane. The direction of force pointing up the plane is taken to be positive. As P is varied from P_1 = mg(sinθ - μcosθ) to P_2 = mg(sin + μcos), the frictional force f versus P graph will look like

a) 

b) 

c) 

d) 

91. (A) A body is moving along a straight line under a variable force, area under the force-time graph on the time axis will be the 'Impulse'.
(R) Impulse is the total change in linear momentum.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

92. The total kinetic energy of a body of mass 10 kg and radius 0.5 m moving with a velocity of 2 m/s without slipping is 32.8 J. The radius of gyration of the body is:
a) 0.25 m b) 0.2 m c) 0.5 m d) 0.4 m

93. (A) The maximum horizontal range of projectile is proportional to square of velocity.
(R) The maximum horizontal range of projectile is equal to maximum height attained by projectile.

a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

94. What is moment of inertia in terms of angular momentum (L) and kinetic energy (K)?
a) $\frac{L^2}{K}$ b) $\frac{L^2}{2K}$ c) $\frac{L}{2K^2}$ d) $\frac{L}{2K}$

95. A boy presses a book against the front wall such that the book does not move. The force of friction between the wall and the book is:
a) towards right b) towards left c) downwards d) upwards

96. A car turns a comer on a slippery road at a constant speed of 12 rn/s. If the coefficient of friction is 0.4, the minimum radius of the arc (in metre) in which the car turns is:
a) 72 b) 36 c) 18 d) 9

97. Total angular momentum of a rotating body is conserve, if the net torque acting on the body is
a) zero b) maximum c) minimum d) unity

98. An ice cube is kept on an inclined plane of angle 30°. Coefficient of kinetic friction between the block and the inclined plane is $\left(1\sqrt{3}\right)$, What is the acceleration of block?
a) Zero b) 2 m/s^2 c) 1.5 m/s^2 d) 5 m/s^2

99. A rocket of mass 120 kg is fired in the gravity-free space. It ejects gases with velocity 600 m s^{-1} at the rate of 1 kg/so What will be the initial acceleration of the rocket? 80 percent of the mass of the rocket is fuel, what will be the acceleration of the rocket 100 seconds after the firing?
a) Zero b) 1 ms^{-2} c) 5 ms^{-2} d) 10 ms^{-2}

100. An aeroplane requires for take-off a speed of 81 kmlh, the run on ground being 100 m. The mass of aeroplane is 10,000 kg and coefficient of friction between the plane and the ground is 0.2. Assume that the plane accelerates uniformly during take-off. The minimum force required by engine of the plane for take-off is: (Take g = 10m s-^{2})
a) 4.53 N b) 4.53 x 10^4 N c) 4.53 x 10^2 N d) 4.53 x 10^6 N

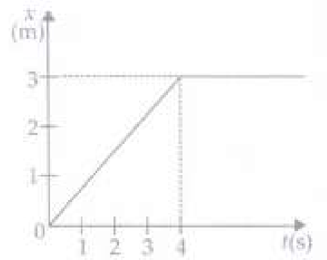
101. A projectile is fired from the surface of the earth with a velocity of 5 ms^{-1} and angle θ with the horizontal. Another projectile fired from another planet with a velocity of 3 ms^{-1} at the same angle follows a trajectory which is identical with the trajectory of the projectilee fired from the earth. The value of the acceleration due to gravity on the planet is (in m s^{-2}) is: (Given g = 9.8 ms^{-2})
a) 3.5 b) 5.9 c) 16.3 d) 110.8

102. A block of mass m is placed on a rough inclined plane of inclination θ kept on the floor of the lift. The coefficient of friction between the block and the inclined plane is u. With what acceleration will the block slide down the inclined plane when the lift falls freely?
a) Zero b) g sin θ - μg cos θ c) g sin θ + μg cos θ d) None of these

103. Two discs of moments of inertia I_1 and I_2 about their respective axes, rotating with angular frequencies ω_1 and ω_2 respectively, are brought into contact face to face with their axes of rotation coincident. The angular frequency of the composite disc will be :

a) $\frac{I_1\omega_1+I_2\omega_2}{I_1+I_2}$ b) $\frac{I_2\omega_1+I_1\omega_2}{I_1+I_2}$ c) $\frac{I_1\omega_1-I_2\omega_2}{I_1-I_2}$ d) $\frac{I_2\omega_1-I_1\omega_2}{I_1-I_2}$

104. The position-time graph of a body of mass 2 kg is as shown in figure. What is the impulse on the body at t = 4 s?



a) $\frac{2}{3}$ kg ms^{-1} b) -$\frac{2}{3}$ kg ms^{-1} c) $\frac{3}{2}$ kg ms^{-1} d) -$\frac{3}{2}$ kg ms^{-1}

105. A body is moving with a velocity of 72 km/h on a rough horizontal surface of coefficient of friction 0.5. If the acceleration due to gravity is 10 m/s 2 , find the minimum distance it can be stopped.
a) 400 m b) 40 m c) 0.40 m d) 4 m

106. Two bodies with moment of inertia I1 and I_2 ($I_1>I_2$) have equal angular momentum. If the KE of rotation is E_1 and E_2, then:
a) $E_1>E_2$ b) $E_1<E_2$ c) $E_1=E_2$ d) none of these

107. A bottle of soda water is held by the neck and swing briskly in a vertical circle. Near which position of the bottle do the bubbles collect?
a) Near the bottom b) Near the neck c) In the middle of the bottle
d) Bubbles remain uniformly distributed

108. A block of mass 1 kg is placed on a truck which accelerates with acceleration 5 m/s^2. The coeflicient of static friction between the block and truck is 0.6. The frictional force acting on the block is _____________
a) 5N b) 6N c) 5.88N d) 4.6N

109. A cyclist is riding with a speed of 27 km h^{-1}. As he approaches a circular turn on the road of radius 80 m, he applies brakes and reduces his speed at the constant rate of 0.50 ms^{-1} every second. The net acceleration of cyclist on the circular turn is :
a) 0.68 ms^{-2} b) 0.86 ms^{-2} c) 0.56 ms^{-2} d) 0.76 ms^{-2}

110. A person, with outstretched arms, is spinning on a rotating stool. He suddenly brings his arms down to his sides. Which of the following is true about his kinetic energy K and angular momentum L?
a) Both K and L increase b) Both K and L remain unchanged
c) K remains constant, L increases d) K increases but L remains constant

111. A body of mass 5 kg rests on a rough horizontal surface of coefficient of friction 0.2. The body is pulled through a distance of 10 m by a horizontal force of 25 N. The kinetic energy acquired by it is:
a) 200 J b) 150 J c) 100 J d) 50 J

112. For a body moving with constant speed in a horizontal circle, which of the following remains constant?
a) Velocity b) Centripetal force c) Acceleration d) Kinetic energy

113. (A) If the position vector of a particle moving in space is given by $\vec{r} = 2t\hat{i} + 4t^2\hat{j}$, then the particle moves along a parabolic trajectory.

(R) Because $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k} = 2t\hat{i} + 4t^2\hat{j} \Rightarrow y = x^2$.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

114. In a carbon monoxide molecule, the carbon and the oxygen atoms are separated by a distance $1.12\text{x}10^{-10}$ m . The distance of the centre of mass from the carbon atom is:

a) 0.48×10^{-10}m b) 0.51×10^{-10}m c) 0.56×10^{-10}m d) 0.64×10^{-10} m

115. The diameter of a flywheel increases by 1%. What will be percentage increase in moment of inertia about axis of symmetry?

a) 2% b) 4% c) 1% d) 0.5%

116. (A) When speed of projection of a body is made n times, its time of flight becomes n times.

(R) At this speed, the range of projectile becomes n^2 times.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

117. A homogeneous disc with a radius 0.2 m and mass 5 kg rotates around an axis passing through its centre. The angular velocity of the rotation of the disc as a function of time is given by the formula ω = 2 + 6t. The tangential force applied to the rim of the disc is:

a) 1 N b) 2 N c) 3 N d) 4 N

118. If a force $10\hat{i} + 15\hat{j} + 25\hat{k}$ acts on a system and gives an acceleration $2\hat{i} + 3\hat{j} - 5\hat{k}$ to the centre of mass of the system, the mass of the system is:

a) 5 units b) units c) $5\sqrt{38}$ units d) given data is not correct

119. Two particles of masses ml and m2 ($m_1 > m_2$) attract each other with a force inversely proportional to the square of the distance between them. The particles are initially held at rest and then released. Which one is correct?

a) The CM moves towards m_1 b) The CM moves towards m_2 c) The CM remains at rest

d) The CM moves at right angles to the line joining m_1 and m_2

120. Two projectiles A and B thrown with speeds in the ratio 1 :$\sqrt{2}$ acquired the same heights. If A is thrown at an angle of 45° with the horizontal, the angle of projection of B will be:

a) 0° b) 60° c) 30° d) 45° e) 15°

121. The moment of inertia of a body does not depend on:

a) the mass of the body b) the angular velocity of the body

c) the axis of rotation of the body d) the distribution of the mass in the body

122. A monkey of mass m is climbing a rope with uniform speed; the tension in the rope will be:

a) more than mg b) less than mg c) equal to mg d) zero

123. A uniform heavy disc is rotating at constant angular velocity ω about a vertical axis through its centre and perpendicular to the plane of the disc. Let Lbe its angular momentum. A lump of plasticine is dropped vertically on the disc and sticks to it. Which of the following will change?
a) ω b) ω and L both c) L only d) Neither ω nor L

124. A body of mass 4 kg is being rotated with 120 rev per minute in a horizontal circular path of radius 2 m. Its kinetic energy is:
a) 2 J b) 32 J c) 80 J d) 1263 J

125. The moment of inertia of a solid cylinder about its axis is I. It is allowed to roll down an inclined plane without slipping. it is angular velocity at the bottom be co,then kinetic energy of the cylinder will be:
a) $\frac{1}{2}I\omega^2$ b) $I\omega^2$ c) $\frac{3}{2}I\omega^2$ d) $2I\omega^2$

126. A conveyor belt is moving at a constant speed of 2 m/s. A box is gently dropped on it. The coefficient of friction between them is (μ = 0.5). The distance that the box will move relative to belt before coming to rest on it taking g = 10 ms^{-2}, is :
a) 1.2 m b) 0.6 m c) zero d) 0.4 m

127. A ring and a disc of different masses are rotating with the same kinetic energy. If we apply a retarding torque, τ on the ring, it stops after making n revolutions. After how many revolutions will the disc stop if the retarding torque on it is also, τ?
a) n/2 b) n c) 2n d) 4n

128. (A) In projectile motion, the angle between the instantaneous velocity and acceleration at highest point is 90°.
(R) At the highest point, velocity of projectile will be in horizontal direction only.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

129. A body of mass 2 kg is hung on a spring balance mounted vertically in a lift. If the lift descends with an acceleration equal to the acceleration due to gravity 'g', the reading on the spring balance will be:
a) 2 kg b) (2 $\times$ g) kg c) (4 $\times$ g) kg d) Zero

130. The relation $\vec{F}$ = m$\vec{a}$, cannot be deduced from Newton's second law, if
a) force depends on time b) momentum depends on time
c) acceleration depends on time d) mass depends on time

131. (A) A body X is thrown vertically upwards with an initial speed 45 mls. Another body Y is also thrown vertically upwards with an initial speed 27 m/s. During the last $\frac{1}{2}$ sec of motion of each body, speed of each reduces by the same value.
(R) Both bodies are moving with same acceleration.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

132. Two particles of masses 4 kg and 8 kg are separated by distance of 12 m. If they are moving towards each other under the influence ofa mutual force of attraction, then the two particles will meet each other at a distance of:
a) 6 m from 8 kg mass b) 2 m from 8 kg mass c) 4 m from 8 kg mass
d) 8 m from 8 kg mass

133. A particle crossing the origin of co-ordinates at time t = 0, moves in the xy-plane with a constant acceleration a in the y-direction. If its equation of motion is $y = bx^2$ (b is a constant), its velocity component in the x-direction is :
a) $\sqrt{\frac{2b}{a}}$ b) $\sqrt{\frac{a}{2b}}$ c) $\sqrt{\frac{a}{b}}$ d) $\sqrt{\frac{b}{a}}$ e) $\sqrt{ba}$

134. A particle moves through angular displacement θ on a circular path of radius r. The linear displacement will be:
a) 2r sin (θ/2) b) 2r cos(θ/2) c) 2r tan (θ/2) d) 2r cot (θ/2)

135. Assertion: The motion of a ceiling fan is rotational only.
Reason: The motion of a rigid body which is pivoted or fixed in some way is rotation.
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

136. A thin hollow sphere of mass m is completely filled with a liquid of mass m. When the sphere rolls with a velocity v, kinetic energy of the system is equal to:
a) $\frac{1}{2}mv^2$ b) mv^2 c) $\frac{4}{3}mv^2$ d) $\frac{4}{5}mv^2$

137. Passengers standing in a bus are thrown outwards when the bus takes a sudden turn. This happens because of:
a) outward pull on them b) inertia c) change in momentum d) change in acceleration

138. If a ladder weighing 250 N is placed against a smooth vertical wall having coefficient of friction between it and floor as 0.3. Then what is the maximum force of friction available at the point of contact between the ladder and the floor?
a) 75 N b) 50 N c) 35 N d) 25 N

139. Why does a horse need to pull harder during the first few steps in pulling the cart?
a) Limiting friction is greater than dynamic friction
b) Sliding friction is greater than rolling friction
c) No frictional force acts after the cart comes in motion
d) Air friction is greater during first few steps of motion

140. A particle is projected at an angle of 45°, then find relation between range and maximum height attained by the particle:
a) 2H = R b) none of these c) R = 4H d) 4R = H

141. (A) On a rainy day, it is difficult to drive a car at high speed.
(R) The value of coefficient of friction is lowered due to wetting of the surface

a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

142. Which of the following principles a circus acrobat employs in his performance?
a) Conservation of energy b) Conservation of linear momentum c) Conservation of mass
d) Conservation of angular momentum

143. (A) A frame accelerated with respect to an inertial frame is a non- inertial frame.
(R) The concept of pseudo force is valid both for inertial as well as non-inertial frame.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

144. A body moves along a circular path of radius 5 m. The coefficient of friction between the surface of the path and the body is 0.5. The angular velocity (in radians/see) with which the body should move so that it does not leave the path is: (Takeg = 10m/s ^{2})
a) 4 b) 3 c) 2 d) 1

145. Awire of mass mand length lis bent in the form ofa circular ring. The moment of inertia ofthe ring about its axis is:
a) ml^2 b) $\frac{ml^2}{4\pi^2}$ c) $\frac{ml^2}{2\pi^2}$ d) $\frac{ml^2}{8\pi^2}$

146. If the equation for the displacement of a particle moving on a circular path is given by:
$\theta = 2t^3 + 0.5$
where θ is in radian and t in second, then the angular velocity of the particle is:
a) 8 rad/sec b) 12 rad/sec c) 24 rad /sec d) 36 rad /sec

147. A spirit level is placed at the edge of a turntable along its radius. The bubble will lie:
a) at the centre b) at the outer edge c) at the inner edge
d) will oscillate about the centre

148. Which one of the following statements is not true about Newton's second law of motion $\vec{F}$ = m $\vec{a}$?
a) The second law of motion is consistent with the first law.
b) The second law of motion is a vector law.
c) The second law of motion is applicable to a single point particle.
d) The second law of motion is not a local law

149. (A) In Karate, a brick is broken with a bare hand.
(R) In this process the impulse is sharp.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

150. Two bodies of masses m and 4 m are moving with equal kinetic energies. The ratio of their linear momentum will be :
a) 1 : 4 b) 4 :1 c) 1 : 2 d) 2 : 1

151. A spaceman in training is rotated in a seat at the end of a horizontal arm of length 5 m. If he can withstand acceleration upto 9g, then what is the maximum number of revolutions per second permissible? (Take g = 10 m/s^2)
a) 13.5 rev/s b) 1.35 rev/s c) 0.675 rev/s d) 6.75 rev/s

152. Angular momentum of a body is defined as the product of:
a) mass and angular velocity b) centripetal force and radius
c) linear velocity and angular velocity d) moment of inertia and angular velocity

153. A false balance is such that the beam remains horizontal when the pans are empty. An object weighs W_1 when placed in one pan and W_2 when placed in the other pan. Then the weight W of the object is:
a) $\sqrt{W_1W_2}$ b) $\frac{w_1+w_2}{2}$ c) $\sqrt{w_1^2+w_2^2}$ d) $\frac{w_1-w_2}{2}$

154. Two billiard balls A and B, each of mass 50 g and moving in opposite directions with speed of 5 m s^{-1} each, collide and rebound with the same speed. The impulse imparted to each ball is
a) 0.25 kg m s^{-1} b) 0.5 kg m s^{-1} c) 0.1 kg m s^{-1} d) 0.125 kg m s^{-1}

155. Two particles of equal masses are revolving in circular paths of radii r_1 and r_2 respectively with the same period. The ratio of their centripetal force is:
a) r_1/r_2 b) $\sqrt{r_2/r_1}$ c) $(r_1/r_2)^2$ d) $(r_2/r_1)^2$

156. (A) In uniform circular motion, speed is constant.
(R) In uniform circular motion, tangential acceleration is zero.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

157. A mass of M kg is suspended by a weightless string. The horizontal force that is required to displace it until the string makes an angle of 45° with the initial vertical direction is:
a) Mg $\left(\sqrt{2}+1\right)$ b) Mg $\sqrt{2}$ c) $\frac{Mg}{\sqrt{2}}$ d) Mg $\left(\sqrt{2}-1\right)$

158. We can derive Newton's
a) second and third laws from the first law. b) first and second laws from the third law.
c) third and first laws from the second law
d) all the three laws are independent of each other.

159. Mass is distributed uniformly over a thin square plate. If two end points of a diagonal are (-2, 0) and (2, 2), what are the co-ordinates of the centre of mass of plate?
a) (2,1) b) (2,2) c) (1,0) d) (0,1)

160. Consider a two particle system with particles having masses m_1 and m_2 If the first particle is pushed towards the centre of mass through a distance d, by what distance should the second particle be moved, so as to keep the centre of mass at the same position?

a) d b) (m_2/m_1) d c) $[m_1/(m_1+m_2)]$d d) (m_1/m_2)d

161. A body of mass 10 kg is moved with a uniform speed on a rough horizontal surface, for a distance of 2 m. The work done is 150 J. The surface is inclined to the horizontal at 30°. The same body is moved over the inclined plane for a distance of 2 m. The work done against friction will be: (Take g = 10m s^{-2})

a) 250 J b) 50 J c) 150 J d) 75 $\sqrt{3}$J

162. A fielder in a cricket match throws ball from the boundary line to the wicket keeper. The ball describes a paraboA particle is moving in a vertical circle. The tension in the string when passing through two positions at angle of 30° and 60° from vertical (the lowest position) are T_1 and T_2 respectively, thenlic path. Which of the following quantities remain constant during the motion in air? (Neglecting air resistance)

a) $T_1 = T_2$ b) $T_2 > T_1$ c) $T_1 > T_2$ d) tension in the string always remains the same

163. Which one of the following is not force?

a) Impulse b) Tension c) Thrust d) Weight

164. A body of mass 2 kg moving on a horizontal surface with an initial velocity of 4 m/sec comes to rest after 2 sec. If one wants to keep this body moving on the same surface with a velocity of 4 m/sec, the force required is:

a) 8 N b) Zero c) 4 N d) 2 N

165. A cricket ball of mass 0.25 kg with speed 10 m S^{-1} collides with a bat and returns with same speed within 0.01 s. The force acted on bat is:

a) 25 N b) 50 N c) 250 N d) 500 N

166. A batsman hits back a ball of mass 0.15 kg straight in the direction of the bowler without changing its initial speed of 12 m S^{-1}. If the ball moves linearly, then the impulse imparted to the ball is

a) 1.8 N s b) 2.8 N s c) 3.6 N s d) 4.2 N s

167. A body revolving in a circle with uniform speed possesses:

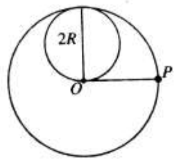
a) normal acceleration b) uniform acceleration c) tangential acceleration
d) none of these

168. Let g be acceleration due to gravity on the surface of the earth and K_R be the rotational kinetic energy of the earth. Suppose the earth's radius decreases by 2%, keeping all other quantities same (even ω):

a) g decreases by 2% and K_R decreases by 4%
b) g decreases by 4% and K_R decreases by 2%
c) g increases by 4% and K_R decreases by 4%
d) g decreases by 4% and K_R increases by 4%

169. A lamina is made by removing a small disc of diameter 2R from a bigger disc of uniform mass density and radius 2R, as shown in the figure. The moment of inertia of this lamina about axes passing through O and P is I_O and I_P respectively. Both these axes are perpendicular to

the plane of the lamina. The ratio $\frac{I_P}{I_O}$



a) 13/37 b) 37/13 c) 73/31 d) 8/13

170. (A) A body rolls down an inclined plane without slipping. The fraction of total energy associated with its rotation will depend on its radius of gyration.
(R) Total kinetic energy of rolling body is equal to addition of kinetic energy of rotation and kinetic energy of translation.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

171. The radius of gyration ofa uniform rod oflength Labout an axis passing through its centre of mass is:
a) $\frac{L}{\sqrt{12}}$ b) $\frac{L^2}{12}$ c) $\frac{L}{\sqrt{3}}$ d) $\frac{L}{\sqrt{2}}$

172. A ball is thrown up at an angle with the horizontal. Then, the total change of momentum by the instant it returns to the ground is:
a) acceleration due to gravity x total time of flight
b) weight of the ball x half the time of flight c) weight of the ball x total time of flight
d) weight of the ball x horizontal range

173. Two weights are suspended from a string thrown over a light frictionless pulley. The mass of one weight is 0.200 kg. If a heavy weight is attached to its other end, the tension in the string is:
a) Zero b) 0.200 Kgf c) 0.400 Kgf d) 0.600 Kgf

174. A force of 250 N is required to lift a 75 kg mass through a pulley system. In order to.lift the mass through 3 m, the rope has to be pulled through 12 m. The efficiency of the system is:
a) 50% b) 75% c) 33% d) 90%

175. A small object of mass m is attached to a light string and made to rotate on a frictionless table in a circular path whose radius can be changed by pulling the other end of the string through the hole at the centre. If the initial and final values of the radius of the orbit, speed and angular velocities of the object are r_1, v_1 ω_1 and r_2, v_2, ω_2 (02 respectively, then ω_2/ω_1 is:
a) R_1/R_2 b) $(r_1/r_2)^2$ c) $(r_2/r_1)^2$ d) r_2/r_1

176. (A) A man who falls from a height on a cement floor receive more injury than when he falls from the same height on a heap of sand.
(R) The impulse given by cement floor is more than the impulse given by a heap of sand.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

177. A man sits on a chair supported by a rope passing over a frictionless fixed pulley. The man who weighs 1000 N exerts a force of 450 N on the chair downwards while pulling on the rope. If the chair weighs 250 N and g is $10 m.s^2$, then the acceleration of the chair is:
a) $0.45 m/sec^2$ b) Zero c) $2 m/sec^2$ d) $(9/25) m/sec^2$

178. A person of mass 50 kg stands on a weighing scale on a lift. If the lift is ascending upwards with a uniform acceleration of $9 m s^{-2}$, what would be the reading of the weighing scale? (Take $g = 10 ms^{-2}$)
a) 50 kg b) 60 kg c) 95 kg d) 100 kg

179. Assertion: The moment of inertia of a rigid body depends only on the mass of the body, its shape and size.
Reason: Moment of inertia $I = MR^2$, where M is the mass of the body and R is the radius vector.
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

180. Why do we prefer rubber tyres than steel tyres?
a) Rubber is cheaper than steel. b) It is easy to give rubber a circular shape.
c)
Coefficient of friction between rubber and concrete is lower than that between steel and concrete.
d) Steel tyres produce more noise than rubber tyres

181. The mass of a lift is 2000 kg. When the tension in the supporting cable is 28000 N, then its accelerption is ___________
a) $4 ms^{-2}$ upwards b) $4 ms^{-2}$ downwards c) $14 ms^{-2}$ upwards d) $30ms^{-2}$ downwards

182. A force acts on a 3.0 g particle in such a way that the position of the particle as a function of time is given by: $x = 3t - 4t^2 + t^3$
Where x is in metres and 1 is in seconds. The work done during the first 4 s is:
a) 570 mJ b) 450 mJ c) 490 mJ d) 530 mJ

183. If the road is unbanked and the coefficient of friction between the road and the tyres is 0.8, then the maximum speed with which an automobile can move around a curve of 84.5 m radius without slipping is:(Take $g = 10 ms^{-2}$)
a) $26 ms^{-1}$ b) $67.6 ms^{-1}$ c) $13 ms^1$ d) $36.7 ms^{-1}$

184. (A) A block of mass m is kept at rest on an inclined plane, the force applied by the surface to the block will be mg.
(R) Contact force between block and inclined plane is the resultant of normal reaction and frictional force.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

185. A motorcar is travelling at 60 m/s on a circular road of radius 1200 m. It is increasing its speed at the rate of 4 m/s 2. The acceleration of the car is:
a) 3 m/s^2 b) 4 m/s^2 c) 5 m/s^2 d) 7 m/s^2

186. A student unable to answer a question on Newton's laws of motion attempts to pull himself up by tugging on his hair. He will not succeed:
a) as the force exerted is small b) the frictional force while gripping is smal
c) Newton's law of inertia is not applicable to living beings
d) as the force applied is internal to the system

187. A body of moment of inertia of 3 kg x m^2 rotating with an angular speed of 2 radlsec has the same KE as a mass of 12 kg moving with a speed of:
a) 2 ms^{-1} b) 1 ms^{-1} c) 4 ms^{-1} d) 8 ms^{-1}

188. A solid sphere and a hollow sphere of equal mass and radius are placed over a rough horizontal surface after rotating it about its mass centre with same angular velocity ω_0 Once the pure rolling starts let V_1 and V_2 be the linear speeds of their centre of mass. Then:
a) $v_1 = v_2$ b) $v_1 > v_2$ c) $v_1 < v_2$ d) data is insufficient

189. The moment of inertia of a body about a given axis is 1.2 kg x m^2. Initially, the body is at rest. In order to produce a rotational KE of 1500 joule, an angular acceleration of 25 rad/sec^2 must be applied about that axis for a duration of:
a) 4 s b) 2 s c) 8 s d) 10 s

190. (A) The rate of change of total momentum of a many particle system is proportional to the sum of the internal forces of the system.
(R) Internal forces can change the kinetic energy but not the momentum of the system.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

191. (A) The work done during a round trip is always zero.
(R) No force is required to move a body in its round trip.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

192. A light string is wound several times around a spool of mass M and radius R. The free end of the string is attached to a fixed point and the spool is held so that the part of the string not in contact with its vertical. If the spool is let go, the acceleration is:
a) g/3 b) 2g/3 c) g d) 3g/4

193. A large force is acting on a body for a short time. The impulse imparted is equal to the change in
a) acceleration b) momentum c) energy d) velocity

194. (A) A solid body of density, half that of water, falls from a height of 10m and then enters into water. The depth to which it wiJl go in water is 10m.
(R) Depth in water is equal to height from which water faJls.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

195. The angular speed of a motor wheel is increased from 1200 rpm to 3120 rpm in 16 seconds. The angular acceleration of the motor wheel is :
a) 8π rad s $^{-2}$ b) 2π rad s $^{-2}$ c) 4π rad s $^{-2}$ d) 6π rad s $^{-2}$

196. The overbridge of a canal is in the form of a circular arc of radius R. What is the greatest speed at which a motorcyclist can cross the bridge without leaving the ground?
a) $\sqrt{5gR}$ b) $\sqrt{3gR}$ c) $\sqrt{2gR}$ d) $\sqrt{gR}$

197. A force of 5N acts on a body of weight 9.8 N. What is the acceleration produced in m/sec^2.
a) 49.00 b) 1.46 c) 5.00 d) 0.51

198. The rear side of a truck is open and a box of mass 40 kg is placed S m away from the open end. The coefficient of friction between the box and the surface below it is 0.15. The truck starts from rest with an acceleration of 2 m S^{-2} on a straight road. At what distance from the starting point does the box fall off the truck?
a) 20 m b) 30 m c) 40 m d) 50 m

199. Two blocks of masses 6 kg and 4 kg are placed on a frictionless surface and connected by a spring. If the heavier mass is given a velocity of 14 m/s in the direction of lighter one, then the velocity gained by the centre of mass will be:
a) 7.4 m/s b) 14 m/s c) 8.4 m/s d) 10 m/s

200. Particles of masses m, 2m, 3m, ... , nm grams are placed on the same line at distances l, 2l, 3l, ... , nl em from a fixed point. The distance of the centre of mass of the particles from the fixed point (in centimetres) is:
a) $\frac{(2n+1)l}{3}$ b) $\frac{l}{n+1}$ c) $\frac{n(n^2+1)l}{2}$ d) $\frac{2l}{n(n^2+1)}$

201. If $\vec{F}$ is the force acting on a particle having position vector $\vec{r}$ and $\vec{\tau}$ be the torque of this force about the origin, then

a) $\vec{r}.\vec{\tau}$ >0 and $\vec{F}.\vec{\tau}$ <0 b) $\vec{r}.\vec{\tau}$ = 0 and $\vec{F}.\vec{\tau}$= 0 c) $\vec{r}.\vec{\tau}$ = 0 and $\vec{F}.\vec{\tau} \neq 0$

d) $\vec{r}.\vec{\tau} \neq 0$ and $\vec{F}.\vec{\tau}$= 0

202. (A) The acceleration of a body down a rough inclined plane is greater than the acceleration due to gravity.
(R) The body is able to slide on a inclined plane only when its acceleration is greater than acceleration due to gravity.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true

203. (A) A body subjected to three concurrent forces cannot be in equilibrium.
(R) If large number of concurrent forces are acting on the same point, then the point will be in equilibrium, if sum of all the forces is equal to zero.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

204. (A) Mountain roads rarely go straight up the slope.
(R) Slope of mountains are large, therefore more chances of vehicle to slip from roads.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

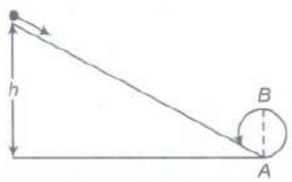
205. A rocket of initial mass 6000 kg ejects gases at a constant rate of 16 kg S^{-1} with constant relative speed of 11 km S^{-1}. What is the acceleration of the rocket one minute after the blast?
a) 25 m S^{-2} b) 50 m S^{-2} c) 10 m S^{-2} d) 35 m S^{-2}

206. A cylinder of mass 10 kg is rolling on a rough plane with a velocity of 10 rn/s. If the coefficient of friction between the surface and cylinder is 0.5, then before stopping, it will cover a distance of: (Take g = 10 M/s^2)
a) 10 m b) 7.5 m c) 5 m d) 2.5 m

207. If a body is projected with an angle O to the horizontal, then:
a) its velocity is always perpendicular to its acceleration
b) its velocity becomes zero at its maximum height
c) its velocity makes zero angle with the horizontal at its maximum height
d)
the body just before hitting the ground, the direction of velocity coincides with the acceleration

208. A block B is pushed momentarily along a horizontal surface with an initial velocity Z. If m is the coefficient of sliding friction between B and the surface, block B will come to rest after a time ___________
a) gm/V b) g\V c) V\g d) V\(gm)

209. A body initially at rest and sliding along a frictionless track from a height h (as shown in the figure) just completes a vertical circle of diameter AB = D. The height h is equal to:



a) 7/5 D b) D c) 3/2 D d) 5/4 D

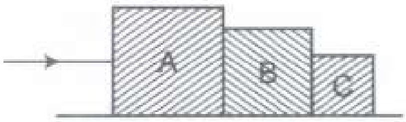
210. A particle is moving in a circle with uniform speed. It has constant:

a) velocity b) acceleration c) kinetic energy d) displacement

211. A constant power is supplied to a rotating disc. Angular velocity (ω) of disc varies with number of rotations (n) made by the disc as:
a) $\omega \propto (n)^{1/3}$ b) $\omega \propto (n)^{3/2}$ c) $\omega \propto (n)^{2/3}$ d) $\omega \propto (n)^2$

212. An object of mass 5 kg is attached to the hook of a spring balance and the balance is suspended vertically from the roof of a lift. The reading on the spring balance when the lift is going up with an acceleration of 0.25 ms^{-2} is: (Take g = 10 m/s^2)
a) 51.25 N b) 48.75 N c) 52.75 N d) 47.25 N e) 55 N

213. Three blocks A, B and C, of masses 4 kg, 2 kg and 1 kg respectively, are in contact on a frictionless surface, as shown. If a force of 14 N is applied on
the 4 kg block, then the contact force between A and B is:



a) 18 N b) 2 N c) 6 N d) 8 N

214. In the question number 91, if a force F is applied to 20 kg block, then the tension in the string is
a) 100 N b) 200 N c) 300 N d) 400 N

215. (A) An object can possess acceleration even at a time when it has uniform speed.
(R) It is possible when the direction of motion keeps changing.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

216. The static friction is:
a) equal to the dynamic friction b) always less than the dynamic friction
c) always greater than the dynamic friction
d) sometimes greater and sometimes equal to dynamic friction

217. An automobile is negotiating a curve of radius r. The coefficient of friction between the tyres and the road is μ. The velocity of the vehicle should not be more than:
a) μrg b) μg/r c) $\sqrt{\mu gr}$ d) $\sqrt{\mu rg}$

218. Brakes of very small contact area are not used, although friction is independent of area, because friction:
a) resists motion b) causes wear and tear c) depends upon the nature of the material
d) operating in this case is sliding friction

219. A ball of mass m strikes a rigid wall with speed u and rebounds with the same speed. The impulse imparted to the ball by the wall is
a) 2mu b) mu c) Zero d) -2mu

220. A book is lying on the table. What is the angle between the action of the book on the table and the reaction of the table on the book?
a) 0° b) 45° c) 90° d) 180°

221. Two bodies are projected from ground with equal speeds 20 m/s from the same position in same vertical plane to have equal range but at different angle above the horizontal. If one of the angle is 30°, the sum of their maximum heights is: (assume g= 10 m/s^2)
a) 400 m b) 20 m c) 30 m d) 40 m

222. A rigid body rotates about a fixed axis with variable angular velocity equal to $\alpha - \beta t$ at time t, where α and β are constants. The angle through which it rotates before it comes to rest isl:
a) $\frac{\alpha^2}{2\beta}$ b) $\frac{\alpha^2-\beta^2}{2\alpha}$ c) $\frac{\alpha^2-\beta^2}{2\beta}$ d) $\frac{\alpha(\alpha-\beta)}{2}$

223. A block of mass M is pulled along a horizontal frictionless surface by a rope of mass m. If a force F is applied at one end of the rope, the force which the rope exerts on the block is:
a) F/(M + m) b) F c) FM/(m + M) d) zero

224. The radius of gyration of an uniform rod of length 1 about an axis passing through one of its ends and perpendicular to its length is
a) $\frac{1}{\sqrt{2}}$ b) $\frac{1}{3}$ c) $\frac{1}{\sqrt{3}}$ d) $\frac{1}{2}$

225. (A) If $\vec{A}, \vec{B}$ and $\vec{C}$ are three coplanar vectors representing same physical quantities such that $|\vec{A}| = |\vec{B}| = |\vec{C}|$ with each pair of vectors having angle of $\frac{2\pi}{3}$ radian between them, then their resultant is zero.
(B) The resultant of three coplanar vectors is zero if they can be represented by three sides of a triangle taken in order.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

226. When a ceiling fan is switched on, it makes 10 revolutions in the first 3 seconds. Assuming a uniform angular acceleration, how many rotations it will make in the next 3 seconds?
a) 10 b) 20 c) 30 d) 40 e) 60

227. 5 discs each of mass m are placed one above the other. The force on the first from the bottom because of the remaining on the top is:
a) mg b) 2mg c) 3mg d) 4mg

228. (A) Two bodies of different masses are projected horizontally with different speeds, they reach the ground simultaneously.
(B) For both bodies, the vertical component of initial velocity is zero.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

229. (A) If there is no external torque on a body about its centre of mass, then the velocity of centre of mass remains constant.
(R) The linear momentum of an isolated system remains constant.

a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion isfalse but reason is true.

230. Three identical metal balls, each of radius r, are placed touching each other on a horizontal surface such that an equilateral triangle is formed when the centres of the three balls are joined. The centre of mass of the system is located at:
a) horizontal surface b) centre of one of the balls c) line joining centres of any two balls
d) point of intersection of their medians

231. Two bodies A and B are attracted towards each other due to gravitation. Given that A is much heavier than B, which of the following correctly describes the relative motion of the centre of mass of the bodies?
a) It moves towards A b) It remains at rest W.r.t. A as well as B c) It moves towards B
d) It moves perpendicular to the line joining the particles

232. A coin is placed on a gramophone record rotating at a speed of 45 rpm. It flies away when the rotational speed is 50 rpm. If two such coins are placed one over the other on the same record, both of them will fly away when the rotational speed is:
a) 12.5 rpm b) 25 rpm c) 50 rpm d) 100 rpm

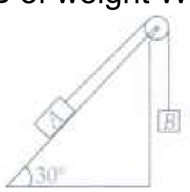
233. A child is standing with folded hands at the centre of a platform rotating about its central axis. The kinetic energy of the system is K. Now, the child stretches his arms so that moment of inertia of the system doubled. Now, the kinetic energy of the system is :
a) $\frac{K}{4}$ b) $\frac{K}{2}$ c) 2K d) 4K

234. For ordinary terrestrial experiments the observer in an inertial frame in the following cases, is:
a) a child revolving in a giant wheel
b) a driver in a sports car moving with a constant high speed of 200 km/hr on a straight road
c) the pilot of an aeroplane which is taking-off d) a cyclist negotiating a sharp curve

235. A wheel has angular acceleration of 3.0 rad/sec^2 and an initial angular speed of 2.0 rad/see. In a time of 2 sec it has rotated through an angle (in radian) of:
a) 10 b) 12 c) 4 d) 6

236. A solid cylinder is rolling down on an inclined plane of angle θ. The coefficient of static friction between the plane and cylinder isu μ_S. The condition for the cylinder not to slip is:
a) tan $\theta \geq 3\mu_S$ b) tan $\theta > 3\mu_S$ c) tan$\theta \leq 3\mu_S$ d) tan $\theta < 3\mu_S$

237. Block A of weight 100 rests on a frictionless inclined plane of slope angle 30° as shown in the figure. A flexible cord attached to A passes over a frictionless pulley and is connected to block B of weight W. Find the weight W for which the system is in equilibrium.



a) 25 N b) 50 N c) 75 N d) 100 N

238. (A) Aeroplanes always fly at low altitudes.
(R) According to Newton's IIIrd law of motion, for every action there is an equal and opposite reaction.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

239. Sand is being dropped on a conveyor belt at the rate of M kg/s. The force necessary to keep the belt moving with a constant velocity of v m/s will be ____________
a) Mv newton b) 2 Mv newton c) $\frac{Mv}{2}$ newton d) zero

240. The moment of inertia of a solid sphere of density p and radius R about its diameter is:
a) $\frac{105}{176}R^5p$ b) $\frac{105}{176}R^2p$ c) $\frac{176}{105}R^5p$ d) $\frac{176}{105}R^2p$

241. A rocket with a lift-off mass 2 x10^4 kg is blasted upwards with an initial acceleration of 5 m s^{-2}. The initial thrust of the blast is (Take g = 10 m S^{-2})
a) 2 x 10^5 N b) 3 x 10^5 N c) 4 x 10^5 N d) 5 x 10^5 N

242. Five vehicles of mass 2 kg are attached to the rim of a circular disc of radius 0.1 m and negligible mass. Moment of inertia 0, the system about the axis passing through the centre of the disc and perpendicular to its plane is:
a) 1 Kg - m^2 b) 0.1 Kg - m^2 c) 2 Kg - m^2 d) 0.2 Kg - m^2

243. A wheel is subjected to uniform angular acceleration about its axis. Initially its angular velocity is zero. In the first 2 sec, it rotates through an angle θ_1; in the next 2 see it rotates through an additional angle θ_2. The ratio of $\frac{\theta_2}{\theta_1}$.
a) 1 b) 2 c) 3 d) 5

244. A block of metal weighing 2 kg is resting on a frictionless plane. It is struck by a jet releasing water at a rate of 1 kg/s and at a speed of 5 mls. The initial acceleration of the block will be:
a) 2.5 m/s^2 b) 5 m/s2 c) 10m/s^2 d) 20m/s^2

245. A man of mass 60 kg is standing on a spring balance inside a lift. If the lift falls freely downwards, then the reading of the spring balance will be:
a) > 60 Kgf b) 60 kg + weight of the spring c) Zero d) 60 Kgf e) < 60 kgf

246. (A) In circular motion, centripetal and centrifugal forces act in opposite directions and balance each other.
(R) Centripetal force is a pseudo force.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

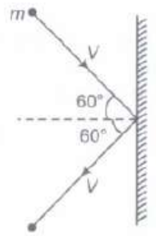
247. (A) Instantaneous axis of rotation is stationary w.r.t. ground.
(R) Instantaneous axis of rotation may lie within or outside the rigid body.

a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

248. A convey or belt is moving at a constant speed of 2m/s' A box is gently dropped on it. The coefficient of friction between them is m: 0.5. The distance that the box will move relative to belt before coming to rest on it taking g = 10 ms 2, is _________
a) 12m b) 0.6m c) zero d) 0.4m

249. Two blocks A and B are released at the top of a rough inclined plane so that A slides along the plane and B falls down freely. Which will have higher velocity on reaching the ground?
a) A b) B c) Both will reach the ground with same velocity
d) It depends on the coefficient of friction

250. A rigid ball of mass m strikes a rigid wall at 60° and gets reflected without loss of speed as shown in the figure below. The value of impulse imparted by the wall on the ball will be



a) $\frac{mV}{2}$ b) $\frac{mV}{3}$ c) mV d) 2mV

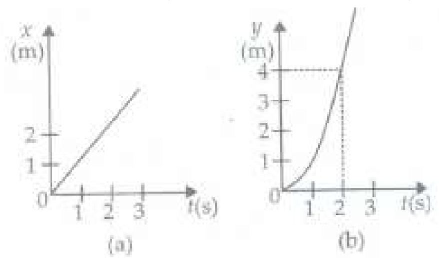
251. Even if the force on the rocket remains same, its acceleration:
a) increases b) decreases c) remains same d) first increases and then decreases

252. Match the Column I with Column II.

Column-I		Column-II	
(A)	For translational equilibrium	(p)	Mk^2
(B)	For rotational equilibrium	(q)	Angular acceleration
(C)	Moment of inertia of a body	(r)	$\sum \vec{F} = 0$
(D)	Torque is required to produce	(s)	$\sum \vec{\tau} = 0$

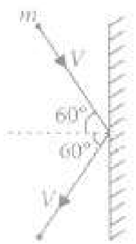
a) A - p, B - q, C - r, D - s b) A - q, B - r, C - s, D - P c) A - r, B - q, C - p, D - s
d) A - r, B - s, C - p, D - q

253. Figure shows (x, t), (y, t) diagram of a particle moving in 2-dimensions. If the particle has a mass of 500 g, the force acting on the particle is



a) 1 N along y-axis b) 1 N along x-axis c) 0.5 N along x-axis d) 0.5 N along y-axis

254. Two blocks of masses 6 kg and 4 kg connected by a rope of mass 2 kg are resting on a frictionless floor as shown in the following figure. tension in the rope at points A, Band Care respectively given by:



a) 60 N, 60 N, 60 N b) 30 N, 25 N, 20 N c) 20 N, 25 N, 30 N d) 20 N, 20 N, 20 N

255. The linear velocity ofthe particle on the N-pole ofthe earth will be:
a) zero b) 486 km h^{-1} c) infinite d) 125 ms^{-1}

256. A body is whirled in a horizontal circle of radius 20 cm. It has angular velocity of 10 radls. What is its linear velocity at any point on circular path?
a) $\sqrt{2}$ ms^{-1} b) 10 ms^{-1} c) 2 ms^{-1} d) 20 ms^{-1}

257. A particle of mass 109 moves along a circle of radius 6.4 em with a constant tangential acceleration. What is the magnitude of this acceleration if the kinetic energy of the particle becomes equal to 8 x 10^{-4} J by the end of the second revolution after the beginning of the motion?
a) 0.1 m/s^2 b) 0.15m/s^2 c) 0.18 m/s^2 d) 0.2 m/s^2

258. Assertion: A girl sits on a rolling chair, when she stretch her arms horizontally, her speed is reduced.
Reason: Principle of conservation of angular momentum is applicable in this situation.
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

259. If the radius of a solid sphere is 35 cm, calculate the radius of gyration when the axis is along a tangent:
a) $7\sqrt{10}cm$ b) $7\sqrt{35}cm$ c) $\frac{7}{5}cm$ d) $\frac{2}{5}cm$

260. In an elevator moving vertically up with an acceleration 'g', the force exerted on the floor by a passenger of mass M is :
a) Mg b) $(\frac{1}{2})$Mg c) zero d) 2Mg

261. A dish of mass 109 is kept floating horizontally in the air by firing bullets each of mass 5 g with the same velocity. If 10 bullets are fired per second and the bullets rebound with the same velocity, then the, velocity of each bullet is:
a) 196 cm/sec b) 98 cm/sec c) 49 cm/sec d) None of these

262. When a bicycle is in motion but not pedalled, the force of friction exerted by the ground on the two wheels is such that it acts:
a) in the backward direction on the front wheel and in the forward direction on the rear wheel
b) in the forward direction on the front wheel and in the backward direction on the rear wheel
c) in the forward direction on both the wheels
d) in the backward direction on both the wheels

263. A tangential force F acts at the top of a disc of mass m and radius R. If it rolls without slipping. Then

a) Acceleration of disc $=\frac{2F}{3m}$ b) Friction force between disc and surface = $\frac{2F}{3m}$

c) Acceleration of disc = $\frac{6F}{5m}$ d) Friction force between disc and surface is $\frac{F}{3}$

264. A thin rod of length L and mass M is held vertically with one end on the floor and is allowed to fall. Find the velocity of the other end when it hits the floor, assuming that the end on the floor docs not slip:

a) $\sqrt{\frac{3g}{L}}$ b) $\sqrt{3gL}$ c) $\sqrt{\frac{L}{3g}}$ d) $\sqrt{\frac{g}{3L}}$

265. A particle of mass m is describing a circular path of radius r with uniform speed. If L is the angular momentum of the particle about the axis of the circle, the kinetic energy of the particle is given by:

a) L^2/mr^2 b) $L^2/2mr^2$ c) $2L^2/mr^2$ d) mr^2L

266. A string of negligible mass going over a clamped pulley of mass m supports a block of mass M as shown in the figure. The force on the pulley by the clamp is given by

a) $\sqrt{2}$ Mg b) $\sqrt{2}$ mg c) $\sqrt{(M+m)^2g}$ d) $\sqrt{(M+m)^2+M^2g}$

267. A stone of mass 1 kg is lying on the floor of a train which is accelerating with 1 m S^{-2}. The net force acting on the stone is

a) zero b) 1 N c) 5 N d) 10 N

268. A child stands at one end of a boat moving with a speed v in still water. If the child starts running towards the other end of the boat with a speed u, the centre of mass of the system (boat and child) will move with a speed:

a) v - u b) v c) u d) v + u

269. A particle of mass m is circulating on a circle of radius r having angular momentum L; then the centripetal force will be:

a) L^2/mr b) $L^2m/rL^2/mr^3$ c) L^2/mr^3 d) L^2/mr^2

270. (A) A stationary object placed on ground may experience a pseudo force as observed by the reference frame attached to the ground.

(R) Earth is a non-inertial frame of reference.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

271. A mass 1 kg is suspended by a thread. It is

(i) lifted up with an acceleration 4.9 m/s^2,

(ii) lowered with an acceleration 4.9 m/s^2.

The ratio of the tensions is:

a) 3:1 b) 1:3 c) 1:2 d) 2:1

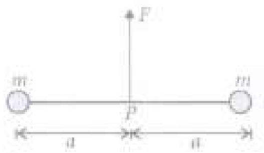
272. Consider a car moving along a straight horizontal road with a speed of 72 km/h. If the coefficient of static friction between the tyres and the road is 0.5, the shortest distance in which the car can be stopped is (takingg=10 m/s^2) :

a) 30 m b) 40 m c) 72 m d) 20 m

273. A body of mass 10 kg falls from a height of 5 m (g = 10m/s^2) and is stopped within one-tenth of a second on the ground. The force of interaction is:

a) 100 N b) Zero c) 1000 N d) 1100 N

274. Two particles of mass m each are tied at the ends of a light string of length 2a The whole system is kept on a frictionless horizontal surface with the string held tight so that each mass is at a distance a from the centre P (as shown in the figure). Now, the mid-point of the string is pulled vertically upwards with a small but constant force F. As a result, the particles move towards each other on the surface. The magnitude of acceleration, when the separation between them becomes 2x is :



a) $\frac{F}{2m}\frac{a}{\sqrt{a^2-x^2}}$ b) $\frac{F}{2m}\frac{x}{\sqrt{a^2-x^2}}$ c) $\frac{F}{2m}\frac{x}{a}$ d) $\frac{F}{2m}\frac{\sqrt{a^2-x^2}}{x}$

275. (A) If torque $\left(\vec{t}\right)$ acting on a rigid body is defined $\vec{t} - \vec{A} \times \vec{L}$ as where $\vec{A}$ is a constant vector and $\vec{L}$ is the angular momentum of the body then magnitude of the angular momentum of the body remains same.

(R) In this case $\vec{t}$ is perpendicular $\vec{L}$ and hence torque does not deliver any power to the body.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion isfalse but reason is true.

276. (A) A body can have acceleration even if its velocity is zero at a given instant of time.

(R) A body is momentarily at rest when it reverses its direction of motion.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

277. (A) A shell at rest, explodes. The centre of mass of fragments moves along a straight line.

(R) In explosion, the linear momentum of the system does not remain always conserved.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

278. In the question number 77, the force acting on the particle is

a) $m\omega^2\vec{r}$ b) $-m\omega^2\vec{r}$ c) $2m\omega^2\vec{r}$ d) $-2m\omega^2\vec{r}$

279. A particle is moving along a circular path of radius 5 m with a uniform speed 5ms $^{-1}$. What will be the average acceleration when the particle completes half revolution?

a) Zero b) 10 ms^{-1} c) 10 πms^{-2} d) $\frac{10}{\pi}$ ms^{-2}

280. A block of mass 2 kg rest on a plane inclined at an angle of 30° with the horizontal. The coefficient of friction between the block and the surface is 0.7. What will be the frictional force acting on the block?

a) 10.3 N b) 23.8 N c) 11.9 N d) 6.3 N

281. Assertion: The centre of gravity of a body coincides with its centre of mass only if the gravitational field does not vary from one part of the body to the other

Reason : Centre of gravity is independent of the gravitational field

a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

282. A body is rolling down an inclined plane. If kinetic energy of rotation is 40% of kinetic energy in translatory state, then the body is a

a) ring b) cylinder c) hollow ball d) solid ball

283. (A) When an automobile while going too fast around a curve overturns, its inner wheels leave the ground first.

(R) The inner wheels are moving in a circle of smaller radius, the maximum permissible velocity for them is less.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

284. A constant torque of 31.4 N-m is exerted on a pivoted wheel. If angular acceleration of wheel is 4π rad/sec 2 , then the moment of inertia ofthe wheel is:

a) 2.5 kg - m^2 b) 3.5 kg - m^2 c) 4.5 kg - m^2 d) 5.5 kg - m^2

285. An open knife edge of mass M is dropped from a height h on a wooden floor. If the blade penetrates a distance s into the wood, the average resistance offered by the wood to the blade is:

a) Mg b) $Mg\left(1+\frac{h}{s}\right)$ c) $Mg\left(1-\frac{h}{s}\right)$ d) $Mg\left(1+\frac{h}{s}\right)^2$

286. A rod of weight W is supported by two parallel knife edges A and B and is in equilibrium in a horizontal position. The knives are at a distance d from each other. The center of mass of the rod is at distance x from A. The normal reaction on A is :

a) $\frac{W(d-x)}{x}$ b) $\frac{Wx}{d}$ c) $\frac{Wd}{x}$ d) $\frac{W(d-x)}{d}$

287. A satellite in a force free space sweeps stationary interplanetary dust at a rate $\left(\frac{dM}{dt}\right) = \alpha v$. The acceleration of satellite is ______________

a) $-\frac{2\alpha v^2}{M}$ b) $-\frac{\alpha v^2}{M}$ c) $-\frac{\alpha v^2}{2M}$ d) $-av^2$

288. A spring is compressed between two toy cars of masses M_1 and M_2. When the cars are released they move apart. If X_1 and x_2 be the displacements of the cars when in contact with the spring, then:

a) $M_1x_1 = M_2x_2$ b) $M_1x_2 = M_2x_1$ c) $M_1x_1^2 = M_2x_2^2$ d) $M_1xx_2^2 = M_2xx_1^2$

289. The horizontal range of a projectile is 400 m. The maximum height attained by it will be:

a) 100 m b) 200 m c) 400 m d) 800 m

290. A cart is moving horizontally along a straight line with constant speed 30 mls. A projectile is to be fired from the moving cart in such a way that it will return to the cart after the cart has moved 80 m. At what speed (relative to the cart) must the projectile be fired? (Take g = 10 m/s^2)

a) $10\sqrt{8}$m/s b) $8\sqrt{10}$m/s c) $\frac{40}{3}$m/s d) None of these

291. (A) A body is rolling without slipping on a surface. There must be frictional force for start to such a motion.

(R) In rolling without slipping, work done against the frictional force is zero.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion isfalse but reason is true.

292. (A) The centre of mass and centre of gravity of a body are two different positions in general.

(R) The centre of mass and centre of gravity of a body coincide if gravitational field is uniform.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion isfalse but reason is true.

293. A force of 100 N need to be applied parallel to a smooth inclined plane just to hold a body on it. The angle of inclination of the inclined plane is 30°. How much horizontal force need to be applied to do the same?

a) 115 N b) 50 N c) 87 N d) 100 N

294. The range of a projectile fired at an angle of 15° is 50 m. If it is fired with the same speed at an angle of 45°, its range will be:

a) 50 m b) 100 m c) 25 m d) 37 m

295. A car is moving in a circular horizontal track of radius 10m with a constant speed of 10 m/s. A bob is suspended from the roof of the car by a light wire of length 1.0 m. The angle made by the wire with the vertical is ________

a) 0^o b) $\frac{\pi}{3}$ c) $\frac{\pi}{6}$ d) $\frac{\pi}{4}$

296. (A) Two bodies A and B are attracted towards each other due to gravitation. If A is much heavier than B, then the centre of mass of the bodies moves towards A.

(R) The centre of mass depends upon mass distribution of a body or a system of bodies.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

297. A heavy disc is thrown on a horizontal surface in such a way that it slides with a speed V_0 initially without rolling. It will start rolling without slipping when its speed reduces to:

a) $\frac{V_0}{2}$ b) $\frac{2V_0}{3}$ c) $\frac{3V_0}{5}$ d) $\frac{5V_0}{7}$

298. Which one of the following statements is not true?

a)

The same force for the same time causes the same change in momentum for different bodies.

b)

The rate of change of momentum of a body is directly proportional to the applied force and takes place in the direction in which the force acts.

c)

A greater opposing force is needed to stop a heavy body than a light body in the same time, if they are moving with the same speed.

d)

The greater the change in the momentum in a given time, the lesser is the force that needs to be applied.

299. Two racing cars of masses $m_1$and m_2 are moving in circles of radii r_1 and r_2 respectively. Their speeds are such thateach makes complete circles of radii r_1 and r_2 respectively. Their speeds are such that each makes a complete circle in the same time t. The ratio of the angular speeds of the first to the second car is:

a) 1 : 1 b) $m_1 : m_2$ c) $r_1 : r_2$ d) $m_1\, m_2 : r_1\, r_2$

300. Assertion: The familiar equation rng = R for a body on a table is true only if the body is in equilibrium.

Reason: The equality of rng and R has no connection with the third law.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

301. (A) If a particle is found to be in equilibrium in two different frames of reference implies that both frames are inertial.

(R) Newton's second law can be used for motion of a particle in any reference frame.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true

302. Of the following forces of friction, the one which is self-adjusting is:

a) rolling friction b) sliding friction c) static friction d) dynamic friction

303. A body is under the action of three forces $\vec{F_1}, \vec{F_2}$ and $\vec{F_3}$ In which case the body cannot undergo angular acceleration?

a) $\vec{F_1}, \vec{F_2}$ and $\vec{F_3}$ are concurrent b) $\vec{F_1} + \vec{F_2} + \vec{F_3} = 0$

c) $\vec{F_1}, \vec{F_2}$ is parallel to $\vec{F_3}$ but the three forces are not concurrent.

d) $\vec{F_1}$ and $\vec{F_2}$ act at the same point but $\vec{F_3}$ acts at different point

304. Assertion: A sphere cannot roll on a smooth inclined surface

Reason: The motion of a rigid body which is pivoted or fixed in some way is rotation.

a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

305. A car sometimes overturns while taking a turn. When it overturns, it is:

a) the inner wheel which leaves the ground first

b) the outer wheel which leaves the ground first

c) both the wheels leave the ground simultaneously

d) either wheel which leaves the ground first

306. A closed tube, partly filled with a liquid and set horizontal, is rotated about a vertical axis passing through its centre. In the process, the moment ofthe system about its axis would:

a) decrease always b) increase always c) remain constant

d) increase if tube is less than halffilled otherwise decrease

307. A body moves in a circular path of radius r = 500 m with tangential acceleration $a_t = 2\ m/s^2$. When its tangential linear velocity is 30 m/s, the total acceleration will be:

a) 5.4 ms^{-2} b) 3.9 ms^{-2} c) 2.7 ms^{-2} d) 2.1 ms^{-2}

308. A hollow cylinder of mass Mand radius R is rotating about its axis of symmetry and a solid sphere of same mass and radius is rotating about an axis passing through its centre. If torques of equal magnitude are applied to them, then the ratio of angular accelerations produced is :

a) $\frac{2}{5}$ b) $\frac{5}{2}$ c) $\frac{5}{4}$ d) $\frac{5}{4}$

309. A fielder in a cricket match throws ball from the boundary line to the wicket keeper. The ball describes a parabolic path. Which of the following quantities remain constant during the motion in air? (Neglecting air resistance)

a) Kinetic energy b) Vertical component of velocity c) Horizontal component of velocity

d) Speed

310. Newton's second and third laws of motion lead to the conservation of:

a) linear momentum b) angular momentum c) potential energy d) kinetic energy
e) force

311. The moment of inertia of a ring of mass M and radius R about an axis, passing through the centre and perpendicular to the plane of the ring is:
a) $\frac{1}{2}MR^2$ b) MR^2 c) $\frac{1}{4}MR^2$ d) $\frac{3}{4}MR^2$

312. A mass of 2 kg is whirled in a horizontal circle by means of a string at an initial speed of 5 revolutions per minute. Keeping the radius constant, the tension in the string is doubled. The new speed is nearly:
a) 14 rpm b) 10 rpm c) 2.25 rpm d) 7 rpm

313. A ballet dancer, dancing on a smooth floor is spinning about a vertical axis with her arms folded with an angular velocity of 20 rad/s. When she stretches her arms fully, the spinning speed decrease in 10 rad/ s. If I is the initial moment of inertia of the dancer, the new moment of inertia is:
a) 2 I b) 3 I c) I/2 d) I/3

314. A particle starting from the origin (0, 0) moves in a straight line in the x, y-plane. Its co-ordinates at a later time are $(\sqrt{3},3\}$ The path of the particle makes with the x-axis an angle of:
a) 45° b) 60° c) 0° d) 30

315. A car moving on a horizontal road may be thrown out of the road in taking a turn:
a) by the gravitational force b) due to the lack of proper centripetal force
c) due to the rolling frictional force between the tyre and road
d) due to the reaction of the ground

316. A person is sitting in a lift accelerating upwards. Measured weight of the person will be:
a) less than actual weight b) equal to actual weight c) more than actual weight
d) none of these

317. The position of the centre of mass of a cube of uniform mass density will be at
a) the centre of one face b) the centre of the interaction of diagonals of one face
c) the geometric centre of the cube d) the edge of a cube

318. A body A of mass M while falling vertically downwards under gravity breaks into two parts; a body B of mass $\frac{1}{3}$ M and body C of mass $\frac{2}{3}$ M. The centre of mass of bodies B and C taken together shifts compared to that of body A towards:
a) body C b) body B c) depends on height of breaking d) does not shift

319. Two discs have same mass and same thickness. Their materials are of densities ρ_1 and ρ_2. The ratio of their moments of inertia about central axis will be:
a) $\rho_1\rho_2 : I$ b) $I : \rho_1\rho_2$ c) $\rho_1 : \rho_2$ d) $\rho_2 : \rho_1$

320. A stone of mass 1 kg is tied to the end of a string 1m long. It is whirled in a vertical circle. If the velocity of the stone at the top be 4 ms^{-1}, what is the tension in the string?
(g = 10m s^{-2})
a) 16 N b) 10 N c) 6 N d) 5 N

321. (A) The angle between vectors $\vec{A} \times B$ and $\vec{B} \times \vec{A}$ is π radian.

(R) $\vec{B} \times A = -\vec{A} \times \vec{B}$

a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

322. A solid sphere rolling on a surface has total kinetic energy given by:
a) $\frac{1}{2}mv^2$ b) $\frac{7}{5}mv^2$ c) $\frac{7}{10}mv^2$ d) $\frac{3}{10}mv^2$

323. A 1200 kg automobile rounds a level curve of radius 200 m, on an unbanked road, with a velocity of 72 km/h. The minimum coefficient of friction between the tyres and the road in order that the automobile may not skid is: ($g=10ms^{-2}$)
a) 0.3 b) 0.2 c) 0.6 d) 0.5

324. The time period of a simple pendulum of length '1' is measured in an elevator descending with acceleration $\frac{g}{3}$:
a) $2\pi\sqrt{\frac{3l}{2g}}$ b) $2\pi\sqrt{\frac{l}{g}}$ c) $2\pi\sqrt{\frac{2l}{3g}}$ d) $2\pi\sqrt{\frac{3l}{4g}}$

325. A particle covers equal distance around a circular path, in equal intervals of time. Which of the following quantities connected with the motion of the particle remains constant with time?
a) Displacement b) Velocity c) Speed d) Acceleration

326. A man weighing 80 kg, stands on a weighing scale in a lift which is moving upwards with a uniform acceleration of $5m/s^2$. What would be the reading on the scale?
a) 1200n b) 0 c) 400N d) 800N

327. The maximum velocity at which a truck can safely travel without toppling over, on a curve of radius 250 m (the height of the centre of gravity of the truck above the ground is 1.5 m and the distance: between the wheels is 1.5 m, the track being horizontal) is:
a) 30 ms^{-1} b) 35 ms^{-1} c) 40 ms^{-1} d) 45 ms^{-1}

328. A block of mass m is placed on a rough floor of a lift. The coefficient of friction between the block and the floor is μ When the lift falls freely, the block is pulled horizontally on the floor. What will be the force of friction?
a) μmg b) μmg/2 c) μmg d) None of these

329. A cylinder rolls down an inclined plane of inclination 30°, the acceleration of cylinder is:
a) g/3 b) g c) g/2 d) 2g/3

330. An astronaut accidentally gets separated out of his small spaceship accelerating in interstellar space at a constant rate of 100 m S^{-2}. What is the acceleration of the astronaut the instant after he is outside the spaceship?
(Assume that there are no nearby stars to exert gravitational force on him)
a) zero b) $10ms^{-2}$ c) 50 m S^{-2} d) 100 m S^{-2}

331. (A) When a man jumps from a boat to the shore, the boat slightly moves away from the shore.
(R) In absence of net force, the total momentum is conserved.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

332. (A) At the centre of the earth, a body has centre of mass,but no centre of gravity.
(R) Acceleration due to gravity is zero at the centre of the earth.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

333. A car is travelling at the rate of 70 km/h. Suddenly the brakes are applied causing the tyres to skid. How far will the car travel before coming to rest? (Given μ = 0.20)
a) 9.645 m b) 96.45 m c) 96.45 cm d) 964. 5 m

334. Four spheres of diameter 2a and mass M are placed with their centres on the four comers of a square of side b. Then the moment of inertia of the system about an axis along one of the sides of the square is:
a) $\frac{4}{5}Ma^2 + 2Mb^2$ b) $\frac{8}{5}Ma^2 + 2Mb^2$ c) $\frac{8}{5}Ma^2$ d) $\frac{4}{5}Ma^2 + 4Mb^2$

335. A man is standing on a weighing machine placed in a lift, when stationary, his weight is recorded as 40 kg. If the lift is accelerated upwards with an acceleration of 2m/s^2, then the weight recorded in the machine will be (g = 10m/s^2) :
a) 32 kg b) 40 kg c) 42 kg d) 48 kg

336. The potential energy for a conservative system is given by: U =ax^2 - bx the equilibrium position is given by:
a) x = 2ab b) x =$\frac{b}{2a}$ c) x = $\frac{2a}{b}$ d) x = $\sqrt{2ab}$

337. A uniform cylinder has radius R and length L.If the moment of inertia of this cylinder an axis passing through its center and normal to its circular face to the moment of inertia of the same cylinder about an axis passing through its center and normal to its length , then
a) L = R b) L = $\sqrt{3}$ c) $\frac{R}{\sqrt{3}}$ d) L = 0

338. (A) It will be much easier to accelerate a merry- go-round full of children if they stand close to its axis then if they all stand at the outer edge.
(R) For larger moment of inertia, the angular acceleration is small for given torque.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

339. A particle is describing uniform circular motion. Its acceleration is:
a) along the radius of circular path pointing towards the centre
b) along the tangent to the circular path
c) along the radius of the circular path pointing away from the centre d) zero

340. The moment of inertia of a sphere is 20 kg-m^2 about the diameter. What is the moment of inertia about any tangent?

a) 25kg-m^2 b) 50kg-m^2 c) 70kg-m^2 d) 80kg-m^2

341. An object is kept on a smooth inclined plane of 1 in l. The horizontal acceleration to be imparted to the inclined plane so that the object is stationary relative to incline is:

a) $g\sqrt{l^2-1}$ b) $g\left(l^2-1\right)$ c) $\frac{g}{\sqrt{l^2-1}}$ d) $\frac{g}{l^2-1}$

342. (A) Mass of the projectile does not affect the maximum height.
(R) Heavier the body, greater is the force required to project it.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

343. A body is suspended from a smooth horizontal nail by a string of length 0.25 m. What minimum horizontal velocity should be given to it in the lowest position so that it may move in a complete vertical circle with the nail at the centre?
a) $\sqrt{12.25}ms^{-1}$ b) 4.9 ms^{-1} c) 7√2 ms^{-1} d) $\sqrt{9.8}$ ms^{-1}

344. A light string passing over a smooth light pulley connects two blocks of masses m_l and m_2 (vertically). If the acceleration of system is $\frac{g}{8}$, then the ratio of masses is :
a) 8: 1 b) 9 : 7 c) 4: 3 d) 5 : 3

345. A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle, the motion of the particle takes place in a plane. It follows that:
a) its velocity is constant b) its acceleration is constant c) its kinetic energy is constant
d) it moves in a straight line

346. A mass is supported on a frictionless horizontal surface. It is attached to a string and rotates about a fixed centre at an angular velocity coo. If the length of the string and angular velocity are doubled, the tension in the string which was initially To, is now:
a) T_0 b) $T_0/2$ c) $4T_0$ d) $8T_0$

347. Two bodies of different masses of 2 kg and 4 kg are moving with velocities 2 m/s and 10 m/s towards each other due to mutual gravitational attraction. What is the velocity of their centre of mass?
a) 5 m/s b) 6 m/s c) 8 m/s d) Zero

348. An object is placed on the surface of a smooth inclined plane of inclination 8. It takes time t to reach the bottom. If the same object is allowed to slide down a rough inclined plane of inclination 8, it takes time nt to reach the bottom where n is a number greater than 1. The coefficient of friction II is given by:

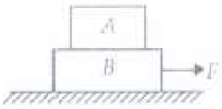
a) $\mu = tan\theta\left(1-\frac{1}{n^2}\right)$ b) $\mu = cot\theta\left(1-\frac{1}{n^2}\right)$ c) $\mu = tan\theta\sqrt{1-\frac{1}{n^2}}$ d) $\mu = cot\theta\sqrt{1-\frac{1}{n^2}}$

349. Assuming the gravity to be in negative Z-direction, a force $\vec{F} = \vec{v}x\vec{A}$ is exerted on a particle in addition to the force of gravity, where $\vec{v}$ is the velocity and $\vec{A}$ is a constant vector in positive X-direction. With what minimum speed a particle of mass m be projected so that it continues to

move un deflected with constant velocity?

a) $-\frac{A}{mg}\hat{j}$ b) $\frac{A}{mg}\hat{j}$ c) $-\frac{mg}{A}\hat{j}$ d) $\frac{mg}{A}\hat{j}$

350. In figure, the coefficient of friction between the floor and the block B is 0.1. The coefficient of friction between the blocks B and A is 0.2. The mass of A is m/2 and of B is m. What is the maximum horizontal force F which can be applied to the block B so that two blocks move together?



a) 0.15 mg b) 0.05 mg c) 0.1 mg d) 0.45 mg

351. (A) If earth shrinks to half its present size, length of the day would become 6 hours.
(R) As the size of the earth changes, its moment of inertia changes.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

352. The minimum force required to start pushing a body up a rough (frictional coefficient μ) inclined plane is F_1 while the minimum force needed to prevent it from sliding down is F_2. If the inclined plane makes an angle θ with the horizontal such that tanθ =2μ, then the ratio $\frac{F_1}{F_2}$ is

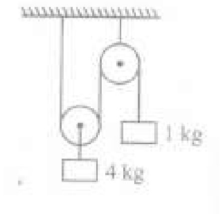
a) 4 b) 1 c) 2 d) 3

353. Two blocks of masses 5 kg and 2 kg are placed on frictionless surface and connected by a spring. An external kick gives a velocity of 14 mlsec to the heavier block in the direction of lighter one. The velocity gained by the centre of mass is:
a) $14ms^{-1}$ b) $7ms^{-1}$ c) $12ms^{-1}$ d) $10ms^{-1}$

354. The tangential component of acceleration of a particle in circular motion is due to:
a) speed of the particle b) change in the direction of velocity
c) change in the magnitude of velocity d) rate of change of acceleration

355. (A) The spokes near the top of a rolling bicycle wheel are more blurred than those near the bottom of the wheeL
(R) The spokes near the top of wheel are moving faster than those near the bottom of the wheel
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion isfalse but reason is true.

356. In the system shown in the figure, the acceleration of 1 kg mass is



a) $\frac{g}{4}$ downwards b) $\frac{g}{2}$ downwards c) $\frac{g}{2}$ upwards d) $\frac{g}{4}$ upwards

357. A rocket of mass 6000 kg is set for vertical firing. If the exhaust speed be 1 km/s, how much gas must be ejected to give the rocket an upward acceleration of 20 m s^{-2}? (Take g = 10 ms^{-2})
a) 45 kg/s b) 90 kh/s c) 120 kg/s d) 180 kg/s

358. A circular disc is rolling on a horizontal plane. Its total kinetic energy is 150 J. What is its translational KE?
a) 200 J b) 100 J c) 125 J d) None of these

359. An 80 kg person is parachuting and is experiencing a downward acceleration of 2.8 m/s'. The mass of the parachute is 5 kg. The upward force on the open parachute is (Take g = 9.8 m/s^2)
a) 595 N b) 675 N c) 456 N d) 925 N

360. (A) Rate of change of linear momentum is equal to external force.
(R) There is always equal and opposite reaction to every action.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

361. Moment of couple is called :
a) angular momentum b) force c) torque d) impulse

362. A particle is moving on a circular path of 10 m radius. At any instant of time, its speed is 5 m s^{-1} and the speed is increasing at a rate of 2 m s^{-2}. The magnitude of net acceleration at this instant is
a) 5 m s^{-2} b) 2 m s^{-2} c) 3.2 m s^{-2} d) 4.3 m s^{-2}

363. An athlete throws a discus from rest to a final angular velocity of 15 rad S^{-1} in 0.270 s before releasing it. During acceleration, discus moves a circular arc of radius 0.810 m. Acceleration of discus before it is released is
a) 45 m s^{-2} b) 182 m s^{-2} c) 187 m s^{-2} d) 192 m s^{-2}

364. Inertia is that property of a body by virtue of which the body is
a) unable to change by itself the state of rest
b) unable to change by itself the state of uniform motion
c) unable to change by itself the direction of motion.
d) unable to change by itself the state of rest or of uniform motion

365. A stone of mass 5 kg is tied to a string of length 10 m is whirled round in a horizontal circle. What is the maximum speed with which the stone can be whirled around if the string can withstand a maximum tension of 200 N?
a) 10 m S^{-1} b) 15 m S^{-1} c) 20 m S^{-1} d) 25 m S^{-1}

366. Assertion: No real body is truly rigid.
Reason : A rigid body is a body with a perfectly definite and unchanging shape.The distances between different pairs of particles of such a body do not change
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

367. Four particles each of mass I kg are placed at the comers of a square of side 1 min X -Y plane.If the point of intersection of the diagonals of the square is taken as origin, the co-ordinates ofthe centre of mass are:
a) (1,1) b) (-1,1) c) (1,-1) d) (0,0)

368. A grindstone has a moment of inertia of 6 kg m2. A constant torque is applied and the grindstone is found to have a speed of 150 rpm, 10 seconds after starting from rest. The torque is :
a) 3π N m b) 3 N m c) $\frac{\pi}{3}$ N m d) 4π N m

369. Assertion: If external force on a body is zero, its acceleration is zero.
Reason: This is the simple form of Newton's second law of motion.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

370. A block moves down a smooth inclined plane of inclination θ. Its velocity on reaching the bottom is v. If it slides down a rough inclined plane of same inclination, its velocity on reaching the bottom is v/n, .where n is a number greater than zero. The coefficient of friction II is given by

a) $\mu = tan\theta\left(1 - \frac{1}{n^2}\right)$ b) $\mu = cot\theta\left(1 - \frac{1}{n^2}\right)$ c) $\mu = tan\theta\sqrt{1 - \frac{1}{n^2}}$ d) $\mu = cot\theta\sqrt{1 - \frac{1}{n^2}}$

371. A solid sphere of mass 2 kg rolls on a smooth horizontal surface at 10 m/s. It then rolls up a smooth inclined plane of inclination 30° with the horizontal. The height attained by the sphere before it stops, is:
a) 1.7 m b) 4.5 m c) 5.4 m d) 7.1 m

372. Which statement is wrong?
a) If a body is rotating around a circle with constant speed, its velocity is accelerating.
b) Force is conserved. c) Kirchhoff's law obeys conservation of charge.
d) When electron falls on lower orbit from higher orbit, energy is released.

373. The moment of inertia of a solid sphere about an axis passing through centre of gravity is $\frac{1}{5}MR^2$; then its radius of gyration about a parallel axis at a distance 2R from first axis is:
a) 5R b) $\sqrt{22/5}R$ c) $\frac{5}{2}R$ d) $\sqrt{12/5}R$

374. A wheel has radius 10 cm and it is coupled by a belt to another wheel of radius 30 em, The smaller wheel increases its speed from rest at a uniform rate of π: rad/ sec^2. After how much time will the speed of larger wheel become 100 rpm?

a) 2 s b) 5 s c) 10 s d) 20 s

375. A person of mass 60 kg is inside a lift of mass 940 kg and presses the button on control panel. The lift starts moving upwards with an acceleration $1.0 m/s^2$, If g $=10 m/s^{-2}$ the tension in the supporting cable is ________

a) 8600N b) 9680N c) 11000N d) 1200N

376. A rope of length 8 m and linear density 0.5 kg/m is lying lengthwise on a horizontal smooth floor. It is pulled by a force of 12 N. The tension at the mid-point would be :

a) 12 N b) 8 N c) 6 N d) 4 N

377. A heavy uniform chain lies on horizontal table top. If the coefficient of friction between the chain and the table stnface is 0.25, then the maximum friction of the length of the chain that can hang over one edge of the table is __________

a) 20% b) 25% c) 15% d) 35%

378. Two masses 2 kg and 3 kg are attached to the ends of the string passed over a pulley fixed at the top. The tension and acceleration in the string in terms of 'g' are:

a) $\left(\frac{7g}{8}, \frac{g}{8}\right)$ b) $\left(\frac{21g}{8}, \frac{g}{8}\right)$ c) $\left(\frac{21g}{8}, \frac{g}{5}\right)$ d) $\left(\frac{12g}{8}, \frac{g}{5}\right)$

379. Two thin uniform circular rings each of radius 10 em and mass 0.1 kg are arranged such that they have common centre and their planes are perpendicular to each other. The moment of inertia of this system about an axis passing through common centre and perpendicular to the plane of either of the rings (in kg-m^2) is:

a) 1.5×10^{-3} b) 5×10^{-3} c) 15×10^{-4} d) 18×10^{-4}

380. A gun of mass 10 kg fires 4 bullets per second. The mass of each bullet is 20 kg and the velocity of the bullet when it leaves the gun is 300 m s^{-1} .The force required to hold the gun when firing is:

a) 6 N b) 8 N c) 24 N d) 240 N

381. (A) In uniform circular motion, magnitude of acceleration is v^2/R and direction is always towards the centre.

(R) In uniform circular motion, acceleration is constant.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

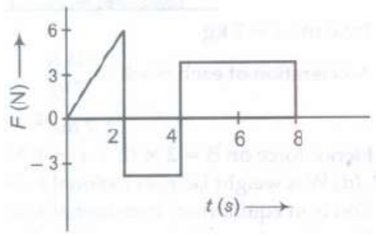
c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

382. If vector $\vec{F}$ be a force acting on a particle having the position vector $\vec{r}$ and $\vec{\tau}$ be the torque of this force about the origin, then:

a) $\vec{r}.\vec{\tau} = 0 \; and \; \vec{F}.\vec{\tau} = 0$ b) $\vec{r}.\vec{\tau} = 0 \; and \; \vec{F}.\vec{\tau} \neq 0$ c) $\vec{r}.\vec{\tau} \neq 0 \; and \; \vec{F}.\vec{\tau} \neq 0$ d) $\vec{r}.\vec{\tau} \neq 0 \; and \; \vec{F}.\vec{\tau} \; 0$

383. The force 'F' acting on a particle of mass 'm' is indicated by the force-time graph shown below. The change in momentum of the particle over the time interval from zero to 8 s is :



a) 12 Ns b) 6 Ns c) 24 Ns d) 20 Ns

384. A homogeneous chain of length L lies on a table. The coefficient of friction between the chain and the table is u. The maximum length which can hang over the table in equilibrium is:

a) $\left(\frac{\mu}{\mu+1}\right)L$ b) $\left(\frac{1-\mu}{\mu}\right)L$ c) $\left(\frac{1-\mu}{1+\mu}\right)L$ d) $\left(\frac{2\mu}{\mu+1}\right)L$

385. (A) If the ice on the polar caps of the earth melts, then length of day will increase.
(R) Moment of inertia of earth increases as ice on polar caps melts.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If assertion is true but reason is false.
e) If assertion is false but reason is true.

386. (A) The sum of squares of cosines of angle made by a vector with X, Y and Z axes is equal to unity.
(R) A vector makes 45° from X-axis have equal components along X and Y-axes.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

387. The direction of motion of body with the horizontal at this instant is:
a) $\tan^{-1}(2)$ b) $\tan^{-1}(1/2)$ c) 45° d) 0°

388. Torque applied on a particle is zero, then its angular momentum will be:
a) equal in direction b) equal in magnitude c) both (a) and (b) d) neither (a) nor (b)

389. The outer rail of the curved railway track is raised above the inner one:
a) to provide centripetal force b) to overcome the frictional force c) to balance the gravity
d) for some reason other than those mentioned above

390. A bird is sitting in a large closed cage which is placed on a spring balance. It records a weight placed on a spring balance. It records a weight of 25 N. he bird (mass = 0.5 kg) flies upward in the cage with an acceleration of $2 m/s^2$.The spring balance will now record a weight of:
a) 24 N b) 25 N c) 26 N d) 27 N

391. Which of the following statements about the centripetal and centrifugal forces is correct?
a) Centripetal force balances the centrifugal force.
b) Both centripetal force and centrifugal force act on the same body.

c) Centripetal force is directed opposite to the centrifugal force.
d)
Centripetal force is experienced by the observer at the centre of the circular path described by the body.

392. (A) The relative angular velocity between any two points of a rigid body is zero at any instant.
(R) There is no relative velocity between the points of a rigid body.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion isfalse but reason is true.

393. If the length of the second's hand in a stop-clock is 3 em, the angular velocity and linear velocity of the tip is:
a) 0.2047 $rads^{-1}$,0.0314ms^{-1} b) 0.2547 $rads^{-1}$,0.314ms^{-1} c) 0.1472 $rads^{-1}$,0.06314ms^{-1}
d) 0.1047 $rads^{-1}$,0.00314ms^{-1}

394. Ball bearings are used to:
a) convert static to dynamic friction b) convert limiting friction to dynamic friction
c) convert sliding friction to rolling friction d) convert rolling friction to fluid friction

395. Two particles starting from a point on a circle of radius 4 m in horizontal plane move along the circle with constant speeds of 4 ms^{-1} and 6 ms^{-1} respectively in opposite directions. The particles will collide with each other after a time of:
a) 3.0 s b) 2.5 s c) 2.0 s d) 1.5 s e) 3.5 s

396. A motor cyclist rides around the well with a round vertical wall and does not fall down while riding because
a) the force of gravity disappears b) he loses weight some how.
c) he is kept in this path due to the force exerted by surrounding air.
d) the frictional force of the wall balances his weight.

397. Angular momentum L and rotational kinetic energy K_R of a rigid body are related to each other by the relation. (I = moment of inertia)
a) K_R =2IL b) $K_R = \frac{L^2}{2I}$ c) $K_R = \frac{2I}{L}$ d) $K_R \frac{L^2}{I}$

398. When a sphere of moment of inertia 1 about an axis through its centre of mass and of mass M rolls from rest down an inclined plane without slipping, its KE is:
a) $\frac{1}{2}I\omega^2$ b) $\frac{1}{2}Mv^2$ c) $I\omega + Mv$ d) $\frac{1}{2}I\omega^2 + \frac{1}{2}Mv^2$

399. An electric fan is placed on a stationary boat and air is blown with it on the sail of the boat. Which of the following statements is correct?
a) The boat will remain stationary as before.
b) The boat will be uniformly accelerated in the direction of the flow of the air.
c) The boat will start moving with uniform speed.
d) The boat will be uniformly accelerated opposite to the direction of flow of air.

400. A uniform metal chain is placed on a rough table such that one end of it hangs down over the edge of the table. When one-third of its length hangs over the edge, the chain starts sliding. Then, the coefficient of static friction is:

a) $\frac{3}{4}$ b) $\frac{1}{4}$ c) $\frac{1}{4}$ d) $\frac{1}{2}$

401. (A) A ring and a disc of same mass and radius begin to roll without slipping from the top of and inclined surface at t =(1 The ring reaches the bottom of incline at time t_1 while the disc reaches the bottom at time t_2, then $t_1 > t_2$

(R) Disc will roll down the plane with a large acceleration because of its smaller moment of inertia.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion isfalse but reason is true.

402. (A) Pseudo force is an imaginary force which is recognized only by a non-inertial observer to explain the physical situation according to Newton's laws.

(R) Pseudo force has no physical origin, that is it is not caused by one of the basic interactions in nature. It does not exist in the action- reaction pair.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true

403. (A) A solid sphere is rolling on a rough horizontal surface. Tangential acceleration of contact point is zero.

(R) For contact point, tangential acceleration is given by at = $a_{cm} - \alpha R = 0$,

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If assertion is true but reason is false.

e) If assertion is false but reason is true.

404. (A) Moment of inertia of a rigid body is a tensor quantity.

(R) Moment of inertia of a body always occurs due to tensile effects produced in the body.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

405. A particle of mass m is revolving in a horizontal circle of radius r with constant angular speed ω. The areal velocity of the particle is:

a) $r^2\omega$ b) $r^2\theta$ c) $\frac{r^2\omega}{2}$ d) $\frac{r\omega^2}{2}$

406. If a block moving up at θ=30° with a velocity 5m/s, stops after 0.5sec, then μ is

a) 0.5 b) 1.25 c) 0.6 d) none of the above

407. A truck is moving on a frictionless surface with uniform velocity of 10 m/s. A leak occurs in the water tank of the truck at the rate of 2 kg/so What is the speed of truck after 50 s, if the mass of the truck is 100 kg and mass of water in the truck initially was 100 kg?
a) 20 m/s b) 10 m/s c) 5 m/s d) None of these

408. (A) The work done, in bringing a body down from the top to the base along a frictionless inclined plane, is the same as the work done in bringing it down the vertical circle.
(R) The gravitational force on the body along the inclined plane is the same as that along the vertical circle.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

409. A man weighing 60 kg is standing on a trolley weighing 240 kg. The trolley is resting on frictionless horizontal rails. If the man starts walking on the trolley along the rails at speed 1 m/s, then after 4 seconds, his displacement relative to the ground will be:
a) 6 m b) 4.8 m c) 3.2 m d) 2.4 m

410. The string of a pendulum of length I is displaced through 90° from the vertical and released. Then, the minimum strength of the string in order to withstand the tension as the pendulum passes through the mean position is:
a) mg b) 3mg c) 5mg d) 6mg

411. (A) Inertia and moment of inertia are same quantities.
(R) Moment of inertia represent the capacity of a rigid body to oppose its state of translatory motion.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

412. The force $7\hat{i} - 3\hat{j} - 5\hat{k}$ acts on a particle whose position vector is $\hat{i} - \hat{j} + \hat{k}$ What is the torque of a given force about the origin?
a) $2\hat{i} + 12\hat{j} + 10\hat{k}$ b) $2\hat{i} + 10\hat{j} + 12\hat{k}$ c) $2\hat{i} + 10\hat{j} + 10\hat{k}$ d) $10\hat{i} + 2\hat{j} + \hat{k}$

413. A ball is projected from the ground at a speed of 10 ms-I making an angle of 30° with the horizontal. Another ball is simultaneously released from a point on the vertical line along the maximum height of the projectile. The initial height of the second ball is: (Take g = $10ms^{-2}$)
a) 6.25 m b) 2.50 m c) 3.75 m d) 5 m

414. An electric fan has blades oflength 30 cm as measured from the axis of rotation. If the fan is rotating at 1200 rpm, the acceleration of a point on the tip of a blade is about:
a) 4740 m/sec/^{2} b) 5055 m/sec^2 c) 1600 m/sec^2 d) 2370 m/sec^2

415. A body is just being revolved in a vertical circle of radius R with a uniform speed. The string breaks when the body is at the highest point. The horizontal distance covered by the body after the string breaks is:

a) 2 R b) R c) R√2 d) 4 R

416. Frictional force increases when surfaces in contact are made very-very smooth. This is because :

a) of molecular forces b) of decrease in surface area c) of decrease in irregularities

d) increase in area

417. (A) Pulling a lawn roller is easier than pushing it.

(R) Pushing increases the apparent weight and hence friction.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

418. A hoop of radius 2 m weighs 100 kg. It rolls along a horizontal floor so that its centre of mass has a speed of 20 cm s^{-1}. How much work has to be done to stop it?

a) 2 J b) 4 J c) 6 J d) 8 J

419. pendulum of length l= 1m is released from 80 = 60° . The rate of change of speed of the bob at θ = 30° is: (g = 10 m/s^2)

a) $5\sqrt{5}$ m/s^2 b) 5 m/s^2 c) 10 m/s^2 d) 2.5 m/s^2

420. (A) If polar ice cap melts, the day will be shortened.

(R) Angular momentum of earth about its own rotation axis is conserved

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

421. A 60 kg man stands on a spring scale in the lift. At some instant he finds, scale reading has changed from 60 kg to 50 kg for a while and then comes back to the original mark. What should we conclude?

a) The lift was in constant motion upwards. b) The lift was in constant motion downwards

c) The lift while in constant motion upwards, is stopped suddenly.

d) The lift while in constant motion downwards, is suddenly stopped

422. Vehicle of mass 1500 kg is moving along a curved path of length 314 m with a speed of 20 ms^{-1} Ifit takes a turn of 90°, the centripetal force needed by the vehicle is:

a) 1000 N b) 2000 N c) 3000 N d) 4000 N

423. Which one of the following can also act as a lubricant in the machines?

a) Iron fillings b) Polish on machines c) Flow of water through the machine

d) Flow of compressed and purified air.

424. (A) As the frictional force increases, the safe velocity limit for taking a turn on an unbanked road also increases.

(R) Banking of roads will increase the value of limiting velocity.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

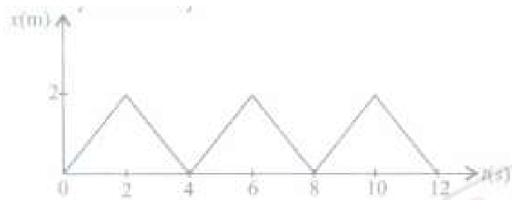
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

425. A body is moving up an inclined plane of angle θ with an initial kinetic energy E. The coefficient of friction between the plane and the body is μ The work done against friction before the body comes to rest is:

a) $\frac{\mu cos\theta}{Ecos\theta+sin\theta}$ b) μEcosθ c) $\frac{\mu Ecos\theta}{\mu cos\theta-sin\theta}$ d) $\frac{\mu Ecos\theta}{\mu cos\theta+sin\theta}$

426. A ball rolls-off the top of stairway with a horizontal velocity of magnitude 1.8 m/s. The steps are 0.20 m high and 0.20 m wide. Which step will the ball hit first?
a) First b) Second c) Third d) Fourth

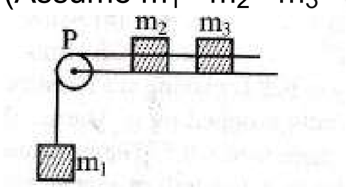
427. Figure shows the position-time (x-t) graph of one dimensional motion of a body of mass 500 g. What is the time interval between two consecutive impulses received by the body?



a) 2 s b) 4 s c) 6 s d) 8 s

428. A tube of length L is filled completely with an incompressible liquid of mass M and closed at both the ends. The tube is then rotated in a horizontal plane about one of its ends with a uniform angular velocity ω. The force exerted by the liquid at the other end is:
a) $M\omega^2L$ b) $\frac{1}{2}M\omega^2L$ c) $2M\omega^2L$ d) none of these

429. A system consists of three masses m_1, m_2 and m_3 connected by a string passing over a pulley p. The mass m_1 hangs freely and m_2 and m_3 are on a rough horizontal table (the coefficient of friction : m. The pulley is frictionless and of negligible mass. The downward acceleration of mass m_1 is ___________
(Assume m_1= m_2= m_3 = m)



a) $\frac{g(1-g\mu)}{g}$ b) $\frac{2g\mu}{3}$ c) $\frac{g(1-2\mu)}{3}$ d) $\frac{g(1-2\mu)}{2}$

430. The average acceleration vector (taken over a full circle) for a particle having a uniform circular motion is:

a) a constant vector of magnitude $\frac{v^2}{r}$ b) a null vector

c) a vector of magnitude $\frac{v^2}{r}$ directed normal to the plane of the given uniform circular motion

d) equal to the instantaneous acceleration vector

431. A body takes $1\frac{1}{3}$ times as much time to slide down a rough inclined plane as it takes to slide down an identical but smooth inclined plane. If the angle of inclined plane is 45°, the coefficient of friction is:

a) $\frac{7}{16}$ b) $\frac{9}{16}$ c) $\frac{7}{9}$ d) $\frac{3}{4}$

432. Two rotating bodies A and B of masses m and 2m with moments of inertia I_A and I_B ($I_B > I_A$) have equal kinetic energy. of rotation. If L_A and L_B be their angular momenta respectively, then :

a) $L_A > L_B$ b) $L_A = \frac{L_B}{2}$ c) $L_A = 2L_B$ d) $L_B > L_A$

433. A car is moving with a speed of 10 ms $^{-1}$ on a concave road of radius 100 m. If the mass of the car is 700 kg, then the reaction on the car tyres when it is at the lowest position will be:

a) 4560 N b) 5560 N c) 6560 N d) 7560 N

434. A body of mass m slides down a rough plane of inclination α if μ is the coefficient offriction, then acceleration of the body will be:

a) g sin α b) μ cos a c) g (sin α - μ cos α) d) g (cos α - μ sin α)

435. (A) When a particle is thrown obliquely from the surface of the earth, it always moves in a parabolic path, provided the air drag is negligible.

(R) A projectile motion is a three dimensional motion.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

436. Two bodies of equal masses revolve in circular orbits of radii R_1 and R_2 with the same period. Their centripetal forces are in the ratio:

a) $\left(\frac{R_2}{R_1}\right)^2$ b) $\frac{R_1}{R_2}$ c) $\left(\frac{R_1}{R_2}\right)^2$ d) $\sqrt{R_1R_2}$

437. (A) The trajectory of projectile in XY -plane is quadratic in x and linear in y if x is horizontal.

(R) j-coordinate of trajectory is independent of x-coordinate.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

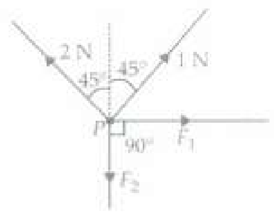
c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

438. A circular disc A of radius r is made from an iron plate of thickness 1 and another circular disc B of radius 4r and thickness 1/4. The relation between moments of inertia I_A and I_B is:

a) $I_A > I_B$ b) $I_A = I_B$ c) $I_A < I_B$ d) depends on the actual values of 1 and r

439. There are four forces acting at a point P produced by strings as shown in figure, which is at rest. The forces F_1 and F_2 are



a) $\frac{1}{\sqrt{2}}N, \frac{3}{\sqrt{2}}N$ b) $\frac{3}{\sqrt{2}}N, \frac{1}{\sqrt{2}}N$ c) $\frac{1}{\sqrt{2}}N, \frac{1}{\sqrt{2}}N$ d) $\frac{3}{\sqrt{2}}N, \frac{3}{\sqrt{2}}N$

440. The resultant of two forces, one double the other in magnitude, is perpendicular to the smaller of the two forces. The angle between the two forces is:
a) 60° b) 120° c) 150^0 d) 90°

441. A monkey climbs up and another monkey climbs down a rope hanging from a tree with same uniform acceleration separately. If the respective masses of monkeys are in the ratio 2 : 3, the common acceleration must be:
a) g/5 b) 6g c) g/2 d) g e) g/3

442. (A) On an un banked road, as the frictional force increases, the safe velocity limit for taking a turn also increases.
(R) Banking of roads will increase the value of limiting velocity.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

443. A mass of 1 kg is suspended by a thread. It is
1. Lifted up with an acceleration 4.9 m/s^2,
2. lowered with an acceleration 4.9 m/s^2.
The ratio of the tensions is ___________
a) 3:1 b) 1:3 c) 1:2 d) 2:1

444. (A) When a body dropped from a height, explodes in mid-air, its centre of mass keeps moving in vertically downward direction.
(R) Explosion occur under internal forces only.
a) If assertion is true but reason is false. b) If both assertion and reason are false.
c) If assertion is false but reason is true.
d) If both assertion and reason are true and reason is the correct explanation of assertion.
e)
If both assertion and reason are true but reason is not the correct explanation of assertion.

445. A block has been placed on an inclined plane with the slope angle θ, block slides down the plane at constant speed. The coeflicient of kinetic friction is equal to ___________
a) sin θ b) cos θ c) g d) tan θ

446. The potential energy at the equilibrium position is, the equilibrium is :
a) unstable b) stable c) neutral d) none of these

447. A wheel of mass 5 kg and radius 0.40 m is rolling on a road without sliding with angular velocity 10 rad s^{-1}. The moment of inertia of the wheel about the axis of rotation is 0.65 kg m^2
The percentage of kinetic energy of rotation in the total kinetic energy of the wheel is
a) 22.4 % b) 11.2 % c) 88.8 % d) 44.8 %

448. (A) A solid sphere and ring of same mass and radius are released simultaneously from the top of an inclined surface. The two objects roll down the plane without slipping. They reach the bottom of the incline with equal linear speeds.
(R) Loss of potential energy for both is the different.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If assertion is true but reason is false.

e) If assertion isfalse but reason is true.

449. Point masses 1, 2, 3 and 4 kg are lying at the points (0, 0, 0), (2, 0, 0), (0, 3, 0) and (-2, - 2, 0) respectively. The moment of inertia of this system about x-axis will be:

a) 43 kg-m^2 b) 34 kg-m^2 c) 27 kg-m^2 d) 72 kg-m^2

450. A car of mass m starts from rest and acquires a velocity along east $\vec{v} = v\hat{i}$ (v > 0) in two seconds. Assuming the car moves with uniform acceleration, the force exerted on the car is

a) $\frac{mv}{2}$ eastward and is exerted by the car engine

b) $\frac{mv}{2}$ eastward and is due to the friction on the tyres exerted by the road.

c) more than $\frac{mv}{2}$ eastward exerted due to the engine and overcomes the friction of the road.

d) $\frac{mv}{2}$ exerted by the engine.

Ravi Maths Tuition Centre

Time : 1 Mins **WORK POWER ENERGY 1 1** **Marks : 1468**

1. A body x with a momentum p collides with another identical stationary body y one dimensionally. During the collision y gives an impulse J to body x. Then coefficient of restitution is:

   a) $\frac{2J}{p} - 1$ b) $\frac{J}{p} + 1$ c) $\frac{J}{p} - 1$ d) $\frac{J}{2p} - 1$

2. A radioactive nucleus initially at rest decays by emitting an electron and neutron at right angles to one another. The momentum of the electron is 3.2 x 10^{-23} kg-m/sec and that of the neutron is 6.4 x 10^{-23} kg-m/sec. The direction of the recoiling nucleus with that of the electron motion is:

   a) $\tan^{-1}(0.5)$ b) $\tan^{-1}(2)$ c) $\pi - tan^{-1}(2)$ d) $\frac{\pi}{2} + tan^{-1}(2)$

3. A block of mass l0 kg moving in x -direction with a constant speed of 10 ms^{-l}, is subject to a retarding force F- 0.1 x J/m during its travel from x = 20 m to 30 m. Its final KE will be __________

   a) 450J b) 275J c) 250J d) 475J

4. In question number 4, if the collision between the block and the incline is completely elastic, then the vertical (upward) component of the velocity of the block at point B, immediately after it strikes the second incline is

   a) $\sqrt{30}$ m/s b) $\sqrt{15}$ m/s c) 0 d) -$\sqrt{15}$ m/s

5. A simple pendulum of length 1m has a wooden bob of mass 1 kg. It is struck by a bullet of mass 10^{-2} kg moving with a speed of 2 x 10^{2} m S^{-1}. The height to which the bob rises before swinging back is
   (Takeg = 10 m S^{-2})

   a) 0.2m b) 0.6m c) 8m d) 1m

6. The potential difference that must be applied to stop the fastest photoelectrons emitted by a nickel surface, having work function 5.01 eV, when ultraviolet light of 200 nm falls on it, must be__________

   a) 24V b) -1.2V c) -2.4V d) 1.2V

7. Light of frequency 1.5 times the threshold frequency is incident on a photo sensitive material. What will be the photoelectric current if the frequency is halved the intensify is doubled

   ____

   a) 0 b) doubled c) four times d) one fourth

8. If the mornentum of electron is changed by P, then the de- Broglie wavelength associated with it changes by 0.5%. The initial momentum of electron will be ___________
a) 200P b) 400P c) $\frac{P}{200}$ d) 100P

9. Two masses of 1 g and 9 g are moving with equal kinetic energies. The ratio of the magnitudes of their respective linear momenta is:
a) 1 : 9 b) 9 : 1 c) 1 : 3 d) 3 : 1

10. A tank of 2 x 2 x 3 is to be filled with water from a well of average depth 10 m. The work done will be:
a) 1176 x 10^3 J b) 1276 x 10^3 J c) 1476 x 10^3 J d) 1576 x 10^3 J

11. A ball is dropped from a height h. If the coefficient of restitution be e, then the body rebounds to a height of:
a) eh b) e^2h c) e^3h d) e^4h

12. The upper half of an inclined plane of inclination θ is perfectly smooth while lower half is rough. A block starting from rest at the top of the plane will again come to rest at the bottom, if the coefficient of friction between the block and lower half of the plane is given by:
a) $\mu = \frac{2}{tan\theta}$ b) $\mu = 2tan\theta$ c) $\mu = tan\theta$ d) $\mu = \frac{1}{tan\theta}$

13. block of mass 4 kg is placed on a rough horizontal plane. A time dependent force F=kf^2 acts on the block, where k =2 N/s^2. Force of friction between block and the plane at t = 2 see is:
a) 8 N b) 4 N c) 2 N d) 1 N

14. In two separate collisions, the coefficients of restitutions 'e_1' and 'e_2' are in the ratio 3: 1. In the first collision the relative velocity of approach is twice the relative velocity of separation. Then the ratio between the relative velocity of approach and relative velocity of separation in the second collision is:
a) 1:6 b) 2:3 c) 3:2 d) 6:1

15. A body of mass m moving with velocity v makes a head-on collision with another body of mass 2 m which is initially at rest. The loss of kinetic energy of the colliding body (mass m) is: (in kJ)
a) $\frac{1}{2}$ of its initial KE b) $\frac{1}{9}$ of its initial KE c) $\frac{8}{9}$ of its initial KE d) $\frac{1}{4}$ of its initial KE

16. A ball is dropped from height 20 m. If coefficient of restitution is 0.9, what will be the height attained after first bounce?
a) 1.62 m b) 16.2 m c) 18 m d) 14 m

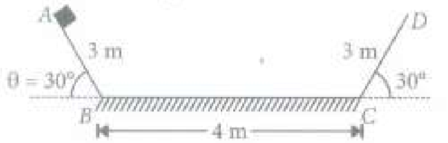
17. The kinetic energy K of a particle moving in a straight line depends upon the distance s as; K = as^2. The force acting on the particle is:
a) 2as b) 2mas c) 2a d) $\sqrt{a^2}$

18. The bob of a pendulum is released from a horizontal position. If the length of pendulum is 2 m, what is the speed with which the bob arrives at the lower most point. Assume that 10% of its energy is dissipated against air resistance.
(Take g = 10 m S^{-2})
a) 4 ms^{-1} b) 6 ms^{-1} c) 8 ms^{-1} d) 10 ms^{-1}

19. A cricket ball of mass 150 g moving with a speed of 126 km/h hits at the middle of the bat, held firmly at its position by the batsman. The ball moves straight back to the bowler after hitting the bat. Assuming that collision between ball and bat is completely elastic and the two remain in contact for 0.001 s, the force that the batsman had to apply to hold the bat firmly at its place would be :
a) 10.5 N b) 21 N c) 1.05 x 10^4 N d) 2.1 x 10^4 N
20. An adult weighing 600 N raises the centre of gravity of his body by 0.25 m while taking each step of . 1m length in jogging. Ifhe jogs for 6 km, the energy . utilised by him in jogging assuming that there is no energy loss due to friction of ground and air. Assuming that the body of the adult is capable of converting 10% of energy intake in the form of food, calculate the energy equivalents of food that would be required to compensate energy utilized for jogging.
a) 3 x 10^6 J and 9 x 10^6 J b) 9 x 10^5 J and 9 x 10^6 J c) 4 x 10^5 J and 9 x 10^6 J
d) 6 x 10^4 J and 3 x 10^6 J
21. A constant power P is applied to a particle of mass m. The distance travelled by the particle when its velocity increases from v_1 to v_2 is: (neglect friction)
a) $\frac{3P}{m}\left(v_2^2-v_1^2\right)$ b) $\frac{m}{3P}\left(v_2-v_1\right)$ c) $\frac{3P}{m}\left(v_2^3-v_1^3\right)$ d) $\frac{m}{3P}\left(v_2^2-v_1^2\right)$
22. A 1.5 kg block is initially at rest on a horizontal frictionless surface when a horizontal force in the positive direction of x-axis is applied to the block. The force is given by:
$\vec{F}=\left(4-x^2\right)\hat{i}$, where x is in metre and the initial position of the block is x = 0 The maximum kinetic energy of the block between x = 0 and x = 2. 0m is
a) 2.33 J b) 8.67 J c) 5.33 J d) 6.67 J
23. A body is allowed to fall on the ground from a height hi. If it is to rebound to a height h_2, then the coefficient of restitution is:
a) $\frac{h_2}{h_1}$ b) $\sqrt{\frac{h_2}{h_1}}$ c) $\frac{h_1}{h_2}$ d) $\sqrt{\frac{h_1}{h_2}}$
24. Work done by the conservative force on a system is equal to:
a) the change in kinetic energy of the system
b) the change in potential energy of the system
c) the change in total mechanical energy of the system d) none of the above
25. The slope of the kinetic energy versus position vector gives the rate of change of:
a) work b) velocity c) force d) power e) momentum
26. An explosion blows a rock into three parts. Two parts go off at right angles to each other. These two are, 1 kg fiist part moving with a velocity of 12 ms 1 and 2 kg/second part moving with a velocity of g ms^{-1}. If the third part flies off with a velocity of 4 ms^{-1}, its mass would be ________
a) 7kg b) 17kg c) 3kg d) 5kg
27. A ball which is at rest is dropped from a height h metre. As it bounces off the floor its speed is 80% of what it was just before touching the ground. The ball will then rise to nearly a height:
a) 0.94h b) 0.80h c) 0.75h d) 0.64h

28. A metre scale of mass 100 kg is pivoted at one end. It is held at 30° with the horizontal. What is the potential energy associated with it?
a) 0.10J b) 0.15J c) 0.20J d) 0.25J
29. A cannon of mass 2m located at the base of an inclined plane shoots a shell of mass m in horizontal direction with velocity v_0. The angle of inclination of plane is 45° and the coefficient of friction between the cannon and the plane is 0.5. The height to which cannon ascends the plane as a result of recoil is:
a) $\frac{v_0^2}{2g}$ b) $\frac{v_0^2}{12g}$ c) $\frac{v_0^2}{6g}$ d) $\frac{v_0^2}{g}$
30. A vertical spring with force constant k is fixed on a table. A ball ofmass m at a height h above the free upper end of the spring falls vertically on the spring so that the spring is compressed by a distance d. The net work done in the process is ____________
a) $mg(h+d)-\frac{1}{2}kd^2$ b) $mg(h-d)-\frac{1}{2}kd^2$ c) $mg(h-d)+\frac{1}{2}kd^2$ d) $mg(h+d)+\frac{1}{2}kd^2$
31. In the first ball of mass m moving with a velocity u collides head-on with the second ball of mass m at rest. If the coefficient of restitution is e, then the ratio of the velocities of the first and the second ball after the collision is, the ratio of the final and initial velocities of the first ball is:
a) $\frac{1-e}{1+e}$ b) $\frac{1+e}{1-e}$ c) $\frac{1+e}{2}$ d) $\frac{1-e}{2}$
32. For a moving particle (mass m, velocity v) having a momentum p, which one of the following correctly describes the kinetic energy of the particle
a) $\frac{p^2}{2m}$ b) $\frac{p}{2m}$ c) $\frac{v^2}{2m}$ d) $\frac{v}{2m}$
33. A bullet of mass 0.05 kg moving with a speed of 80 m s^{-1} enters a wooden block and is stopped after a distance of 0.40 m. The average resistive force exerted by the block on the bullet is:
a) 300 N b) 20 N c) 400 N d) 40 N
34. The work done by the man is
a) mgl b) mgh c) $\frac{1}{2}mgl$ d) mg(l- h)
35. A stone projected up with a velocity u reaches a maximum height h. When it is at a height of 3h/4 from the ground, the ratio of KE and PE at that point is:
a) 3 : 1 b) 1 : 1 c) 1 : 3 d) 1 : 2
36. A projectile is moving at 20 m s^{-1} at its highest point, where it breaks into equal parts due to an internal explosion. One part moves vertically up at 30 m s^{-1} with respect to the ground. Then the other part will move at:
a) 20 ms^{-1} b) $10\sqrt{31}\ ms^{-1}$ c) 50 ms^{-1} d) 30 ms^{-1}
37. A track has two inclined surface AB and DC each of length 3 m and angle of inclination of 30° with the horizontal and a central horizontal part of length 4 m as shown in figure. A block of mass 0.2 kg slides from rest from point A. The inclined surfaces are frictionless. If the

coefficient of friction between the block and the horizontal flat surface is 0.2, where will the block finally come to rest



a) 0.5 m away from point B b) 3.5 m away from point B c) 0.5 m away from point C
d) 1.5 m away from point C

38. A metal ball ofmass 2 kg moving with a velocity of 36 km/ h has a head on collision with a stationary ball of mass 3 kg. If after the collision, the two balls move together, the loss in kinetic energy due to collision is _________
a) 140J b) 100J c) 60J d) 40J

39. An electron of mass m with a velocity $v = v_0\hat{i}\left(v_0 > 0\right)$ enters an electric field $E = -E_0\hat{i}\left(E_0\right.$ = constant > 0) at t =0. If I_o is its de-Broglie wavelength initially, then its de- Broglie wavelength at time / is ______________

a) $\lambda_0 t$ b) $\lambda_0\left(1+\frac{eE_0}{mv_0}t\right)$ c) $\frac{\lambda_0}{\left(1+\frac{eE_0}{mv_0}t\right)}$ d) I_o

40. A spherical ball A of mass 4 kg, moving along a straight line strikes another spherical ball B of mass 1 kg at rest. After the collision, A and B move with velocities VI m S^{-1} and V^2 m S-I respectively making angles of 30° and 60° with respect to the original direction of motion of A.

The ratio $\frac{v_1}{v_2}$ will be

a) $\frac{\sqrt{3}}{4}$ b) $\frac{4}{\sqrt{3}}$ c) $\frac{1}{\sqrt{3}}$ d) $\sqrt{3}$

41. A block of mass 5 kg is resting on a smooth surface. At what angle a force of 20 N be acted on the body so that it will acquired a kinetic energy of 40 J after moving 4 m?
a) 30° b) 45° c) 60° d) 120°

42. 4 m^3 of water is to be pumped to a height of 20 m and forced into a reservoir at a pressure of 2 x 10^5 N/m ^{2}. The work done by the motor is: (external pressure = 10^5N/m^2)
a) 8 x 10^5 J b) 16 x 10^5 J c) 12 x 10^5 J d) 32 x 10^5 J

43. Ball I collides with another identical ball at rest. For what value of coefficient of restitution e, the velocity of second ball becomes two times that of I after collision?
a) $\frac{1}{3}$ b) $\frac{1}{2}$ c) $\frac{1}{4}$ d) $\frac{1}{6}$

44. A 2 kg block slides on a horizontal floor with a speed of 4 m/s. It strikes an uncompressed spring and compresses it till the block is motionless. The kinetic frictional force is 15 N and spring constant is 10,000 N/m. The spring compresses by:
a) 8.5 cm b) 5.5 cm c) 2.5 cm d) 11.0 cm

45. A bomb of mass 9 kg explodes into two pieces of masses 3 kg and 6 kg. The velocity of mass 3 kg is 16 m/s. The KE of mass 6 kg (in joule) is:
a) 96 b) 384 c) 192 d) 768

46. An engine pumps water continuously through a hose. Water leaves the hose with a velocity v and m is the mass per unit length of the water jet. What is the rate at which kinetic energy is imparted to water?

a) mv^2 b) $\frac{1}{2}mv^2$ c) $\frac{1}{2}m^2v^2$ d) $\frac{1}{2}mv^3$

47. A particle with total energy E is moving in a potential energy region U(x). Motion of the particle is restricted to the region when ___________

a) $U(x) > E$ b) $U(x) < E$ c) U(x) = 0 d) $U(x) \leq E$

48. A particle of mass 1 g moving with a velocity $\vec{v_1} = 3\hat{i} - 2\hat{j}\ \text{ms}^{-1}$ experiences a perfectly in elastic collision with another particle of mass 2 g and velocity $\vec{v_2} = 4\hat{j} - 6\hat{K}\ \text{ms}^{-1}$ The velocity of the particle is

a) 2.3 ms^{-1} b) 4.6 ms^{-1} c) 9.2 ms^{-1} d) 6 ms^{-1}

49. Which of the following statements is false?

a)
Area under force/displacement curve with prope ralgebraic sign represents work done by the force.

b)
Area under the P - V graph represents the work done in case of expansion or compression of a gas.

c) In a conservative field work is path independent.

d) Work does not depend on the frame of reference.

50. An engine pumps water continuously through a hole. If the speed with which water passes through the hole nozzle is v and k is the mass per unit length of the water jet as it leaves the nozzle, the rate at which kinetic energy is being imparted to the water is:

a) $\frac{1}{2}kv^2$ b) $\frac{1}{2}kv^3$ c) $\frac{v^2}{2k}$ d) $\frac{v^3}{2k}$

51. Fast neutrons can easily be slowed down by

a) the use oflead shield b) passing them through heavy water

c) elastic collision with heavy nucleus d) applying a strong electric field

52. Assertion: In a perfectly inelastic collision the kinetic energy is never conserved.

Reason: The objects get deformed and stick together in perfectly in elastic collision.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

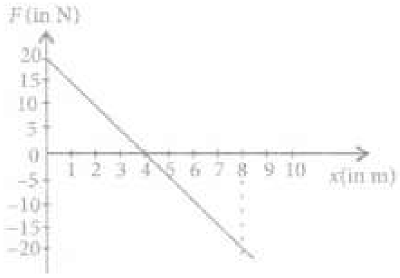
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

53. Two radiations of photons energies 1 eV and 2.5 eV, successively illuminate a photosensitive metallic surface of work function 0.5 eV. The ratio of the maximurn speeds of the emitted electrons is ____________

a) 1:4 b) 1:1 c) 1:2 d) 1:5

54. A force F acting on an object varies with distance x as shown in the figure.



The work done by the force in moving the object from x = 0 to x = 8 m is

a) zero J b) 80 J c) -40 J d) 40 J

55. For a system to follow the law of conservation of linear momentum during a collision, the condition is:

(i) total external force acting on the system is zero.

(ii) total external force acting on the system is finite and time of collision is negligible.

(iii) total internal force acting on the system is zero.

a) (i) only b) (ii) only c) (iii) only d) (i) or (ii)

56. If a porter with a suitcase on his head moves up a staircase, work done by the upward lifting force relative to him will be:

a) +mgh b) -mgh c) zero d) none of these

57. A ball of mass 2 kg moving with velocity 3 m/s, collides with spring of natural length 2 m and force constant 144 N/m. What will be length of compressed spring?

a) 2 m b) 1.5 m c) 1 m d) 0.5 m

58. Body A of mass 4m moving with speed u collides with another body B of mass 2m, at rest. The collision is head on and elastic in nature. After the collision the fraction of energy lost by the colliding body A is ____________

a) $\frac{8}{9}$ b) $\frac{4}{9}$ c) $\frac{5}{9}$ d) $\frac{1}{9}$

59. Which of the following statements is correct?

a) Heat is absorbed in exothermic reaction. b) Heat is released in endothermic reaction.

c) Energy released in burning 1 litre of gasoline is 300 MJ.

d) Chemical energy is associated with the forces that give rise to the stability of substances.

60. A body of mass 2.0 kg makes an elastic collision with another body at rest and continues to move in the original direction but with one-fourth of its original speed u. What is the mass of other body and the speed of the two body center of mass?

a) 1.0 kg and $\frac{2}{3}v$ b) 1.2 kg and c) 1.4 kg and $\frac{10}{17}v$ d) 1.5 kg and $\frac{4}{7}v$

61. A 120 g mass has a velocity $\vec{v} = 2\hat{i} + 5\hat{j}$ m S^{-1} at a certain instant. Its kinetic energy is

a) 3 J b) 4 J c) 5 J d) 1.74 J

62. A block m_1 strikes a stationary block m_3 inelastically. Another block m_2 is kept on m_3. Neglecting the friction between all contacting surfaces, the fractional decrease of KE of the system in collision is:

a) $\frac{m_1}{m_1+m_2+m_3}$ b) $\frac{m_1}{m_2+m_3}$ c) $\frac{m_3}{m_1+m_3}$ d) $\frac{m_2+m_3}{m_1+m_2+m_3}$

63. Assertion: The conservation of kinetic energy in elastic collision applies after the collision is over and does not hold at every instant of the collision.
Reason: During a collision the total linear momentum is conserved at each instant of the collision.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

64. A block of mass M slides down the surface of a bowl of radius R from its rim to the bottom. What will be the kinetic energy of the block at the bottom?
a) 2MgR b) MgR c) MgR/2 d) MgR/4

65. A spherical ball of mass ml collides head on with another ball of mass m_2 at rest. The collision is elastic. The fraction of kinetic energy lost by m_1 is :
a) $\frac{4m_1m_2}{(m_1+m_2)^2}$ b) $\frac{m_1}{m_1+m_2}$ c) $\frac{m_2}{m_1+m_2}$ d) $\frac{m_1m_2}{(m_1+m_2)^2}$

66. Consider the following statements A and B. Identify the correct choice in the given answers.
A. In a one dimensional perfectly elastic collision between two moving bodies of equal masses, the bodies merely exchange their velocities after collision.
B. If a lighter body at rest suffers perfectly elastic collision with a very heavy body moving with a certain velocity, then after collision both travel with same velocity.
a) A and B are correct b) Both A and B are wrong c) A is correct, B is wrong
d) A is wrong, B is correct

67. If we throw a body upwards with velocity of 4 m/s, at what height does its kinetic energy reduce to half of the initial value? (Take g = 10 m s^{-2})
a) 1 m b) 0.4 m c) 4 m d) 4.1 m

68. A 15 g ball is shot from a spring gun whose spring has a force constant 600 N m-1. The spring is compressed by 5 cm. The greatest possible horizontal range of the ball for this compression (Take g = 10 m S^{-2})
a) 6 m b) 8 m c) 10 m d) 12 m

69. The momentum of a body is increased by 25%. The kinetic energy is increased by about
a) 25% b) 5% c) 56% d) 38%

70. Two spherical bodies of mass M and 5M and radii Rand 2R respectively are released in free space with initial separation between their centres equal to 12R. If they attract each other due to gravitational force only, then the distance covered by the smaller body before collision is:
a) 7.5 R b) 4.5 R c) 2.5 R d) 1.5 R

71. In the first ball of mass m moving with a velocity u collides head-on with the second ball of mass m at rest. If the coefficient of restitution is e, then the ratio of the velocities of the first and the second ball after the collision is, the ratio of final velocity of the second ball to the initial velocity of the first ball is:
a) $\frac{1-e}{1+e}$ b) $\frac{1+e}{1-e}$ c) $\frac{1+e}{2}$ d) $\frac{1-e}{2}$

72. Momentum is closely related to:
a) impulse b) kinetic energy c) angular momentum d) tangential velocity

73. A force $\left(4\hat{i}+\hat{j}-2\hat{k}\right)$ N acting on a body maintains its velocity at $\left(2\hat{i}+2\hat{j}-3\hat{k}\right)$ m s^{-1} . The power exerted is

a) 4 W b) 5 W c) 2 W d) 2 W

74. A 10 gm bullet is fired from a rifle horizontally into a 5 kg block of wood suspended by a string and the bullet gets embedded in the block. The impact causes the block to swing to a height of 2.5 cm above its initial level. The velocity of the bullet is:

a) 286.8 m/sec b) 350.7 m/sec c) 1000 m/sec d) 523 m/sec

75. A particle is released from a height S. At certain height its kinetic energy is three times its potential energy. The height and speed of the particle at that instant are respectively:

a) $\frac{S}{4}, \frac{3gs}{2}$ b) $\frac{S}{4}, \sqrt{\frac{3gs}{2}}$ c) $\frac{S}{2}, \sqrt{\frac{3gs}{2}}$ d) $\frac{S}{4}, \sqrt{\frac{3gs}{2}}$

76. A steel ball of mass 5 g is thrown downward with a velocity 10 m/s from a height 19.5 m. It penetrates sand by 50 cm. The change in mechanical energy will be:
(g = 10 m/s^2)

a) 1 J b) 1.25 J c) 1.5 J d) 1.75 J

77. A particle of mass M moves in a circle of radius R with a constant speed v. The work done when it completes one circle is:

a) $\frac{Mv^2}{R} \times 2\pi R$ b) $\frac{1}{2}Mv^2$ c) $\frac{Mv^2}{R} \times \pi R$ d) zero

78. A body is dropped from a height of 8 m. After striking the surface it rises to 6 m, what is fractional loss in kinetic energy during impact? (Assuming air resistance to be negligible.)

a) 2/5 b) 1/4 c) 3/4 d) 1/5

79. A ball of mass 100g is projected vertically upwards from the ground with a velocity of 49 m/s. At the same time another identical ball is dropped from a height of 98 m to fall freely along the same path as followed by the first ball. After sometime the two balls collide and stick together. The velocity of the 'combined mass' just after the collision is:

a) 4.9 m/s upward b) 4.9 m/s downward c) 9.8 m/s upward d) 9.8 m/ downward

80. A sphere P of mass m and velocity V_i undergoes an oblique and perfectly elastic collision with an identical sphere Q initially at rest. The angle θ between the velocities of the spheres after the collision shall be

a) 0 b) 45° c) 90° d) 180°

81. The power of a water pump is 2 kW If g = 10 m s^{-2}, the amount of water it can raise in one minute to a height of 10m is

a) 2000 litre b) 1000 litre c) 100 litre d) 1200 litre

82. A ball falls under gravity from a height of 10 m with an initial downward velocity u. It collides with the ground, losses 50% of its energy in collision and then rises back to the same height. The initial velocity u is

a) 7 m S^{-1} b) 25 m S^{-1} c) 14 m S^{-1} d) 28 m S^{-1}

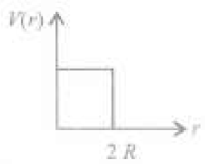
83. A body of mass m falls from a height h and collides with another body of same mass. After collision the two bodies combine and move through distance till they come to rest. Find the work done against the resistive force.

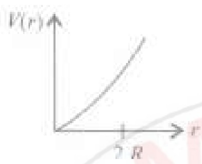
a) $\frac{1}{2}mg(h+2d)$ b) $\frac{1}{2}mg(h+4d)$ c) $\frac{1}{2}mg(h-d)$ d) $\frac{1}{2}mg(h-2d)$

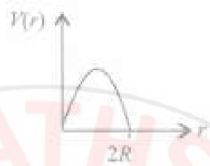
84. For photoelectric ernission frorn certain metal the cut-off frequency is n. If radiation of frequency 2v impinges on the metal plate, the maximum possible velocity of the emitted electron will be ___________ (m is the electron mass)
a) $\sqrt{hv/m}$ b) $\sqrt{2hv/m}$ c) $2\sqrt{hv/m}$ d) $\sqrt{hv/(2m)}$

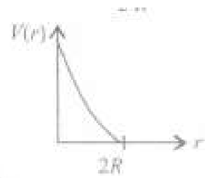
85. A stone is projected vertically upto reach maximum height h. The ratio of its KE to its potential energy at a height (4/5)h, will be:
a) 5: 4 b) 4: 5 c) 1: 4 d) 4: 1

86. Which of the following potential energy curves possibly describe the elastic collision of two billiard balls?
Here r is the distance between centres of the balls.

a) 

b) 

c) 

d) 

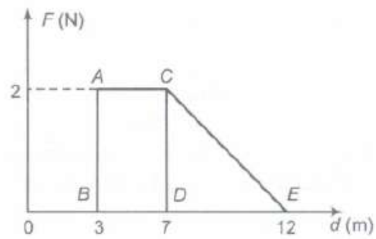
87. A body of mass 1 kg begins to move under the action of a time dependent force

$F = \left(2t\hat{i} + 3t^2\hat{i}\right)$N, where 7 and) are unit vectors along x and y-axes. What power will be developed by the force at the time t?
a) $(2t^2 + 3t^2)$W b) $(2t^2 + 4t^4)$W c) $(2t^3 + 3t^4)$W d) $(2t^3 + 3t^5)$W

88. When the force retards the motion of a body, the work done is:
a) zero b) -ve c) +ve
d) +ve or -ve depending upon the magnitude of force and displacement

89. The coefficient of restitution e for a perfectly elastic collision is _________
a) 1 b) 0 c) infinite d) -1

90. Force F on a particle moving in a straight line varies with distance d as shown in the figure. The work done on the particle during its displacement of 12m is:



a) 18 J b) 21 J c) 26 J d) 13 J

91. A bicyclist comes to a skidding stop in 10 m. During this process, the force on the bicycle due to the road is 200 N and is directly opposed to the motion. The work done by the cycle on the road is :
a) +2000 J b) -200 J c) zero d) 20000 J

92. A body of mass 1kg is thrown upwards with a velocity 20 m/s. It momentarily comes to rest after attaining a height of 18 m. How much energy is lost due to air friction? (g = 10 m/s^2)
a) 30J b) 40J c) 10J d) 20J

93. A spacecraft of mass M moves with velocity V in free space at first, then it explodes, breaking into two pieces. If after explosion a piece of mass m comes to rest, the other piece of spacecraft will have a velocity:

a) $\frac{MV}{M-m}$ b) $\frac{MV}{M+m}$ c) $\frac{mV}{M-m}$ d) $\frac{mV}{M+m}$

94. Which of the following is not an example of perfectly inelastic collision?
a) A bullet fired into a block if bullet gets embedded into block
b) Capture of electrons by an atom c) A man jumping onto a moving boat
d) A ball bearing striking another ball bearing

95. A bob of mass m, suspended by a string of length l_1 is given a minimum velocity required to complete a full circle in the vertical plane. At the highest point, it collides elastically with another bob of mass m suspended by a string of length l_2, which is initially at rest. Both the strings are mass-less and inextensible. If the second bob, after collision acquires the minimum speed required to complete a full circle in the vertical plane, the ratio l_1/l_2 is
a) 1 b) 3 c) 5 d) 1/5

96. If a body is moving on a horizontal rough road and the body is in dynamic equilibrium, then net work done is:
a) +ve b) -ve c) zero d) unity

97. A neutron collides, head-on with a deuterium at rest. What fraction of the neutron's energy would be transferred to the deuterium?
a) 89% b) 11% c) 79% d) 21%

98. The amount of energy released in burning 1 kg of coal is
a) 3 MJ b) 30 MJ c) 300 MJ d) 3000 MJ

99. A moving body of mass mand velocity 3 km/h collides with a rest body of mass 2 m and sticks to it. Now the combined mass starts to move. What will be the combined velocity?
a) 3 km/h b) 2 km/h c) 1 km/h d) 4 km/h

100. A stationary body of mass 3 kg explodes into three equal pieces. Two of the pieces fly-off at right angles to each other, one with a velocity of $2\hat{i}$ m/s and the other with a velocity of $3\hat{j}$ m/s. If the explosion takes place in 10^{-5} see, the average force acting on the third piece (in newtons) is:
a) $(2\hat{i}+3\hat{j})\times 10^{-5}$ b) $-(2\hat{i}+3\hat{j})\times 10^{-5}$ c) $(3\hat{j}-2\hat{i})\times 10^{5}$ d) $(2\hat{i}-3\hat{j})\times 10^{-5}$

101. A particle of mass m is moving in a horizontal circle of radius r, under a centripetal force F = k/ r2, where k is a constant:

a) The potential energy of a particle is zero b) The potential energy of a particle is $\frac{k}{r}$

c) The total energy of a particle is $-\frac{k}{2r}$ d) The kinetic energy of a particle is $-\frac{k}{r}$

102. Which of the following statements is incorrect?
a) Most of the collisions on the macroscopic scale are inelastic collisions
b) In a perfectly inelastic collision, there is a complete loss of KE

c) Forces involved in an elastic collision are conservative in nature

d)

Oblique collision is that collision in which the colliding bodies do not move along the same straight line path

103. A bullet of mass 10 g leaves a rifle at an initial velocity of 1000 m/s and strikes the earth at the same level with a velocity of 500 m/s. the work done in joules overcoming the resistance of air will be:

a) 375 b) 3750 c) 5000 d) 500

104. A bullet when fired at a target has its velocity decreased to 50% after penetrating 30 em into it. Then, the additional thickness it will penetrate before coming to rest is:

a) 10 cm b) 30 cm c) 40 cm d) 60 cm

105. Which of the following statements is true?

a) Kinetic energy is conserved in all types of collisions.

b) By definition there is no difference between elastic and perfectly elastic collisions

c) By definition there is no difference between inelastic and perfectly inelastic collisions.

d) After the collision, the relative displacement of the particles can decrease with time

106. When a long spring is stretched by 2 em, its potential energy is V. If the spring is stretched by 10 em, the potential energy in it will be

a) 10 V b) 25 V c) $\frac{V}{5}$ d) 5V

107. If the force acting on a body is inversely proportional to its speed, then its kinetic energy is

a) linearly related to time b) inversely proportional to time

c) inversely proportional to the square of time d) a constant

108. An elevator which can carry a maximum load of 1800 kg (elevator + passengers) is moving up with a constant speed of 2 m s^{-1}. The frictional force opposing the motion is 4000 N. What is minimum power delivered by the motor to the elevator?

a) 22 kW b) 44 kW c) 66 kW d) 88 kW

109. The work done in first six seconds is:

a) 18 m J b) zero c) $\frac{9}{2}$ m J d) 36 m J

110. Assertion: Work done by the force of friction in moving a body around a closed loop is zero.

Reason: Work done does not depend upon the nature of force.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

111. A simple pendulum of length l is moved aside till the string makes an angle 9), with the vertical. If the acceleration due to gravity is g, the kinetic energy of the bob when the string is inclined at 92 to the vertical is

a) $mgl\cos(\theta_1-\theta_2)$ b) $mgl(\cos\theta_2-\cos\theta_1)$ c) $mgl(\cos\theta_1-\cos\theta_2)$ d) $mgl\sin(\theta_1-\theta_2)$

112. An engine pumps water through a hose pipe. Water passes through the pipe and leaves it with a velocity of 2 m/s. The mass per unit length of water in the pipe is 100 kg/m. What is the power of the engine?
a) 400W b) 200w c) 100W d) 800W

113. A ball of mass m collides with a wall with speed v and rebounds on the same line with the same speed. If the mass of the wall is taken as infinite, then the work done by the ball on the wall is
a) mv^2 b) $\frac{1}{2}mv^2$ c) 2mv d) zero

114. A car of mass 400 kg and travelling at 72 km/h crashes into a truck of mass 4000 kg and travelling at 9 km/h in the same direction. The car bounces back at a speed of 18 km/h. The speed of the truck after the impact is:
a) 9 km/h b) 18 km/h c) 27 km/h d) 36 km/h

115. A car is driven for 0.9 sec. If the car travelling initially with 36 km/h is stopped by the driver after observing a signal by the deceleration of 5 m/s^2, the total distance travelled by the car before coming to rest is:
a) 19 m b) 26.5 m c) 21 m d) 28 m

116. A particle of mass m moving with a speed v hits elastically another stationary particle of mass 2m on a smooth horizontal circular tube of radius r. The time in which the next collision will take place is equal to:
a) $\frac{2\pi r}{v}$ b) $\frac{4\pi r}{v}$ c) $\frac{3\pi r}{2v}$ d) $\frac{\pi r}{v}$

117. A body of mass (4m) is lying in x-y plane at rest. It suddenly explodes into three pieces. Two pieces, each of mass (m) move perpendicular to each other with equal speeds (v). The total kinetic energy generated due to explosion is ________
a) mv^2 b) $\frac{3}{2}mv^2$ c) $3mv^2$ d) $4mv^2$

118. In a shotput event an athlete throws the shotput of mass 20 kg with an initial speed of 2 m S^{-1} at 45° from a height 3 m above ground. Assuming air resistance to be negligible and acceleration due to gravity to be 10 m S^{-2}, the kinetic energy of the shotput when it just reaches the ground will be :
a) 2.5 J b) 5 J c) 525 J d) 640 J

119. A bullet of mass m moving horizontally with a velocity v strikes a block of wood of mass M and gets embedded in the block. The block is suspended from the ceiling by a massless string. The height to which block rises is
a) $\frac{v^2}{2g}\left(\frac{m}{M+m}\right)^2$ b) $\frac{v^2}{2g}\left(\frac{M+m}{m}\right)^2$ c) $\frac{v^2}{2g}\left(\frac{m}{M}\right)^2$ d) $\frac{v^2}{2g}\left(\frac{M}{m}\right)^2$

120. bag P (mass M) hangs by a long thread and a bullet (mass m) comes horizontally with velocity υ and gets caught in the bag. Then for the combined (bag + bullet) system
a) momentum is $\frac{m\upsilon M}{M+m}$ b) kinetic energy is $\frac{1}{2}m\upsilon^2$ c) momentum is $\frac{m\upsilon(M+m)}{M}$
d) kinetic energy is $\frac{m^2\upsilon^2}{2(M+m)}$

121. An object of mass m is allowed to fall from rest along a rough inclined plane. The speed of the object on reaching the bottom of the plane is proportional to:
a) m^0 b) m c) m^2 d) m^{-1}

122. The potential energy of a certain spring when stretched through a distance s is 10 joule. The amount of work (in joule) that must be done on this spring to stretch it through additional distance swill be:
a) 30 b) 40 c) 10 d) 220

123. In the question number 25, the kinetic energy of the air is
a) $\frac{1}{2}Apvt$ b) $\frac{1}{2}Apv^2t$ c) $\frac{1}{2}Apv^3t$ d) $2Apv^3t$

124. A parrot is in a cage which is hanging from a spring balance. Initially, the parrot sits in the cage and in the second instance, the parrot flies about inside the cage:
a) the reading of the balance will be greater when the parrot flies in the cage:
b) the reading of the balance remains unchanged.
c) the reading of the balance remains unchanged. d) none of the above

125. A water pump lifts water at the rate of 5 litre per second through an average height of 8 m from a well of depth 12 m Its power will be:
a) 1280 watt b) 980 watt c) 1180 watt d) 1080 watt

126. The rate of change of kinetic energy is:
a) 0.4 joule/see b) 0.08 joule/see c) 0.04 joule/see d) 0.2 joule/see

127. A rubber ball is dropped from a height of 5 m on a planet where the acceleration due to gravity is not known. On bouncing, it rises to 1.8 m. The ball loses its velocity on bouncing by a factor of :
a) 16/25 b) 2/5 c) 3/5 d) 9/5

128. A body of mass m collides against a wall with a velocity v and rebounds with the same speed. Its change of momentum is
a) $2mv$ b) mv c) $-mv$ d) zero

129. If the momentum of a certain body be increased by 50%, its KE will increase by:
a) 25% b) 50% c) 100% d) 125%

130. Consider a drop of rain water having mass 1g falling from a height of 1 km. It hits the ground with a speed of 50 m/ s. Take g constant with a value of 10 m/s^2. The work done by the (i) gravitational force and the (ii) resistive force of air is __________
a) (i)-10 J, (ii)-8.25 J b) (i) 1.25 J, (ii) − 8.25 J c) (i) 100 J, (ii) − 8.75 J d) (i) 10 J, (ii) − 8.75 J

131. A mass of 0.5 kg moving with a speed of 1.5 m/s on a horizontal smooth surface, collides with a nearly weightless spring of force constant k = 50 N/m. The maximum compression of the spring would be ___________
a) 0.5m b) 0.15m c) 0.12m d) 1.5m

132. Assertion: No work is done if the displacement is zero.
Reason: Work done by the force is defined to be the product of component of the force in the direction of the displacement and the magnitude of displacement.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

133. A block of mass 0.50 kg is moving with a speed of 2.00 ms^{-1} on a smooth surface. It strikes another mass of 1.00 kg and then they move together as a single body. The energy loss during the collision is:
a) 0.16 J b) 1.00 J c) 0.67 J d) 0.34 J

134. A ball of mass m moves with speed v and strikes a wall having infinite mass and it returns with same speed, then the work done by the ball on the wall is:
a) zero b) $m\upsilon$J c) (m/υ)J d) (υ/m)J

135. When the energy of the incident radiation is increased by 20% the kinetic energy of the photoelectrons emitted from a metal surface increased from 0.5 eV to 0.8 eV. The work function of the metal is ___________
a) 0.65eV b) 1.0eV c) 1.3eV d) I.5eV

136. A boy weighing 50 kg finished long jump at a distance of 8 m. Considering that he moved along a parabolic path and his angle of jump was 45°, his initial KE will be:
a) 960 J b) 1560 J c) 2460 J d) 1960 J

137. A nuclide at rest emits an o-particle. In this process:
a) αparticle moves with large velocity and the nucleus remains at rest
b) both α-particle and nucleus move with equal speed in opposite directions
c) both move in opposite directions but nucleus with greater speed
d) both move in opposite directions but α-particle with greater speed

138. An electric motor creates a tension of 4500 N in a hoisting cable and reels it in at the rate of 2 m s^{-l}. What is the power of the electric motor?
a) 15 kW b) 9 kW c) 225 W d) 9000 hp

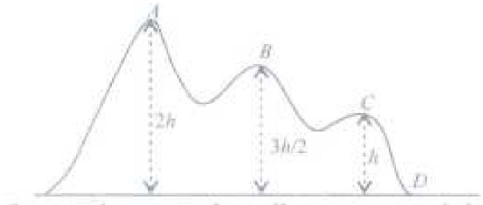
139. A shell of mass 200 grn is ejected from a gun of mass 4 kg by an explosion that generates 1.05 kJ of energy. The initial velocity of the shell is __________
a) 100 ms^{-1} b) 80 ms^{-1} c) 40 ms^{-1} d) 120 ms^{-1}

140. How much water a pump of 2 kW can raise in one minute to a height of 10 m? (Take g=10 m/s^2)
a) 1000L b) 1200L c) 100L d) 2000L

141. Assertion: Energy can neither be created nor destroyed.
Reason: The principle of conservation of energy cannot be proved.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

142. A rope ladder with a length 1 carrying a man with a mass mat its end is attached to the basket of a balloon with a mass M. The entire system is in equilibrium in the air. As the man climbs up the ladder into the balloon, the balloon descends by a height h. Then, the potential energy of the man:
a) increases by mg(l- h) b) increases by mgl c) increases by mgh
d) increases by mg(21 - h)

143. A small roller coaster starts at point A with a speed u on a curved track as shown in the figure



The friction between the roller coaster and the track is negligible and it always remains in contact with the track. The speed of roller coaster at point D on the track will be

a) $(u^2 + gh)^{1/2}$ b) $(u^2 + 2gh)^{1/2}$ c) $(u^2 + 4gh)^{1/2}$ d) u

144. A body is initially at rest. It undergoes one dimensional motion with constant acceleration. The power delivered to it at time *t* is proportional to

a) $t^{1/2}$ b) t c) $t^{3/2}$ d) t^2

145. A car is moving on a straight horizontal road with a speed u. If the coefficient of friction between the tyres and the road is u, the shortest distance in which the car can be stopped is:

a) $\frac{v^2}{2\mu g}$ b) $\frac{v^2}{\mu g}$ c) $\left(\frac{v}{\mu g}\right)^2$ d) $\frac{v^2}{\mu}$

146. The correct relation between joule and erg is :

a) 1J = 10^{-5} erg b) 1J = 10^{5} erg c) 1J = 10^{-7} erg d) 1J = 10^{7} erg

147. A ball is dropped from height h on a plane. If the coefficient of restitution of the plane is e and if ball hits ground two times, the height upto which it reaches after two jumps, will be:

a) e^4 h b) eh c) 2eh d) eh/2

148. In an elastic collision between two bodies, complete energy is transferred when:

a) both bodies have equal mass b) both bodies are moving

c) heavy body is moving and lighter one is at rest

d) heavy body is moving and lighter one is at rest

149. The vessels A and B of equal volume and weight are immersed in water to depth h. The vessel A has an opening at the bottom through which water can enter. If the work done in immersing A and Bare W_A and W_B respectively, then:

a) $W_A = W_B$ b) $W_A < W_B$ c) $W_A > W_B$ d) none of these

150. A bullet having a speed of 100 m/sec crashes through a plank of wood. After passing through a plank, its speed is 80 m/sec. Another bullet of the same mass and size, but travelling at 80 m/sec, is fired at the plank. The speed of the second bullet after travelling through the plank is: (Assume that resistance of the plank is independent of the speed of the bullet)

a) $10\sqrt{7}ms^{-1}$ b) $20\sqrt{7}ms^{-1}$ c) $30\sqrt{7}ms^{-1}$ d) $20\sqrt{5}ms^{-1}$

151. A body contained to move in y-direction is subjected to a force given by:

$$\vec{F} = (-2\hat{i} + 15\hat{j} + 6\hat{k})N$$

The work done by this force in moving the body a distance of 10 m along the y-axis is:

a) 20 J b) 150 J c) 160 J d) 190 J

152. If the kinetic energy of a particle is increased by 300%, the momentun: of the particle will increase by ____________

a) 20% b) 200% c) 100% d) 50%

153. A body of mass 1 kg is thrown upwards with a velocity 20 m/s. It momentarily comes to rest after attaining a height of 18 m. How much energy is lost due to air friction? (g = 10 ms^{-2})
a) 30 J b) 40 J c) 10 J d) 20 J

154. A body projected vertically from the earth reaches a height equal to earth's radius before returning to the earth. The power exerted by the gravitational force is greatest ____________
a) at the highest position of the body b) at the instantjust before the body hits the earth
c) it remains constant all through d) at the instantjust after the body is projected

155. A ball whose KE is E_1, is thrown at an angle of 45° with the horizontal; its KE at the highest point of its flight will be:
a) $E/\sqrt{2}$ b) E/2 c) zero d) E

156. Two equal masses ml and m_2 moving along the same straight line with velocities +3 m/s and -5 m/s respectively, collide elastically. Their velocities after the collision will be respectively:
a) +4 m s^{-1} for both b) -3 m s^{-1} and +5 m s^{-1} c) 4 m s^{-1} and +4 m s^{-1}
d) -5 m s^{-1} and +3 m s^{-1}

157. The blades of a windmill sweep out a circle of area A. If the wind flows at a velocity v perpendicular to the circle, then the mass of the air of density p passing through it in time t is
a) $Av\rho t$ b) $2Av\rho t$ c) $Av^2\rho t$ d) $\frac{1}{2}Av\rho t$

158. In perfectly inelastic collisions, the relative velocity of the bodies:
a) before impact is zero b) before impact is zero c) after impact is zero
d) is characterised by none of the above

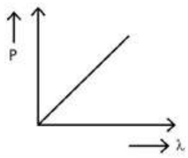
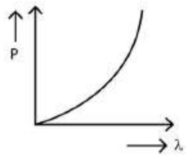
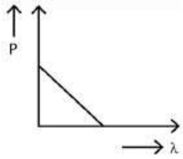
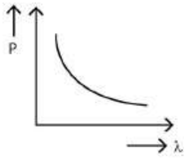
159. A vessel at rest explodes, breaking it into three pieces. Two pieces having equal mass fly-off perpendicular to one another with the same speed of 30 m/s. The third piece has three times the mass of each other piece. What is the direction and magnitude of its velocity immediately after the explosion?
a) $10\sqrt{2}$ m/s,135^0 b) $10\sqrt{2}$ m/s,90^0 c) $10\sqrt{2}$ m/s,60^0 d) $10\sqrt{2}$ m/s,30^0

160. A ball is dropped from a height of 20 cm. Ball rebounds to a height of 10 cm. What is the loss of energy?
a) 25% b) 75% c) 50% d) 100%

161. A ball is let to fall from a height ho. There are n collisions with the Earth. If the velocity of rebound after n collisions is υ_n and the ball rises to a height h_n, then coefficient of restitution e is given by:
a) $e^n = \sqrt{\frac{h_n}{h_0}}$ b) $e^n = \sqrt{\frac{h_0}{h_n}}$ c) $ne = \sqrt{\frac{h_n}{h_0}}$ d) $\sqrt{ne} = \sqrt{\frac{h_n}{h_0}}$

162. A body of mass 4 kg is moving with momentum of 8 kg m s^{-1}. A force of 0.2 N acts on it in the direction of motion of the body for 10 s. The increase in kinetic energy is
a) 10 J b) 8.5 J c) 4.5 J d) 4 J

163. Which of the following figures represent the variation of particle momentum and the associated de-Broglie wavelength?

a)  b)  c)  d) 

164. A proton is kept at rest. A positively charged particle is released from rest at a distance d in its field. Consider two experiments; one in which the charged particle is a proton and in another a positron. In the same time t, the work done on the two moving charged particles is

a) same as the same force law is involved in the two experiments

b)

less for the case of a positron, as the positron moves away more rapidly and the force on it weakens

c) more for the case of a positron, as the positron moves away a larger distance.

d) same as the work done by charged particle on the stationary proton

165. A body of mass 40 kg having velocity 4 m/s collides with another body of mass 60 kg having velocity 2 m/s. If the collision is inelastic, then loss in kinetic energy will be:

a) 440 J b) 392 J c) 48 J d) 144 J

166. Force of 4 N is applied on a body of mass 20 kg. The work done in 3rd second is:

a) 2J b) 4J c) 16 J d) 1.2J

167. A trolley of mass 300 kg carrying a sand bag of 25 kg is moving uniformly with a speed of 27 km/h on a frictionless track. After a while, sand starts leaking out of a hole on the floor of the trolley at the rate of 0.05 kg /sec. What is the speed of the trolley after the entire sand bag is empty?

a) 30 m/s b) 27 km/h c) 35 m/s d) 35 km/h

168. A ball moving with a velocity ur collides elastically with another ball of equal mass, in a one-dimensional collision. Which of the following is not possible?

a) First ball will come to rest b) Second ball will move with a velocity $\vec{\mu_1}$

c) Both balls will move with velocity $\vec{\mu_1}$ after collision

d) The first ball will move with a velocity less than $\vec{\mu_1}$

169. A big particle of mass (3 + m) kg blasts into 3 pieces, such that a particle of mass 1 kg moves along x-axis, with velocity 2m/s and a particle of mass 2 kg moves with velocity 1 m/s perpendicular to direction of 1 kg particle. If the third particle moves with velocity $\sqrt{2}$ m/s, then m/s:

a) 2 kg b) 1 kg c) $2\sqrt{2}$ kg d) none of these

170. In the question number 13, the work done by friction in 10 s is

a) 200 J b) -200 J c) 600 J d) -600 J

171. 1000 kg elevator rises from rest in the basement to the fourth floor, a distance of 20 m. As it passes the fourth floor its speed is 4 m/sec. There is a constant frictional force of 500 N. The work done by the lifting mechanism is

a) 196×10^3 J b) 204×10^3 J c) 214×10^3 J d) 203×10^5 J

172. Two bodies A and B have masses 20 kg and 5 kg respectively. Each one is acted upon by a force of 4 kg wt. If they acquire the same kinetic energy in times t_A and t_B, then the ratio $\frac{t_A}{t_B}$ is :

a) $\frac{1}{2}$ b) 2 c) $\frac{2}{5}$ d) $\frac{5}{6}$

173. A ball is allowed to fall from a height of 10 m. If there is 40% loss of energy due to impact, then after one impact ball will go up to:

a) 10 m b) 8 m c) 4 m d) 6 m

174. An electric pump is used to fill an overhead tank of capacity 9 m^3 kept at a height of 10m above the ground. If the pump takes 5 minutes to fill the tank by consuming 10 kW power, the efficiency of the pump should be: (Takeg = $10ms^{-2}$)

a) 60% b) 40% c) 20% d) 30%

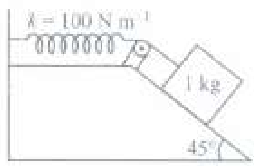
175. A mass m moving horizontally (along the x-axis) with velocity y collides and sticks to mass of 3m moving vertically upward (along they-axis) with velocity 2v. Thi final velocity of the combination is ________

a) $\frac{1}{4}v\hat{i} + \frac{3}{2}v\hat{j}$ b) $\frac{1}{3}v\hat{i} + \frac{2}{3}v\hat{j}$ c) $\frac{2}{3}v\hat{i} + \frac{1}{3}v\hat{j}$ d) $\frac{3}{2}v\hat{i} + \frac{1}{4}v\hat{j}$

176. Two masses ma and mb moving with velocities v_a and v_b in opposite direction collide elastically and after that m_a and m_b move with velocities v_b and v_a respectively. Then the ratio m_a/m_b is:

a) $\frac{v_a - v_b}{v_a + v_b}$ b) $\frac{m_a + m_b}{m_a}$ c) 1 d) 1/2

177. A 1 kg block situated on a rough incline is connected to a spring of negligible mass having spring constant 100 N m^{-1} as shown in the figure.



The block is released from rest with the spring in the unstretched position. The block moves 10 cm down the incline before coming to rest. The coefficient of friction between the block and the incline is

(Take g = 10 m s^{-2} and assume that the pulley is frictionless)

a) 0.2 b) 0.3 c) 0.5 d) 0.6

178. A bucket full of water weighs 5 kg, it is pulled from a well 20 m deep. There is a small hole in the bucket through which water leaks at a constant rate of 0.2 kg/m. The total work done in pulling the bucket up from the well is : (g = 10 m/s^2)

a) 600 J b) 400 J c) 100 J d) 500 J

179. A particle of mass 4 m which is at rest explodes into three fragments. Two of the fragments, each of mass m are found to move with a speed of v each in perpendicular directions. What is the total energy released in the process?

a) $3mv^2$ b) $\frac{7}{2}mv^2$ c) $\frac{3}{2}mv^2$ d) $4mv^2$

180. A ball of mass m_1 makes a head-on elastic collision with a ball of mass m_2 which is initially at rest. The transfer of kinetic energy to the second ball is maximum when:

a) $m_1 >> m_2$ b) $m_1 = m_2$ c) $m_1 < 2$ d) $m_1 \overset{<}{->} m_2$

181. The area under force-displacement curve represents
a) velocity b) acceleration c) impulse d) work done

182. A machine is delivering constant power to drive a body along a straight line. What is the relation between the distance travelled by the body against time?
a) $s^2 \propto t^3$ b) $s^2 \propto t^{-3}$ c) $s^3 \propto t^2$ d) $S \propto t^3$

183. A neutron moving with velocity v collides with a stationary α-particle. The velocity of the neutron after the collision is:
a) -3v/5 b) 3v/5 c) 2v/5 d) -2v/5

184. If two masses m_1 and m_2 collide, the ratio of change in their respective velocities is proportional to:
a) $\frac{m_1}{m_2}$ b) $\sqrt{\frac{m_1}{m_2}}$ c) $\frac{m_2}{m_1}$ d) $\sqrt{\frac{m_2}{m_1}}$

185. A bullet of mass m is fired with certain velocity from a gun of mass M. Gun, which is attached with one end of spring, compresses it by distance d. If k is spring constant, then velocity of bullet is:
a) $(d/m)\sqrt{km}$ b) $(d/m)\sqrt{km}$ c) $md\sqrt{1/Mk}$ d) $mk\sqrt{1/dM}$

186. The velocity of the second ball is maximum when
a) $m_1 >> m_2$ b) $m_l = m_2$ c) $m_1 << m_2$ d) $m_1 \overset{<}{->} m_2$

187. If a ball of mass m elastically collides against a wall with velocity v and returns in the opposite direction with the same velocity, then the change in momentum is equal to:
a) 2m b) 2v c) 2mv d) 4mv

188. An open watertight railway wagon of mass 5 x 10^3 kg is moving with an initial velocity of 1.2 m/s without friction on a railway track. Rain falls vertically downwards into the wagon. What change will occur in the kinetic energy of the wagon, when it has collected 10^3 kg of water?
a) 1200 J b) 300 J c) 600 J d) 900 J

189. Which of the following is not an inelastic collision?
a) A man jumps on a cart b) A bullet embedded in a block c) Collision of two glass balls
d) None of the above

190. A ball of mass 2 kg and anothef of mass 4 kg are dropped together from a 60 feet tall building. After a fall of 30 feet each towards earth, their respective kinetic energies will be in the ratio of ________
a) $1:\sqrt{2}$ b) $\sqrt{2}:1$ c) 1:4 d) 1:2

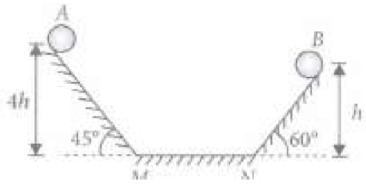
191. On microscopic level, all forms of energy may be studied as:
a) potential b) kinetic c) potential or kinetic d) nuclear

192. Two billiard balls, each of mass 50 g, moving in opposite directions to each other with a speed 6 m/s collide and rebound with the same speed. The impulse imparted to each ball is:
a) 0.3 N-s b) 0.6 N-s c) 0.9 N-s d) 1.2 N-s

193. A particle of mass 100 g is thrown vertically upwards with a speed of S m/s. The work done by the force of gravity during the time the particle goes up is:

a) -0.5J b) -125J c) 1.25J d) 0.5J

194. Two identical balls A and B are released from the positions shown in the figure. They collide elastically on horizontal portion MN. The ratio of heights attained by A and B after collision will be (neglect friction)



a) 1: 4 b) 2: 1 c) 4: 13 d) 2: 11

195. Match the Column I with Column II

Column I		Column II	
(A)	When a body does work against friction, its kinetic energy	(i)	independent of time
(B)	Work done by a body is	(ii)	time
(C)	Power of a body varies inversely as	(iii)	force must be conservative
(D)	When work done over a closed path is zero	(iv)	decreases

a) A - p, B - q, C - r, D - s b) A - q, B - r, C - s, D - P c) A - s, B - r, C - q, D - P
d) A - s, B - P. C - q, D - r

196. A position dependent force F = (7 - 2x + 3x^2) N acts on a small abject of mass 2 kg to displace it from x = 0 to x = 5 m. The work done in joule is:
a) 70 J b) 270 J c) 35 J d) 135 J

197. If the potential energy of a gas molecule is $U = \frac{M}{r^6} - \frac{N}{r^{12}}$, M and N being positive constants, then the potential energy at equilibrium must be:
a) zero b) M^2/4N c) N^2/4M d) MN^2/4 e) NM^2/4

198. Force acting on a particle moving in a straight line varies with the velocity of the particle as $F = \frac{K}{v}$, where K is a constant. The work done by this force in time tis:

a) $\frac{K}{v^2}t$ b) 2Kt c) Kt d) $\frac{2Kt}{v^2}$

199. A particle of mass 10 g moves along a circle of radius 6.4 em with a constant tangential acceleration. What is the magnitude of this acceleration if the kinetic energy of the particle becomes equal to 8 × 10^{-4} J by the end of the second revolution after the beginning of the motion?
a) 0.2 m/s^2 b) 0.1 m/s^2 c) 0.15 m/s^2 d) 0.18 m/s^2

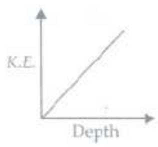
200. A particle of mass m is driven by a machine that delivers a constant power of k watts. If the particle starts from rest the force on the parlicle at time t is ________

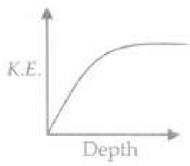
a) $\sqrt{mkt}^{-1/2}$ b) $\sqrt{2mkt}^{-1/2}$ c) $\frac{1}{2}\sqrt{mkt}^{-1/2}$ d) $\sqrt{\frac{mk}{2}t^{-1/2}}$

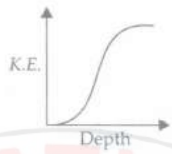
201. The threshold fiequency for a photosensitive metal is 3.3×10^{14} Hz. If light of frequency 8.2×10^{14} Hz is incident on this metal, the cut-off voltage for the photoelectric emission is nearly __________
a) 2V b) 3V c) 5V d) 1V

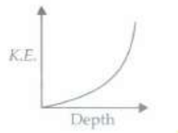
202. A particle of mass 2 m is projected at an angle of 45° with the horizontal with a velocity of $20.\sqrt{2}$ m/s. After I see explosion takes place and the particle is broken into two equal pieces. As a result of explosion one part comes to rest. The maximum height from the ground attained by the other part is:($g = 10\ m/s^2$)
a) 50 m b) 25 m c) 40 m d) 35 m

203. Which of the diagrams in figure correctly shows the change in kinetic energy of an iron sphere falling freely in a lake having sufficient depth to impart it a terminal velocity?

a) 

b) 

c) 

d) 

204. A ball bounces to 80% of its original height. What fraction of its potential energy is lost in each bounce?
a) 0.20 b) 0.60 c) 0.40 d) 1

205. A bullet of mass 10 gm is fired horizontally with a velocity $1000\ ms^{-1}$ from a rifle situated at a height 50 m above the ground. If the bullet reaches the ground with a velocity $500\ m\ s^{-1}$, the work done against air resistance in the trajectory of the bullet is: (Take $g = 10\ ms^{-2}$)
a) 5005 J b) 3755 J c) 3750 J d) 17.5 J

206. A particle in a certain conservative force field has a potential energy given by $V = \frac{20xy}{z}$. The force exerted on it is :

a) $\left(\frac{20y}{z}\right)\hat{i} + \left(\frac{20x}{z}\right)\hat{j} + \left(\frac{20xy}{z^2}\right)\hat{K}$ b) $-\left(\frac{20y}{z}\right)\hat{i} - \left(\frac{20x}{z}\right)\hat{j} + \left(\frac{20xy}{z^2}\right)\hat{K}$ c) $-\left(\frac{20y}{z}\right)\hat{i} - \left(\frac{20x}{z}\right)\hat{j} - \left(\frac{20xy}{z^2}\right)\hat{K}$

d) $\left(\frac{20y}{z}\right)\hat{i} + \left(\frac{20x}{z}\right)\hat{j} - \left(\frac{20xy}{z^2}\right)\hat{K}$

207. Which of the following energies is conserved for the system?
a) Kinetic energy b) Potential energy c) Mechanical energy d) None of these

208. The work done in dragging a stone of mass 100 kg up an inclined plane 1 in 100 through a distance of 10 m is:
a) zero b) 980J c) 9800J d) 98J

209. The first ball of mass m moving with a velocity u collides head-on with the second ball of mass m at rest. If the coefficient of restitution is e, then the ratio of the velocities of the first and the second ball after the collision is:
a) $\frac{1-e}{1+e}$ b) $\frac{1+e}{1-e}$ c) $\frac{1+e}{2}$ d) $\frac{1-e}{2}$

210. Which of the following statements is correct?
a) Kinetic energy of a system can be changed without changing its momentum
b) Kinetic energy of a system cannot be changed without changing its momentum

c) Momentum of a system cannot be changed without changing its kinetic energy.

d) Body cannot have energy without having momentum

211. A particle of mass 5 m initially at rest explodes into three fragments with mass ratio 3: 1: 1. Two of the fragments each of mass m are found to move with a speed 60 m/s in mutually perpendicular directions. The velocity of third fragment is:

a) $60\sqrt{2}\,ms^{-1}$ b) $20\sqrt{3}\,ms^{-1}$ c) $10\sqrt{2}\,ms^{-1}$ d) $20\sqrt{2}\,ms^{-1}$

212. A neutron in a nuclear reactor collides head on elastically with the nucleus of a carbon atom initially at rest. The fraction of kinetic energy transferred from the neutron to the carbon atom is

a) $\frac{11}{12}$ b) $\frac{2}{11}$ c) $\frac{48}{121}$ d) $\frac{48}{169}$

213. A mass of 2.9 kg is suspended from a string of length 50 cm and is at rest. Another body of mass 10 gm which is moving horizontally with a velocity of 150 m/sec strikes it. After striking the two bodies combine together. The tension in the string, when it makes an angle of 60° with the vertical, is:

a) 135.3 N b) 165.5 N c) 142.4 N d) 90 N

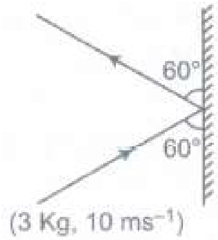
214. An electron and a proton are detected in a cosmic ray experiment, the first with kinetic energy 10 keV, and the second with 100 keV. The ratio of their speeds is (where me and mp are masses of electron and proton respectively)

a) $\sqrt{\frac{1}{10}\frac{m_e}{m_p}}$ b) $\sqrt{\frac{1}{10}\frac{m_p}{m_e}}$ c) $\frac{1}{10}\frac{m_e}{m_p}$ d) $\frac{1}{10}\frac{m_p}{m_e}$

215. A particle of mass M, starting from rest, undergoes uniform acceleration. If the speed acquired in time T is V, the power delivered to the particle is:

a) $\frac{MV^2}{T}$ b) $\frac{1}{2}\frac{MV^2}{T^2}$ c) $\frac{MV^2}{T^2}$ d) $\frac{1}{2}\frac{MV^2}{T}$

216. A 3 kg ball strikes a heavy rigid wall with a speed of 10 m/s at an angle of 60°. It gets reflected with the same speed and angle as shown here. If the ball is in contact with the wall for 0.20 s, what is the average force exerted on the ball by the wall



a) 150N b) zero c) $150\sqrt{3}N$ d) 300 N

217. If v be the instantaneous velocity of the body dropped from the top of a tower, when it is located at height h, then which of the following remains constant?

a) $gh + v^2$ b) $gh + \frac{v^2}{2}$ c) $gh - \frac{v^2}{2}$ d) $gh - v^2$

218. A particle strikes elastically with another particle with velocity V. After collision, it moves with half the velocity in the same direction. Find the velocity of the second particle if it is initially at rest.

a) $\frac{3V}{2}$ b) $\frac{V}{2}$ c) V d) none of these

219. A body of mass 3 kg is under a force which causes a displacement in it, given by s = $t^2/3$ (in m). Find the work done by the force in 2 second

a) 2 J b) 3.8 J c) 5.2 J d) 2.6 J

220. A ball collides elastically with another ball of the same mass. The collision is oblique and initially one of the balls was at rest. After the collision, the two balls move with same speeds. What will be the angle between the velocity of the balls after the collision?

a) 30° b) 45° c) 60° d) 90°

221. A ball strikes against the floor and returns with double the velocity; in which type of collision is it possible?

a) Perfectly elastic b) Inelastic c) Perfectly inelastic d) It is not possible

222. A U^{238} nucleus initially at rest emits an a-particle and is converted into Th^{234}. If the KE of α-particle be 4.1 MeV, the KE of the residual Th^{234} nucleus is:

a) 6.8 MeV b) 0.68 MeV c) 0.07008 MeV d) 0.0068 MeV

223. An object of mass 5 kg is projected with a velocity of 20 m S^{-1} at an angle of 60° to the horizontal. At the highest point of its path, the projectile explodes and breaks up into two fragments of masses 1 kg and 4 kg. The fragments separate horizontally after the explosion, which releases internal energy such that K.E. of the system at the highest point is doubled. Find the separation between the two fragments when they reach the ground.

a) 11 m b) 22 m c) 44 m d) 66 m

224. Water is falling on the blades of a turbine from a height of 25 m. 3 x 10^3 kg of water pours on the blade per minute. If the whole of energy is transferred to the turbine, power delivered is:

a) 12250 W b) 16250 W c) 8250 W d) 20250 W

225. A 0.5 kg ball moving with speed of 12 m/s strikes a hard wall at an angle of 30° with the wall. It is reflected with the same speed and at the same angle. If the ball is in contact with the wall for 0.25 seconds, the average force acting on the wall is ________ .

a) 24N b) 12N c) 96N d) 48N

226. The potential energy of a system increases if work is done __________

a) upon the system by a non-conservative force

b) by the system against a conservative force

c) by the system against a non-conservative force

d) upon the system by a conservative force

227. A ball of mass m is dropped from a cliff of height H. The ratio of its kinetic energy to the potential energy when it is fallen through a height 3/4 H is

a) 3:4 b) 4:3 c) 1:3 d) 3:1

228. The potential energy of a 1 kg particle free to move along the x-axis is given by:

$$V(x) = (\frac{x^4}{4} - \frac{x^2}{2})J$$

The total mechanical energy of the particle is 2 J. Then the maximum speed (in m/s) is:

a) 2 b) $3/\sqrt{2}$ c) $\sqrt{2}$ d) $1/\sqrt{2}$

229. A man squatting on the ground gets straight up and stands. The force of reaction of ground on the man during the process is

a) constant and equal to mg in magnitude. b) constant and greater than mg in magnitude.

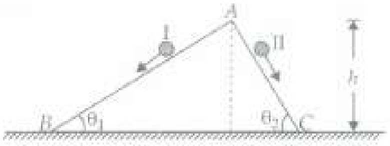
c) variable but always greater than mg

d) at first greater than mg, and later becomes equal to mg.

230. Two bodies, having masses in the ratio 1: 4, have kinetic energies in the ratio 4: 1. The ratio of their linear momentum is

a) 1: 1 b) 1: 2 c) 2: 1 d) 1: 4

231. Two inclined frictionless tracks, one gradual and the other steep meet at A from where two stones are allowed to slide down from rest, one on each track as shown in figure. Which of the following statements is correct?



a) Both the stones reach the bottom at the same time but not with the same speed

b)
Both the stones reach the bottom with the same speed and stone I reaches the bottom earlier than stone II.

c)
Both the stones reach the bottom with the same speed and stone II reaches the bottom earlier than stone I.

d) Both the stones reach the bottom at different times and with different speeds

232. A solid cylinder of mass 2 kg and radius 4 cm is rotating about its axis at the rate of 3 rpm. The torque required to stop after 2p revolutions is __________

a) 2×10^{-3}Nm b) 12×10^{4}Nm c) 2×10^{6}Nm d) 2×10^{-6}Nm

233. A moving mass of 8 kg collides elastically with a stationary mass of 2 kg. If E be the initial kinetic energy of the moving mass, the kinetic energy left with it after the collision will be:

a) 0.80E b) 0.64E c) 0.36E d) 0.08E

234. A car running at 25 km h^{-1} can be brought to rest by applying brakes in a distance of 0.5 m. If the car is running at 75 km h^{-1}how far will it go before coming to rest, if the braking force remains the same?

a) 1m b) 2m c) 3 m d) None of these

235. If the kinetic energy of the particle is increased to 16 times its previous value, the percentage change in the de- Broglie wavelength of the particle is __________

a) 25% b) 75% c) 60% d) 50%

236. Consider a car moving along a straight horizontal road with a speed of 72 km/h. If the coefficient of static friction between road and tyres is 0.5, the shortest distance in which the car can be stopped is:

a) 30 m b) 40 m c) 72 m d) 20 m

237. Two bodies of masses 0.1 kg and 0.4 kg move towards each other with the velocities 1 m/s and 0.1 m/s respectively. After collision they stick together. In 10 see the combined mass travels:

a) 120 m b) 0.12 m c) 12 m d) 1.2 m

238. A man M_1 of mass 80 kg runs up a staircase in 15 s. Another man M_2 also of mass 80 kg runs up the same staircase in 20 s. The ratio of the power developed by them will be:

a) 1 b) 4/3 c) 16/9 d) none of these

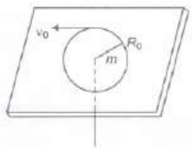
239. How many 2.5 kg bricks can a man carry up a staircase 3.6 m high in one hour if he works at the average rate of 9.8 watt?
a) 800 b) 200 c) 600 d) 400

240. A beam of cathode rays is subjected to crossed Electric (E) and Magnetic fields (B). The fields are adjusted such that the beam is not deflected. The specific charge of the cathode rays is given by __________
a) $\frac{B^2}{2VE^2}$ b) $\frac{2VB^2}{E^2}$ c) $\frac{2VE^2}{B^2}$ d) $\frac{E^2}{2VB^2}$

241. A body of mass m moving with a velocity u collides elastically directly against another stationary body of mass 3m. The velocity of the second body after the collision will be:
a) $\frac{u}{2}$ b) $\frac{u}{3}$ c) $\frac{u}{4}$ d) u

242. In the question number 15, the work done by applied force is
a) 10 J b) 50 J c) 100 J d) 150 J

243. A mass m moves in a circle on a smooth horizontal plane with velocity V_0 at a radius R_0. The mass is attached to a string which passes through a smooth hole in the plane as shown. The tension in the string is increased gradually and finally m moves in a circle of radius $R_0/2$. The final value of the kinetic energy is



a) $2mv_0^2$ b) $1/2mv_0^2$ c) mv_0^2 d) $1/4mv_0^2$

244. In which of the following cases the work done increases the potential energy?
a) Both conservative and non-conservative forces b) Conservative force only
c) Non-conservative force only d) Neither conservative nor non-conservative forces

245. A billiard ball moving with a speed of 5 m/s collides with an identical ball, originally at rest. If the first ball stops dead after collision, then the second ball will move forward with a speed of:
a) 10 ms^{-1} b) 5 ms^{-1} c) 2.5 ms^{-1} d) 1.0 ms^{-1}

246. A block is released from the top of a smooth inclined plane of inclination θ. Let v be the speed of the particle after travelling a distance s down the plane. Then which of the following will remain constant?
a) $v^2 + 2g\sin\theta$ b) $v^2 - 2g\sin\theta$ c) $v^2 - \sqrt{2g\sin\theta}$ d) $v^2 + \sqrt{2g\sin\theta}$

247. A bullet of mass m moving with velocity v strikes a suspended wooden block of mass M. If the block rises to a height h, the initial velocity of the bullet will be:
a) 200 m/s b) 220 m/s c) 204 m/s d) 284 m/s

248. Photons with energy 5 eV are incident on a cathode C in a photoelectric cell. The maximum energy of emitted photoelectrons is 2 eV. When photons of energy 6 eV are incident on C, no photoelectrons will reach the anode A, if the stopping potential of Arelative to C is

____
a) +3V b) +4V c) -1V d) -3V

249. The kinetic energy acquired by a mass (m) in travelling distance (s) starting from rest under the action of a constant force is directly proportional to:
a) $1/\sqrt{m}$ b) 1/m c) $\sqrt{m}$ d) m

250. Assertion: Energy associated with a mere kilogram of matter is 9 x 10^{16} J
Reason: It follows from the relation E = mc^2
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

251. A cricket ball of mass 0.5 kg strikes a cricket bat normally with a velocity of 20 ms^{-1} and rebounds with a velocity of 10 ms^{-1} . The impulse of the force exerted by the ball on the bat is:
a) 15N-s b) 25N-s c) 30N-s d) 10N-s

252. A pump on the ground floor of a building can pump up water to fill a tank of volume 30 m^3 in 15 min. If the tank is 40 m above the ground, and the efficiency of the pump is 30%, how much electric power is consumed by the pump? (Take g = 10 m S^{-2})
a) 36.5 kW b) 44.4 kW c) 52.5 kW d) 60.5 kW

253. A particle of mass m_1 is moving with a velocity v_1 and another particle of mass m_2 is moving with a velocity v_2. Both of them have the same momentum but their different kinetic energies are E_1 and E_2 respectively. If $m_1 > m_2$ then ____________
a) $E_1 = E_2$ b) $E_2 > E_1$ c) $\frac{E_1}{E_2} = \frac{m_1}{m_2}$ d) $E_1 > E_2$

254. A spring is compressed between two toy carts of masses m_1 and m_2. When the toy carts are released the spring exerts on each toy cart equal and opposite forces for the same time t. If the coefficients of friction J.l between the ground and the toy carts are equal, then the displacements of the toy carts are in the ratio
a) $\frac{s_1}{s_2} = \frac{m_2}{m_1}$ b) $\frac{s_1}{s_2} = \frac{m_1}{m_2}$ c) $\frac{s_1}{s_2} = \left(\frac{m_2}{m_1}\right)^2$ d) $\frac{s_1}{s_2} = \left(\frac{m_1}{m_2}\right)^2$

255. The work done by friction in 10 s is
a) 200 J b) -200 J c) 600 J d) -600 J

256. The change of momentum of the first ball is maximum when
a) m_1 >>m_2 b) m_1 =m_2 c) m_1 << m_2 d) $m_1 \overset{<}{->} m_2$

257. A ball of mass 2 kg and another of mass 4 kg are dropped together from a 60 feet tall building. After a fall of 30 feet each towards earth, their respective kinetic energies will be in the ratio of
a) $1:\sqrt{2}$ b) $\sqrt{2}:1$ c) 1 : 4 d) 1 : 2

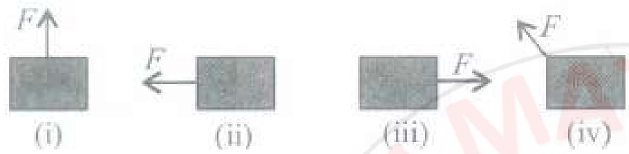
258. A uniform force of $(3\hat{i} + \hat{j})$ newton acts on a particle of mass 2 kg. Hence the particle is displaced from position $(2\hat{i} + \hat{k})$ metre to position $(4\hat{i} + 3\hat{j} - \hat{k})$ metre. The work done by the force on the particle is:
a) 6 J b) 13 J c) 15 J d) 9 J

259. A plastic ball is dropped from a height of 1m and rebounds several times from the floor. If 1.03 sec elapse from the moment it is dropped to the second impact with the floor, what is the coefficient of restitution?
a) 0.03 b) 0.64 c) 0.02 d) 0.05

260. A rock of mass m is dropped to the ground from a height h. A second rock with mass 2m is dropped from the same height. When second rock strikes the ground, what is its kinetic energy?
a) Twice that of the first rock b) Four times that of the first rock
c) The same as that of the first rock d) Half that of the first rock

261. Two spheres A ard B mass m_1 and m_2 respectively collide. A is at rest initially and B is moving with velocity v along x-axis. After collision B has a velocity $\frac{v}{2}$ direction perpendicular to the original direction. The mass A moves after collision in the direction.
a) Same as that of, B b) Opposite to that of B c) $q = \tan^{-1}(1/2)$ to the x-axis
d) $q = \tan^{-1}(-1/2)$ to the x-axis

262. Figure shows four situations in which a force is applied to a block. In all four cases, the force has the same magnitude, and the displacement of the block is to the right and of the same magnitude. Which of the following cases work done by the applied force on the block is zero?



a) (i) b) (ii) c) (iii) d) (iv)

263. A tennis ball falls freely from a height H on to an inclined smooth plane making an angle 45° with horizontal. After bouncing the ball falls on the plane again. The distance between the two points striking the plane is:
a) $4\sqrt{2}H$ b) $\frac{H}{\sqrt{2}}$ c) $H\sqrt{2}$ d) zero

264. When two bodies collide elastically, then
a) KE of the system alone is conserved b) KE of the system alone is conserved
c) KE of the system alone is conserved d) neither KE nor momentum is conserved

265. A ball of mass m moving with a speed $2v_o$ collides head-on with an identical ball at rest. If e is the coefficient of restitution, then what will be the ratio of velocity of two balls after collision?
a) $\frac{1-e}{1+e}$ b) $\frac{1+e}{1-e}$ c) $\frac{e-1}{e+1}$ d) $\frac{e+1}{e-1}$

266. A weightlifter lifts a weight off the ground and holds it up
a) work is done in lifting as well as holding the weight
b) no work is done in both lifting and holding the weight
c) work is done in lifting the weight but no work is required to done in holding it up
d) no work is done in lifting the weight but work is required to be done in holding it up

267. Electrons used in an electron microscope are accelerated by avoltage of 25 kV. If the voltage is increased to 100 kV then the de-Broglie wavelength associated with the electrons would ___________ .
a) increase by 2 times b) decrease by 2 times c) decrease by 4 time
d) increase by 4 times

268. If a person is pushing a box inside a moving train, the work done in the frame of the earth will be:

a) $\vec{F}.\vec{s_0}$ b) $\vec{F}.\vec{s}$ c) $\vec{F}.\left(\vec{s}+\vec{s_0}\right)$ d) zero

269. A bullet hits and gets embedded in a solid block resting on a frictionless surface. In this process which one of the following is correct?
a) Only momentum is conserved b) Only kinetic energy is conserved
c) Neither momentum nor kinetic energy is conserved
d) Both momentum and kinetic energy are conserved.

270. A block of mass M is attached to the lower end of a vertical spring. The spring is hung from the ceiling and has force constant value k. The mass is released from rest with the spring initially unstretched. The maximum extension produced in the length of the spring will be:
a) 2 Mg/k b) 4 Mg/k c) Mg/2k d) Mg/k

271. Two spheres of same size, one of mass 2 kg and another of mass 4 kg, are dropped simultaneously from the top of Qutub Minar (height =72 m). When they are 1m above the ground, the two spheres have the same:
a) momentum b) kinetic energy c) potential energy d) acceleration

272. If two balls, each of mass 0.06 kg moving in opposite directions with speed 4 m/s collide and rebound with the same speed, then the impulse imparted to each ball due to other is:
a) 0.48 kg-m/s b) 0.24 kg-m/s c) 0.81 kg-m/s d) zero

273. A heavy weight is suspended from a spring. A person raises the weight till the spring becomes slack. The work done by him is W. The energy stored in the stretched spring was E. What will be the gain in gravitational potential energy?
a) W b) E c) W + E d) W-E

274. An object of mass m accelerates uniformly from rest to a speed υ_F in time t_F. The work done on the object as a function of time t in terms of υ_F and t_F is:

a) $W=\frac{1}{2}m\upsilon_F^2 t_F^2 t^2$ b) $W=\frac{1}{2}m\left(\frac{\upsilon_F}{t_F}\right)t^2$ c) W=zero d) $W=\frac{1}{2}m\left(\frac{\upsilon_F}{t_F}\right)^2 t^2$

275. Three particles each of mass m are located at vertices of an equilateral triangle ABC. They start moving with equal speeds each along the medians of the triangle and collide at its centroid G. If after collision A comes to rest and B returns on its path along GB, then C:
a) also comes to rest b) also comes to rest c) moves with a speed along BG
d) moves with a speed along AG

276. Two unequal masses are tied together with a compressed spring. When the cord is burnt with a match releasing the spring the two masses fly apart with equal
a) kinetic energy b) speed c) momentum d) acceleration

277. A crane lifts a mass of 100 kg to a height of 10m in 20 s. The power of the crane is (Take g = 10 m S^{-2})
a) 100 W b) 200 W c) 250 W d) 500 W

278. The work done in lifting water from a well 6 m deep using a bucket of mass 0.5 kg and volume 2.5 litres will be:
a) 176.4J b) 4.764×10^3J c) 276.4J d) 3.76×10^2J

279. A neutron moving with velocity u collides elastically with an atom of mass number A. If the collision is head-on and the initial kinetic energy of neutron is E, then the final kinetic energy of the neutron after collision is:
a) $(\frac{A+1}{A-1})^2 E$ b) $(\frac{A-1}{A+1})^2 E$ c) $(\frac{A-1}{A+1}) E$ d) $(\frac{A+1}{A-1}) E$

280. A block of mass 2 kg initially at rest moves under the action of an applied horizontal force of 6 N on a rough horizontal surface. The coefficient of friction between block and surface is 0.1. The work done by the applied force in 10 s is (Take g = 10 m s^{-2})
a) 200 J b) -200 J c) 600 J d) -600 J

281. A toy gun uses a spring of force constant K. When charged before being triggered in the upward direction, the spring is compressed by a distance x. If the mass of shot is m, on being triggered it will go upto a height of:
a) $\frac{Kx^2}{mg}$ b) $\frac{x^2}{Kmg}$ c) $\frac{Kx^2}{2mg}$ d) $\frac{K^2x^2}{mg}$

282. Assertion: Kilowatt hour is the unit of power.
Reason: One kilowatt hour is equivalent to 3.6×10^5 J.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

283. The angle between force $\vec{F} = (3\hat{i} + 4\hat{j} - 5\hat{k})$ unit and displacement $\vec{d} = (5\hat{i} + 4\hat{j} + 3\hat{k})$ unit is
a) $\cos^{-1}(0.16)$ b) $\cos^{-1}(0.32)$ c) $\cos^{-1}(0.24)$ d) $\cos^{-1}(0.64)$

284. When two spheres of equal masses undergo glancing elastic collision with one of them at rest, after collision they will move
a) opposite to one another b) in the same direction c) together
d) at right angle to each other

285. A source S_1 is producing, 10^{15} photons por second of wavelength 5000. Another source S_2 is producing 1.02×10^{15} photonsper second of wavelength 5100 then, (power of S_2) is equal to___________
a) 1.00 b) 1.02 c) 1.04 d) 0.98

286. A curved surface is shown in figure. The portion BCD is frictionless. There are two spherical balls of identical radii and masses. Balls are released from rest one by one from A which is at a slightly greater height than C. With the surface AB, ball 1 has a small friction and ball 2 has a negligible friction. For which balls is total mechanical energy conserved?

a) 1 and 2 b) 1 c) 2 d) Cannot be predicted

287. In an explosion a body breaks up into two pieces of unequal masses. In this:
a) both parts will have numerically equal momentum
b) lighter part will have more momentum c) heavier part will have more momentum
d) both parts will have equal kinetic energies

288. A simple pendulum is vibrating in an evacuated chamber. It will oscillate with:

a) constant amplitude b) decreasing amplitude c) increasing amplitude
d) none of these

289. A body is acted upon by a force which is inversely proportional to the distance x. The work done will be proportional to:
a) x b) x^2 c) $x^{3/2}$ d) none of these

290. The number of photoelectrons emitted for light of- a frequency v (higher than the threshold frequency vo) is proportional to ________
a) Threshold frequency (v_0) b) Intensity of light c) Frequency of light d) $v - v_0$

291. The earth circles the sun once a year. The work which would have to be done on the earth to bring it to rest relative to the sun is : (Ignore the rotation of the earth about its own axis. Given that mass of the earth = 6×10^{24} kg and distance between the sun and the earth is 1.5×10^8 km)
a) 2.7×10^{30} J b) 2.7×10^{31} J c) -2.7×10^{33} J d) $+ 2.7 \times 10^{33}$ J

292. The kinetic energies in joule at t = 0 and t = 6 see are respectively:
a) 0 and 0 b) 18 m and 18 m c) 0 and 18 m d) 18 m and 0

293. A particle moves in a straight line with retardation proportional to its displacement. Its loss of kinetic energy for any displacement x is proportional to:
a) x^2 b) e^X c) x d) $\log_e x$

294. A bullet of mass m fired at 30° to the horizontal leaves the barrel of the gun with a velocity v. The bullet hits a soft target at a height h above the ground while it is moving downward and emerges out with half the kinetic energy it had before hitting the target. Which of the following statements is correct in respect of bullet after it emerges out of the target?
a) The velocity of the bullet remains the same.
b) The velocity of the bullet will be reduced to half its initial value.
c) The velocity of the bullet will be more than half of its earlier velocity
d) The bullet will continue to move along the same parabolic path.

295. Two men with weights in the ratio 4 : 3 run up a staircase in time in the ratio 12 : 11. The ratio of power of the first to that of second is
a) $\frac{4}{3}$ b) $\frac{12}{11}$ c) $\frac{48}{33}$ d) $\frac{11}{9}$

296. The speed of the earth is:
a) zero b) equal to that of the ball c) greater than that of the ball
d) much less than that of the ball

297. The centripetal acceleration of a particle varies inversely with the square of the radius r of the circular path. The kinetic energy of the particle is directly proportional to:
a) r b) r^2 c) r^{-1} d) r^{-2}

298. The instantaneous power delivered to the body in time t is proportional to:
a) $\frac{V}{T}t$ b) $\frac{V^2}{T}t^2$ c) $\frac{V^2}{T^2}t$ d) $\frac{V^2}{T^2}t^2$

299. Two blocks of wood P and Qare connected with each other through a spring and are placed on a frictionless table. If the spring is compressed and released, then K p : KQ will be equal to
a) $m_Q : m_p$ b) $\sqrt{m_Q}:\sqrt{m_p}$ c) $\sqrt{m_p}:\sqrt{m_q}$ d) $m_p : m_Q$

300. A car of mass m starts from rest and accelerates so that the instantaneous power delivered to the car has a constant magnitude P_o. The instantaneous velocity of this car is proportional to ________

a) t^2P_0 b) $t^{1/2}$ c) $t^{-1/2}$ d) $\frac{t}{\sqrt{m}}$

301. A pump motor is used to deliver water at a certain rate from a given pipe. To obtain, twice as much water from the same pipe, in the same time, the power of motor has to be increased to:
a) 2 times b) 4 times c) 8 times d) 16 times

302. A stone of mass 10 kg is lying at the bed of a lake 5 m deep. If the relative density of the stone is 2, the amount of work done to bring it to the top of the lake will be:
a) 245J b) 285 J c) 345J d) 385J

303. Two identical balls A and B moving with velocities + 0.5 m/s and - 0.3 m/s respectively, collide head on elastically. The velocity of the balls A and B after collision will be respectively ________

a) - 0.3 m/s and + 0.5 m/s b) + 0.3 m/s and 0.5 m/s c) 0.5 m/s and + 0.3 m/s
d) + 0.5 m/s and + 0.3 m/s

304. The wavelength 1, of an electron and λ_p of a photon are of same energy E are related by ________

a) $\lambda_p \propto \lambda_e$ b) $\lambda_p \propto \sqrt{\lambda_e}$ c) $\lambda_p \propto \frac{1}{\sqrt{\lambda_e}}$ d) $\lambda_p \propto \lambda_e^2$

305. A tennis ball is thrown from a-height h above the ground. If the ball strikes to the ground with elastic collision, what height will the ball achieve after the third collision?
a) he^6 b) e^{2}h c) e^{3}h d) None of these

306. At her maximum height, a girl in a swing is 3 m above the ground and at the lowest point she is 2 m above the ground. What is her maximum velocity?
a) $\sqrt{29.4}ms^{-1}$ b) $\sqrt{98}ms^{-1}$ c) $\sqrt{1.6}ms^{-1}$ d) 9.8ms^{-1}

307. The potential energy function for the force between two atoms in a diatomic molecule is approximately given by $U(x) = \frac{a}{x^{12}} - \frac{b}{x^2}$ where a and b are constants and x is the distance between the atoms. If the dissociation energy of the molecules is $D = \left[U(x=\infty) - U_{at \quad equilibriam}\right]$, D is

a) $\frac{b^2}{2a}$ b) $\frac{b^2}{12a}$ c) $\frac{b^2}{4a}$ d) $\frac{b^2}{6a}$

308. A bullet when fired at a target with a velocity of 100 mlsec penetrates one metre into it. If the bullet is fired at a similar target with a thickness 0.5 metre, then it will emerge from it with a velocity of:

a) $5\sqrt{2}$ m/s b) $\frac{50}{\sqrt{2}}$ m/s c) 50 m/s d) 10 m/s

309. Two bodies M and N of equal masses are suspended from two separate springs of spring constants K_1 and K_2 respectively. If the two bodies oscillate vertically such that their maximum velocities are equal, the ratio of the amplitude of vibration of M to that of N is

a) $\frac{K_1}{K_2}$ b) $\sqrt{\frac{K_1}{K_2}}$ c) $\frac{K_2}{K_1}$ d) $\sqrt{\frac{K_2}{K_1}}$

310. A ball is 'thrown on a staircase with the initial velocity u. It will strike with the nth step for what value of x, where band h are the width and height of step respectively?

a) $n = \frac{2hu^2}{b^2g}$ b) $n = \frac{hu^2}{b^2g}$ c) $n = \frac{hu^2}{2b^2g}$ d) $n = \frac{3hu^2}{2b^2g}$

311. The negative of the work done by the conservative internal forces on a system equals to the change in

a) total energy b) kinetic energy c) potential energy d) none of these

312. The potential energy of the balloon:

a) decreases by mgh b) increases by mgh c) increases by mg(l- h)

d) increases by mgl

313. On a frictionless surface, a block of mass M moving at speed v collides elastically with another block of same mass M which is initially at rest. After collision the first block moves at an angle θ to its initial direction and has a speed v/3. The second block's speed after the collision is:

a) $\sqrt{3}/2v$ b) $2\sqrt{2}/3v$ c) 3/4v d) $3/\sqrt{2}$v

314. If a number of forces act on a body and the body is in static or dynamic equilibrium, then:

a) work done by individual forces must be zero b) net work done is +ve

c) net work done is -ve d) net work done is zero

315. In question number 4, the speed of the block at point C, immediately before it leaves the second incline is

a) $\sqrt{120}$ m/s b) $\sqrt{105}$ m/s c) $\sqrt{90}$ m/s d) $\sqrt{75}$ m/s

316. A body is falling freely under the action of gravity alone in vacuum. Which of the following quantities remain constant during the fall?

a) Kinetic energy b) Potential energy c) Total mechanical energy

d) Total linear momentum

317. A bullet of mass 10 g leaves a rifle at an initial veloocity of 1000 m/s and strikes the earth at the same level with a velocity of 500 m/s. The work done in.ioule to overcome the resistance of air will be ____________

a) 375 b) 3750 c) 5000 d) 500

318. During inelastic collision between two bodies, which of the following quantities always remains conserved?

a) Total kinetic energy b) Total mechanical energy c) Total linear momentum

d) Speed of each body

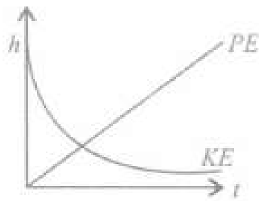
319. In inelastic collision:

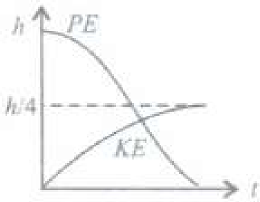
a) momentum, kinetic energy and total energy are conserved

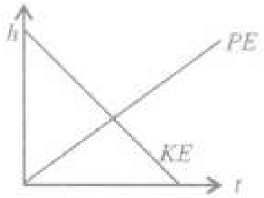
b) momentum, kinetic energy and total energy are not conserved

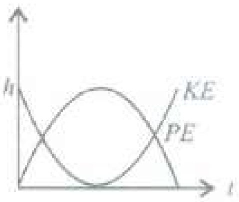
c) momentum and kinetic energy are conserved but total energy is not conserved
d) total energy and momentum are conserved but kinetic energy is not conserved

320. A raindrop falling from a height h above ground, attains a near terminal velocity when it has fallen through a height $\frac{3}{4}h$. Which of the diagrams shown in figure correctly shows the change in kinetic and potential energy of the drop during its fall up to the ground?

a) 

b) 

c) 

d) 

321. The height of the dam, in a hydroelectric power station is 10m. In order to generate 1MW of electric power, the mass of water (in kg/s) that must fall per second on the blades of the turbines is
a) 10^6 b) 10^5 c) 10^3 d) 10^4

322. The recoil velocity of a 4.0 kg rifle that shoots a 0.050 kg bullet at a speed of 280 ms $^{-1}$ is:
a) +3.5ms^{-1} b) -3.5ms^{-1} c) $-\sqrt{3.5}ms^{-1}$ d) $+\sqrt{3.5}ms^{-1}$

323. A body of mass 5 kg falls from a height of 20 m on the ground and it rebounds to a height of 0.2 m. If the loss in potential energy is used up by the body, then what will be the temperature rise? (Specific heat of the material = 0.09 cal gm^{-1} °C^{-1})
a) 5°C b) 4°C c) 8°C d) None of these

324. bullet of mass 10 g moving horizontally with a velocity of 400 m s $^{-1}$ strikes of wooden block of mass 2 kg which is suspended by a light inextensible string of length 5m. As aresult the centre of gravity of the block is found to rise a vertical distance of 10 cm. The speed of the bullet after it emerges out horizontally from the block will be
a) 160 m s^{-1} b) 100 m s^{-1} c) 80 m s^{-1} d) 120 m s^{-1}

325. A person holding a rifle (mass of person and rifle together is 100 kg) stands on a smooth surface and fires 10 shots horizontally, in 5 s. Each bullet has a mass of 10 g with a muzzle velocity of 800 ms^{-1}. The final velocity acquired by the person and the average force exerted on the person are __________
a) $-1.6\ \mathrm{ms}^{-1}$; 8 N b) $-0.08\ \mathrm{ms}^{-1}$; 16 N c) $-0.8\ \mathrm{ms}^{-1}$; 8 N d) $1.6\ \mathrm{ms}^{-1}$; 16 N

326. A body is being raised to a height h from the surface of earth. What is the sign of work done by applied force and gravitational force respectively?
a) Positive, Positive b) Positive, Negative c) Negative, Positive d) Negative, Negative

327. The human hean discharges 75 cc of blood through the arteries at each beat against an average pressure of 10 em of mercury. Assuming that the pulse frequency is 72 per minute, the rate of working of heart is: (Density of mercury = 13.6 gm/cc and g = 9.8m/s^2)

a) 11.9W b) 1.19W c) 0.119W d) 119W

328. A running man has half the kinetic energy than a boy of half his mass has. The man speeds up by 1 m/sec and then has the same kinetic energy as the boy. What were the origin a speeds (in m s-I) of the man and the boy respectively?
a) 2.4, 4.8 b) 2.4, 3.4 c) 3.4,4.8, d) 3.4,6.8

329. Two balls at the same temperature collide, which is conserved?
a) Temperature b) Velocity c) Kinetic energy d) Momentum

330. A uniform chain of length 2 m is kept on a table such that a length of 60 cm hanges freely from the edge of the table. The total mass of the chain is 4 kg. The work done in pulling the entire chain on the table (Take g = 10m s^{-2})
a) 12.9 J b) 6.3 J c) 3.6 J d) 2.0 J

331. A uniform chain has a mass m and length l. It is held on a frictionless table with one-sixth of its length hanging over the edge. The work done in just pulling the hanging part back on the table is:
a) $\frac{mgl}{72}$ b) $\frac{mgl}{36}$ c) $\frac{mgl}{12}$ d) $\frac{mgl}{6}$

332. The string of a pendulum is of length l. It is made horizontal and then left. A nail is located at a distance d below the point of suspension. For the ball to completely swing around in a circle centred on the nail, the value of d in terms of length l is:
a) 0.5l b) 0.6l c) 0.4l d) 0.25l

333. A litre of petrol, on complete combustion, gives off heat equivalent to 3×10^7 J. In a test drive, a car weighing 1200 kg, including the mass of driver, runs 15 km/litre, while moving with a uniform speed on a straight track. Assuming that friction offered by the road surface and air to be uniform. Calculate the force of friction acting on the car during the test drive, if the efficiency of the car engine were 0.5.
a) 100 N b) 1000 N c) 500 N d) 5000 N

334. A force of 10N displaces an object by 10 m. If work done is 50 J, then direction of force, make an angle with the direction of displacement:
a) 120^0 b) 90° c) 60° d) none of these

335. When a spring is wound, a certain amount of PE is stored in it. If this wound spring is dissolved in acid, the stored energy:
a) is completely lost b) appears in the form of electromagnetic waves
c) appears in the form of heat raising the temperature of acid
d) appears in the form of KE by splashing acid drops

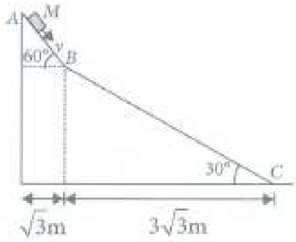
336. If K_I and K_F represent the initial and final kinetic energies of the system respectively, then:
a) $K_I = K_F = 0$ b) $K_I = 0, K_F < 0$ c) $K_I = 0, K_F > 0$ d) $K_I > O, K_F > 0$

337. An engine is attached to a wagon through a shock absorber of length 1.5 m. The system with a total mass of 50,000 kg is moving with a speed of 36 km/h, when the brakes are applied to bring it to rest. In the process of the system being brought to rest, the spring of the shock absorber gets compressed by 1.0 m. If 90% of energy of the wagon is lost due to friction, calculate the spring constant.
a) 10^4 N/m b) 6×10^2 N/m c) 5×10^5 N/m d) 3×10^4 N/m

338. A cable pulls a box with force of 5 kN and raises it at the rate of 2 m s-I. What is the power of the engine providing tension to the cable?
a) 2 kW b) 2.5 kW c) 5 kW d) None of these

339. The work done against force of friction is
a) 8.7 J b) 10.7 J c) 7.8 J d) 12.7 J

340. A small block of mass M moves on a frictionless surface of an inclined plane, as shown in the figure. The angle of the incline suddenly changes from 60° to 30° at point B. The block is initially at rest at A. Assume that collisions between the block and the incline are totally inelastic. The speed of the block at point B immediately after it strikes the second incline is



a) $\sqrt{60}$ m/s b) $\sqrt{45}$ m/s c) $\sqrt{30}$ m/s d) $\sqrt{15}$ m/s

341. If a body is placed on another body and is moving with it, then work done by frictional force on the upper body relative to ground is:
a) -ve b) zero c) +ve d) unity

342. Two similar springs P and Q have spring constants K_P and K_Q, such that $K_P > K_Q$. They are stretched, first by the same amount (case a,) then by the same force (case b). The work done by the springs W_P and W_Q are related as, in case (a) and case (b), respectively __________.
a) $W_P = W_Q; W_P = W_Q$ b) $W_P > W_Q; W_Q > W_P$ c) \(W_{P} d) $W_P = W_Q; W_P > W_Q$

343. block of mass 2 kg is dropped from a height of 40 cm on a spring whose force-constant is 1960 N m^{-1}. The maximum distance through which the spring is compressed by :
a) 5 cm b) 15 cm c) 20 cm d) 10 cm

344. The work done by applied force is
a) 10 J b) 50 J c) 100 J d) 12.7 J

345. A body just dropped from a tower explodes into two pieces of equal mass in mid-air. Which of the following is not possible?
a) Each part will follow parabolic path b) Only one part will follow parabolic path
c) Both parts move along a vertical line
d) One part reaches the ground earlier than the other

346. A shell is fired from a cannon with velocity v m/s at an angle e with the horizontal direction. At the highest point in its path, it explodes into two pieces of equal mass. One of the pieces retraces its path to the cannon and the speed (in m/s) of the other piece immediately after the explosion is:

a) $3v\cos\theta$ b) $2v\cos\theta$ c) $\frac{3v}{2}\cos\theta$ d) $\frac{\sqrt{3}v\cos\theta}{2}$

347. Water falls from a height of 60 m at the ratio of 15 kg/s to operate a turbine. The losses due to frictional forces are 10% of energy. How much power is generated by the turbine? ($g = 10m/s^2$)

a) 12.3 kW b) 7.0 kW c) 8.1 kW d) 10.2 kW

348. A body of mass 1000 kg is moving horizontally with a velocity 50 m/s. A mass of 250 kg is added. Find the final velocity:

a) 40 m/s b) 20 m/s c) $30\sqrt{2}\ m/s$ d) 50 m/s

349. Consider a one-dimensional motion of a particle with total energy E. There are four regions A, B, C and D in which the relation between potential energy V, kinetic energy K and total energy E is as given below:

Region A : V > E Region B : V < E

Region C : K > E Region D : V > K

Which of the following regions the particle cannot be found?

a) Region A b) Region B c) Region C d) Region D

350. α-parlicle consists of ___________

a) 2 electrons,2 protons and 2 neutrons b) 2 electrons and 4 protons only

c) 2 protons only d) 2 protons and 2 neutrons only

351. If g is acceleration due to gravity on the earth's surface, the gain in the potential energy of an object of mass m raised from surface of the earth to a height equal to radius R of the earth is:

a) $\frac{1}{2}$mgR b) 2mgR c) mgR d) $\frac{1}{4}$ mgR

352. A spherical ball of mass 20 kg is stationary at the top of a hill of height 100 m. It rolls down a smooth surface to the ground, then climbs up another hill of height 30 m and finally rolls down to a horizontal base at a height of 20 m, above the ground. The velocity attained by the ball is:

a) 10 m/s b) 30 m/s c) 40 m/s d) 20 m/s

353. Monochromatic light of wavelength 667 nm is produced by a helium neon laser. The power ernitted is 9 m W. The number of photons arriving per sec on the average at a target irradiated by this beam is _________

a) 3×10^6 b) 9×10^{15} c) 3×10^{19} d) 9×10^{17}

354. A neutron having mass of 1.67×10^{-27} kg and moving at 108 m/s collides with a deutron at rest and sticks to it. If the mass of the deutron is 3.34×10^{-27} kg; the speed of the combination is:

a) 2.56×10^3 m/s b) 2.98×10^5 m/s c) 3.33×10^7 m/s d) 5.01×10^9 m/s

355. A mass of 20 kg moving with a speed of 10 m/s collides with another stationary mass of 5 kg. As a result of the collision, the two masses stick together. The kinetic energy of the composite mass will be:

a) 600 J b) 1000 J c) 800 J d) 1200 J

356. Light of two different frequencies whose photons have energies 1eV and 2.5eV respectively illuminate a metallic surface whose work function is 0.5 eV successively. Ratio of maximurn speeds of emitted electrons will be _________

a) 1:4 b) 1:2 c) 1:1 d) 1:5

357. A body constrained to move along y-axis is subjected to a constant force $\vec{F} = -\hat{i} + 2\hat{j} + 3\hat{k}$N. The work done by this force in moving the body a distance of 4 m along y-axis is

a) 4 J b) 8 J c) 12 J d) 24 J

358. A 50 kg mass is travelling at a speed of 2 m/s. Another 60 kg mass is travelling at a speed of 12 m/s in the same direction, strikes the first mass. After the collision the 50 kg mass is travelling with a speed of 4 m/s. The coefficient of restitution of the collision is:

a) $\frac{19}{30}$ b) $\frac{30}{19}$ c) $\frac{20}{11}$ d) $\frac{11}{20}$

359. If the ball is thrown towards the surface of the earth:

a) the earth remains stationary while the ball moves downwards

b) the ball remains stationary while the earth moves upwards

c) the ball and the earth move towards each other

d) the ball and the earth move away from each other

360. When a constant force is applied to a body moving with constant acceleration, power does not remain constant. For power to be constant, the force has to vary with speed as follows:

a) $F \propto \frac{1}{v}$ b) $F \propto \frac{1}{\sqrt{v}}$ c) $F \propto v$ d) $F \propto v^2$

361. Two putty balls of equal mass moving with equal velocity in mutually perpendicular directions, stick together after collision. If the balls were initially moving with a velocity of $45\sqrt{2}$ ms^{-1} each, the velocity of their combined mass after collision is:

a) $22.5\sqrt{2}$ ms^{-1} b) 90 ms^{-1} c) 45 ms^{-1} d) 5 ms^{-1}

362. A simple pendulum of mass 200 gm and length 100 cm is moved aside till the string makes an angle of 60° with the vertical. The kinetic and potential energies of the bob, when the string is inclined at 30° to the vertical, are:

a) 7.174 x 10^6 erg, 2.626 x 10^6 erg b) 7.174 x 10^6 erg, 2.626 x 10^6 erg

c) 2.6 x 10^6 erg, 5.6 x 10^6 erg d) 3.6 x 10^6 erg, 6.2 x 10^6 erg

363. Two particles having position vectors $\vec{r}_1 = (3\hat{i} + 5\hat{j})$ metres and $\vec{r}_2 = (-5\hat{i} - 3\hat{j})$ metres are moving with velocities $\vec{v}_1 = (4\hat{i} + 3\hat{j})$ and $\vec{v}_2 = (a\hat{i} + 7\hat{j})$ m/s. If they collide after 2 seconds, the value of a is:

a) 2 b) 4 c) 6 d) 8

364. In a ballistics demonstration a police officer fires a bullet of mass 50 g with speed 200 m S-I on soft plywood of thickness 2 cm. The bullet emerges with only 10% of its initial kinetic energy. The emergent speed of the bullet is

a) $2\sqrt{10}$ms^{-1} b) $20\sqrt{10}$ms^{-1} c) $10\sqrt{2}$ms^{-1} d) $10\sqrt{20}$ms^{-1}

365. If K E and K B are the kinetic energies of the earth and the ball respectively, then:

a) $\frac{K_E}{K_B} = 1$ b) $\frac{K_E}{K_B} = \frac{m}{M}$ c) $\frac{K_E}{K_B} = \frac{M}{m}$ d) $\frac{K_E}{K_B} = \frac{m^2}{M^2}$

366. During an inelastic collision of two particles

a) $(KE)_{final}$ =$(KE)_{initial}$ b) $(KE)_{final\ must}$ be greater than $(KE)_{initial}$

c) $(KE)_{final\ must}$ be less than $(KE)_{initial}$ d) $(KE)_{final}$ may be greater or less than $(KE)_{initial}$

367. Two bodies with masses M_l and M_2 have equal kinetic energies. If P_l and P_2 are their respective momenta, then P_1 / P_2 is equal to:
a) $M_1 : M_2$ b) $M_1^2 : M_2^2$ c) $M_1^2 : M_2^2$ d) $\sqrt{M_1} : \sqrt{m_2}$

368. A smooth sphere is moving on a horizontal surface with velocity vector $2\hat{i} + 2\hat{j}$ immediately before it hits a vertical wall. The wall is parallel to $\hat{j}$ vector and the coefficient of restitution between the sphere and the wall is e = $\frac{1}{2}$ The velocity vector of the sphere after it hits the wall is:
a) $\hat{i} - \hat{j}$ b) $-\hat{i} + 2\hat{j}$ c) $-\hat{i} - \hat{j}$ d) $2\hat{i} - \hat{j}$

369. A certain metallic surface is illuminated with monochromatic light of wavelength 1. The stopping potential forphoto-electric current for this light is $3V_o$. If the same surface is illuminated with light of wavelength 21, the stopping potential is V_o. The threshold wavelength for this surface for photo-electric effect is ____________
a) 4λ b) $\frac{\lambda}{4}$ c) $\frac{\lambda}{6}$ d) 61

370. The velocity of a particle at which the kinetic energy is equal to its rest energy is:
a) $\left(\frac{3c}{2}\right)$ b) $3\frac{c}{\sqrt{2}}$ c) $\frac{(3c)^{1/2}}{2}$ d) $\frac{c\sqrt{3}}{2}$

371. An electron and a proton are moving under the influence of mutual forces. In calculating the change in the kinetic energy of the system during motion, one ignores the magnetic force of one on another. This is because,
a) the two magnetic forces are equal and opposite, so they produce no net effect
b) the magnetic forces do no work on each particle.
c) the magnetic forces do equal and opposite (but non-zero) work on each particle.
d) the magnetic forces are necessarily negligible.

372. Assertion: A spring has potential energy, when it is either compressed or stretched.
Reason: In compressing or stretching a spring, work is done on it against the restoring force.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

373. Two balls A and B of mass 0.10 kg and 0.25 kg respectively are connected by a stretched spring of negligible mass and placed on a smooth table. When the balls are released simultaneously, the initial acceleration of ball B is 10 cm/s^2 westward. The magnitude and direction of acceleration of the ball A are
a) 2.5 cm/sec ^{2} , westward b) 2.5 cm/sec ^{2} , eastward c) 25 cm/sec ^{2} , westward
d) 25 cm/sec ^{2} , eastward

374. Power supplied to a particle of mass 2 kg varies with time as $\boldsymbol{P} = \frac{3t^2}{2}$ watt. Here, I is in seconds. If velocity of particle at t = 0 is υ = 0, the velocity of particle at time t = 2 s will be:
a) 1 m/s b) 4 m/s c) 2 m/s d) $2\sqrt{2}m/s$

375. A particle moves from a point $(-2\hat{i}+5\hat{j})$ to $(4\hat{j}+3\hat{k})$ when a force of $(4\hat{i}+3\hat{j})$ N is applied. How much work has been done by the force?

a) 8 J b) 11 J c) 5 J d) 2 J

376. Which of the following statements is wrong?

a) KE of a body is independent of the direction of motion

b)

In an elastic collision of two bodies, the momentum and energy of each body is conserved

c) If two protons are brought towards each other, the PE of the system increases

d) A body can have energy without momentum.

377. Which one of the following is not a conservative force?

a) Force of friction b) Magnetic force c) Gravitational force d) Electrostatic force

378. Assertion: A light body and a heavy body have same momentum. Then they also have same kinetic energy.

Reason: Kinetic energy does not depend on mass of the body.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

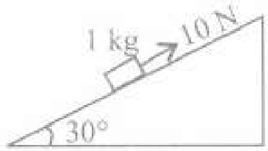
b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

379. A block of mass 1 kg is pushed up a surface inclined to horizontal at an angle of 30° by a force of 10 N parallel to the inclined surface as shown in the figure.

The coefficient of friction between block and the incline is 0.1. If the block is pushed up by 10 m along the incline, then the work against gravity is (Take g = 10 ms^{-2})



a) 10 J b) 50 J c) 100 J d) 150 J

380. One man takes 1 minute to raise a box to a height of 1 metre and another man takes 1/2 minute to do so. The energy of the two is

a) different b) same c) energy of the first is more d) energy of the second is more

381. Identify the false statement from the following.

a) Work-energy theorem is not independent of Newton's second law.

b) Work-energy theorem holds in all inertial frames

c) Work done by friction over a closed path is zero d) Work done is a scalar quantity.

382. A body of mass m, moving with uniform velocity of 40 m/sec, collides with another mass m_2 at least and then the two together begin to move with a uniform velocity of 30 m/sec. The ratio of their masses (m_1/m_2) is:

a) 0.75 b) 1.33 c) 3.0 d) 4.0

383. A machine has an efficiency of 25%. Energy is fed into the machine at the rate of 1 kW. The output of the machine is:

a) 40 W b) 250 W c) 750 W d) 25 kW

384. A pendulum bob of mass m is hanging from a fixed point by a light thread of length l. A horizontal speed V_o is imparted to the bob so that it takes up horizontal position. If g is the acceleration due to gravity, then V_o is:

a) mgl b) $\sqrt{2gl}$ c) $\sqrt{gl}$ d) gl

385. A light body A and a heavy body B have equal linear momentum. Then the KE of the body A:

a) is equal to that of B b) is greater than that of B c) is smaller than that of B d) is zero

386. Assertion: For two bodies, the sum of the mutual forces exerted between them is zero from Newton's third law.

Reason: The sum of work done by the two forces must always cancel.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

387. out of the following which energy ofsystem is conserved?

a) Potential energy b) Mechanical energy c) None of these d) Kinetic energy

388. Water is flowing in a river at 2 m S^{-1}. The river is 50 m wide and has an average depth of 5 m. The power available from the current in the river is (Density of water = 1000 kg m^{-3})

a) 0.5 MW b) 1 MW c) 1.5 MW d) 2 MW

389. Energy required to break one bond in DNA is

a) 10^{-10} J b) 10^{-18} J c) 10^{-7} J d) 10^{-20} J

390. A ball of mass M_1 collides elastically and head-on with another ball of mass M_2 which is initially at rest. In which of the following cases the transfer of momentum will be maximum?

a) $M_1 = M_2$ b) $M_1 > M_2$ c) M_1 2 d) Data is not sufficient to predict it

391. Two bodies with kinetic energies in the ratio 4 : 1 are moving with equal linear momentum. The ratio of their masses is _______

a) 1:2 b) 1:1 c) 4:1 d) 1:4

392. A particle of mass m moving with velocity v collides with a stationary particle of mass 2m. The speed of the system after collision will be:

a) v/2 b) 2v c) v/3 d) 3v

393. An explosion breaks a rock into three parts in a horizontal plane. Two of them go off at right angles to each other. The first part of mass 1 kg moves with a speed of 12 ms^{-l} and the second part of mass 2 kg moves with speed 8 ms^{-1}. If the third part flies off with speed 4 ms^{-l} then its mass is __________

a) 5Kg b) 7Kg c) 17Kg d) 3Kg

394. A moving block having mass m, collides with another stationary block having mass 4m. The lighter block fomes to rest after collision. When the initial velocity of the lighter block is v, then the value of coefficient of restitution (e) will be:

a) 0.8 b) 0.25 c) 0.5 d) 0.4

395. Which of the following remains constant for an isolated system?

a) Sum of kinetic energy and potential energy b) Kinetic energy c) Potential energy

d) None of the above

396. A particle acted upon by constant force $4\hat{i}+\hat{j}-3\hat{k}$ and $3\hat{i}+\hat{j}-\hat{k}$ is displaced from the point $i+2\hat{j}+3\hat{k}$ to point $5\hat{i}+4\hat{j}+\hat{k}$. The total work done by the forces in SI unit is

a) 20 b) 40 c) 50 d) 30

397. A variable force, given by the 2-dimensional vector $\vec{F}=\left(3x^2\hat{i}+4\hat{j}\right)$, acts on a particle. The force is in newton and x is in metre. What is the change in the kinetic energy of the particle as it moves from the point with coordinates (2, 3) to (3, 0)? (The coordinates are in metres.)

a) -7 J b) zero c) +7 J d) + 19 J

398. A bird resting on the floor of an airtight box which is being carried by a boy, starts flying. The boy feels that now the box:

a) is heavier b) is lighter c) shows no change in weight

d) is lighter in the beginning and heavier later

399. A cannon after firing recoils due to:

a) conservation of energy b) backward thrust of gases produced

c) Newton's third law of motion d) Newton's first law of motion

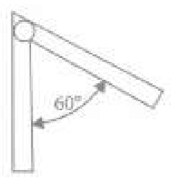
400. If K_R and KB the kinetic energies of rifle and bullet respectively, then:

a) $\frac{K_R}{K_B}=1$ b) $\frac{K_R}{K_B}=\frac{m}{M}$ c) $\frac{K_R}{K_B}=\frac{M}{m}$ d) $\frac{K_R}{K_B}=\frac{m^2}{M^2}$

Ravi Maths Tuition Centre

Time : 1 Mins **WORK POWER ENERGY 2 1** **Marks : 628**

1. In a tug of war, both the teams A and B remained equal
   a) work done by team A is positive b) work done by team B is positive
   c) work done by both the teams is negative d) work done by both the teams is zero
2. A spring is held compressed so that its stored energy is 2.4 J. Its ends are in contact with masses 1 g and 48 g placed on a frictionless table. When the spring is released, the heavier mass will acquire a speed of:
   a) $\frac{2.4}{49} ms^{-1}$ b) $\frac{2.4 \times 48}{49} ms^{-1}$ c) $\frac{10^3}{7} cms^{-1}$ d) $\frac{10^6}{7} cms^{-1}$
3. A metre stick weighing 600 g, is displaced through an angle of 60° in vertical plane as shown. The change in its potential energy is (g = 10 m s^{-2})



   a) 1.5 J b) 15 J c) 30 J d) 45 J
4. At certain point, the potential and kinetic energies of a body of mass 100 gm projected vertically up are 3.6 x 10^7 erg and 6.2 x 10^7 erg respectively. The maximum height reached by the body and the velocity with which it is projected from the ground are:
   a) 10 m, 14 m/s b) 15 m, 19 m/s c) 10 m, 24 m/s d) 20 m, 247 m/s
5. A 30 m deep well is having water upto 15 m. An engine evacuates it in one hour. The power of the engine, if the diameter of the well is 4 m is
   a) 11.55 kW b) 1155 kW c) 23.10 kW d) 2310 kW
6. The KE acquired by a mass m in travelling a certain distance d, starting from rest, under the action of a constant force is directly proportional to ______________
   a) $\frac{1}{\sqrt{m}}$ b) independent of m c) m d) $\sqrt{m}$
7. A mass of 50 kg is raised through a certain height by a machine whose efficiency is 90%; the energy spent is 5000 1. If the mass is now released, its KE on hitting the ground shall be:
   a) 5000J b) 4500J c) 4000J d) 5500J
8. A person holds a bucket of weight 60 N. He walks 7 m along the horizontal path and then climbs up a vertical distance of 5 m. The work done by the man is:
   a) 300 N-m b) 420 N-m c) 720 N-m d) none of these

9. A ball moving with velocity 2 m/s collides head on with another stationary ball of double the mass. If the coefficient of restitution is 0.5, then their velocities (in m/s) after collision will be:
   a) 0,1 b) 1,1 c) 1,0.5 d) 0,2
10. On a stationary sail boat air is blown from a fan attached to the boat. The boat will:
   a) not move b) spin around c) move in the direction in which air is blown
   d) move in a direction opposite to that in which air is blown
11. A quarter horse-power motor runs at a speed of 600 rpm. Assuming 40% efficiency the work done by the motor in one rotation will be:
   a) 7.46 J b) 7400 J c) 7.46 ergs d) 74.6 J
12. When a long spring is stretched by 2 cm, its potential energy is U. If the spring is stretched by 10 cm, the potential energy stored in it will be ____________
   a) 25U b) U/5 c) 5U d) 10U
13. A pump is required to lift 1000 kg of water per minute from a well of depth 10m and eject it with a speed of 10m s^{-1}. The horse-power of the engine needed is: (Assume g = 10m/sec ^{2})
   a) 3.33 b) 4.33 c) 5.35 d) 2.35
14. When the bob of a simple pendulum swings, the work done by tension in the string is:
   a) >0 b) =0 c) zero d) maximum
15. A body falls from a height of 16 m and rebounds to a height of 4 m. The coefficient of restitution is:
   a) $\frac{1}{4}$ b) $\frac{1}{2}$ c) $\frac{3}{4}$ d) $\frac{1}{8}$
16. A man pushes a wall but fails to displace it, it does
   a) negative work b) positive work c) no work at all d) maximum positive work
17. A simple pendulum hanging freely and at rest is vertical because in that position:
   a) kinetic energy is zero b) kinetic energy is minimum c) potential energy is zero
   d) potential energy is minimum
18. In the Davisson and Germer experiment, the velocity of electrons emitted from the electron gun can be increased by __________
   a) increasing the potential difference between the anode and filament
   b) increasing the filament current c) decreasing the filament current
   d) decreasing the potential difference between the anode and filament
19. When a body moves in a circular path, no work is done by the force since:
   a) there is no net force b) there is no displacement
   c) force is always away from the centre
   d) force and displacement are perpendicular to each other
20. Choose the INCORRECT statement:

a)
No work is done if the displacement is perpendicular to the direction of the applied force.
b)
If the angle between the force and displacement vectors is obtuse, then the work done is negative
c) Frictional force is non-conservative d) All the central forces are non-conservative

21. After perfectly inelastic collision between two identical particles moving with same speed in different directions the speed of the particles become half the initial speed. The angle between velocities of the two before collision is:
a) 60^o b) 45^o c) 120^o d) 30^o

22. Water falls from a height of 60 m at the rate of 15 kg/s to operate a turbine. The losses due to frictional force are 10% of energy. How much power is generated by the turbine?
a) 8.1kW b) 10.2kW c) 12.3kW d) 7.0kW

23. The potential energy (in joule) of a body of mass 2 kg moving in the XY -plane is given by U = 6x + 8y, where x and y are in metres. If the body is at rest at point (6 m, 4 m) at time t = 0, it will cross y-axis at time t equal to:
a) $\sqrt{2}s$ b) 2s c) 3s d) 4s

24. The power of a heart which pumps 5 x 10^3 cc of blood per minute at a pressure of 120 mm of mercury is: (g = 10 m s-2 and density of Hg = 13.6x 10^3 kg/m^3)
a) 1.36 W b) 13.6 W c) 0.136 W d) 136 W

25. A solid cylinder of mass 3 kg is rolling on a horizontal surface with velocity 4 ms^{-1}. It collides with a horizontal spring of force constant 200 Nm^{-1}. The maximum compression produced in the spring will be __________
a) 0.5m b) 0.6m c) 0.7m d) 0.2m

26. A stationary particle explodes into two pieces of masses m_1 and m_2 which move in opposite directions with velocities v_1 and v_2. The ratio of their kinetic energies E_1/E_2 is:
a) 1 b) m_1/m_2 c) m_2/m_1 d) m_1v_2/m_2v_1

27. A body of mass 0.5 kg travels in a straight line with velocity $v = kx^{3/2}$ where $k = 5m^{-1/2}\ s^{-1}$. The work done by the net force during its displacement from x = 0 to x = 2 m is :
a) 1.5 J b) 50 J c) 10 J d) 100 J

28. A 10 kg object collides with stationary 5 kg object and after collision they stick together and move forward with velocity 4 ms^{-1}. What is the velocity with which the 10 kg object hit the second one?
a) $4ms^{-1}$ b) $6ms^{-1}$ c) $10ms^{-1}$ d) $12ms^{-1}$

29. 1 kilowatt hour (kWh) is equal to :
a) 2.25 x 10^{23}eV b) 2.25 x 10^{25}eV c) 2.25 x 10^{27}eV d) 2.25 x 10^{22}eV

30. A ping-pong ball of mass m is floating in air by a jet of water emerging out of a nozzle. If the water strikes the ping-pong ball with a speed v and just after collision water falls dead, the rate of flow of water in the nozzle is equal to:

a) $\frac{2mg}{v}$ b) $\frac{mv}{g}$ c) $\frac{mg}{v}$ d) none of these

31. A body of mass 5 kg strikes another body of mass 2.5 kg initially at rest. The bodies after collision coalesce and begin to move as a whole with a kinetic energy of 5 J. The kinetic energy of the first body before collision is:
a) 7.5 J b) 5 J c) 2.5 J d) 10 J

32. A force of 250N is required to lift a 75 kg mass through a pulley system. In order to lift the mass through 3 m, the rope has to be pulled through 12m. The efficiency of system is ___________
a) 50% b) 75% c) 33% d) 90%

33. A body is acted upon by a force which is proportional to the distance covered. If distance covered be denoted by x, then work done by the force will be proportional to:
a) x b) x^2 c) $x^{3/2}$ d) none of these

34. Monochromatic radiation emitted when electron on hydrogcn atom jumps from first excited to the ground state irradiates a photosensitive material. The stopping potential is measured to be 3.57 V. The threshold frequency of the materials is ____________ .
a) 4×10^{15} Hz b) 5×10^{15}Hz c) 1.6×10^{15}Hz d) 2.5×10^{15}Hz

35. A particle of mass m at rest is acted upon by a force P for a time l. Its kinetic energy after an interval t is:
a) $\frac{P^2t^2}{m}$ b) $\frac{P^2t^2}{2m}$ c) $\frac{P^2t^2}{3m}$ d) $\frac{Pt}{2m}$

36. A truck and a car moving with the same kinetic energy are brought to rest by the application of brakes which provide equal retarding forces. Which of them will come to rest in a shorter distance?
a) The truck b) The car c) Both will travel the same distance before coming to rest
d) Cannot be predicted

37. A bus can be stopped by applying a retarding force F when it is moving with a speed u on a level road. The distance covered by it before coming to rest is s. If the load of the bus increases by 50% because of passengers, for the same speed and same retarding force, the distance covered by the bus to come to rest shall be:
a) 1.5 s b) 2 s c) 1 s d) 2.5 s

38. Assertion: Work done by the friction or viscous force on a moving body is negative.
Reason : Work done is a scalar quantity which cannot be negative like mass.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

39. A bullet gets embedded in a solid block resting on a frictionless surface. In this process:
a) momentum is conserved b) kinetic energy is conserved
c) potential energy is conserved d) both (a) and (b)

40. The distance covered by a body to come to rest when it is moving with a speed of 4 m s-l is s, when a retarding force F is applied. If the KE is doubled, the distance covered by it to come to rest for the same retarding force F is:
a) 4s b) 6s c) 2s d) 8s

41. In case of motion of a charged particle in a magnetic field, work done by the magnetic force is always:
a) zero b) > 0 c) < 0 d) minimum

42. A body of mass 3 kg acted upon by a' constant force is displaced by S meter, given by relation $S=\frac{1}{3}t^2$ where t is in second. Work done by the force in 2 seconds is :
a) $\frac{8}{3}J$ b) $\frac{19}{5}J$ c) $\frac{5}{19}J$ d) $\frac{3}{8}J$

43. Two identical mass M moving with velocity u_1 and u_2 collide perfectly inelastically. The loss in energy is:
a) $\frac{M}{2}(u_2-u_1)^2$ b) $\frac{M}{2}(u_1-u_2)^2$ c) $\frac{M}{4}(u_1-u_2)^2$ d) $\frac{M}{4}(u_2-u_1)^2$

44. A pendulum consists of a wooden bob of mass m and of length l. A bullet of mass m) is fired towards the pendulum with a speed v_0 .The bullet emerges out of the bob with a speed $v_1/3$ and the bob just completes motion along a vertical circle. Then v_1 is:
a) $\left(\frac{m}{m_1}\right)\sqrt{5gl}$ b) $\frac{3}{2}\left(\frac{m}{m_1}\right)\sqrt{5gl}$ c) $\frac{3}{2}\left(\frac{m}{m_1}\right)\sqrt{5gl}$ d) $\left(\frac{m_1}{m}\right)\sqrt{gl}$

45. A bullet weighing 50 gm leaves the gun with a velocity of 30 m/s. If the recoil speed imparted to the gun is1m/s, the mass of the gun is:
a) 15 kg b) 30 kg c) 1.5 kg d) 20 kg

46. A car accelerates from rest to a speed of 10 m s^{-1} . Let the energy spent be E. If we accelerate the car from 10 m s^{-1} to 20 m s^{-1} , the energy spent will be:
a) E b) 2E c) 3E d) 4E

47. A particle of mass m, strikes on ground with angle of incidence 45°. If coefficient of restitution $e=1\sqrt{2}$, the velocity of reflection is:
a) $\frac{\sqrt{3}}{2}v$ b) $\sqrt{3}v$ c) $\frac{1}{2}v$ d) $\sqrt{3}v$

48. horizontal cable accelerates a package across a frictionless horizontal floor. The amount of work that has been done by the cable's force on the package is given by W(t) = (0.20 J/s^2) r. The average power due to cable's force in the time interval t_l = 5s to t_2: = 10s and instantaneous power at t = 3s are:
a) 2.0 W, 1.80 W b) 2.0 W, 1.20 W c) 3.0 W, 1.80 W d) 3.0 W, 1.20 W

49. A ball impinges directly on a similar ball at rest. The first ball is brought to rest by the impact. If half of the kinetic energy is lost by impact, the value of coefficient of restitution is:
a) $\frac{1}{2\sqrt{2}}$ b) $\frac{1}{\sqrt{3}}$ c) $\frac{1}{\sqrt{2}}$ d) $\frac{\sqrt{3}}{2}$

50. The kinetic energy of a body becomes four times its initial value. The new momentum will be:
a) same as the initial value b) twice the initial value c) thrice the initial value
d) thrice the initial value

51. A bullet of mass 20 g moving with 600 m/s, collides with a block of mass 4 kg hanging with the string. What is velocity of the bullet when it comes out of block, if block rises to height 0.2 m after collision?
a) 200 m/s b) 150 m/s c) 400 m/s d) 300 m/s

52. A running man has the same kinetic energy as that of a boy of half his mass. The man speeds up by 2 ms^{-1} and the boy changes his speed by x ms^{-1} so that the kinetic energies of the boy and the man are again equal. Then x (in ms^{-1}) is:
a) $-2\sqrt{2}$ b) $+2\sqrt{2}$ c) $\sqrt{2}$ d) 2 e) $1\sqrt{2}$

53. Which of the following units is a unit of power?
a) kilowatt hour b) watt c) erg d) calorie

54. A body of mass 2 kg moving with a velocity of 6 m/s strikes inelastically another body of same mass at rest. The amount of heat evolved during collision is:
a) 36 J b) 18 J c) 9 J d) 3 J

55. In photoelectric emission process from a metal of work function 1.8 eV, the kinetic energy of most energetic electrons is 0.5 eV. The corresponding stopping potential is
____
a) 1.8V b) 1.2V c) 0.5V d) 23V

56. Two trucks, one loaded (A) and the other unloaded (B) are moving and have same kinetic energy. The mass of A is double that of B. Brakes are applied to both and are brought to rest. If distance covered by A before coming to rest is S_1 and that by B is S_2, then:
a) $S_l = S_2$ b) $S_1 = 2S_2$ c) $2s_1 = S_2$ d) $S_1 = 4S_2$

57. A uniform chain of length L and mass M is lying on a smooth table and one third of its length is hanging vertically down over the edge of the table. If g is acceleration due to gravity, work required to pull the hanging part on to the table is
a) MgL b) $\frac{MgL}{3}$ c) $\frac{MgL}{9}$ d) $\frac{MgL}{18}$

58. A vehicle of mass m is moving on a rough horizontal road with momentum p. If the coefficient of friction between the tyres and the road beu, then the stopping distance is:
a) $\frac{p}{2\mu mg}$ b) $\frac{p^2}{2\mu mg}$ c) $\frac{p}{2\mu m^2 g}$ d) $\frac{p^2}{2\mu m^2 g}$

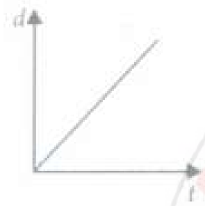
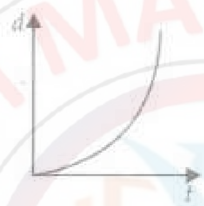
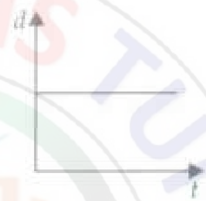
59. The upper half of an inclined plane of inclination q is perfectly smooth while lower half is rough. A block starting from rest at the top of the plane will again come to rest at the bottom, if the coefficient of friction between the block and lower half of the plane is given by ________
a) $\mathrm{m} = \frac{2}{\tan\theta}$ b) $\mu = 2\tan\theta$ c) $\mu = \tan\theta$ d) $\mu = \frac{1}{\tan\theta}$

60. A mass m moving horizontally with velocity v_0 strikes a pendulum of mass m: If the two masses stick together after the collision, then the maximum height reached by the pendulum is:
a) $v_0^2/8_g$ b) $v_0^2/2_g$ c) $\sqrt{2v_0g}$ d) $\sqrt{2v_0g}$

61. The speed v reached by a car of mass m, driven with constant power P, is given by:
a) $v = \frac{3xP}{m}$ b) $v = \left(\frac{3xP}{m}\right)^{1/2}$ c) $v = \left(\frac{3xP}{m}\right)^{1/3}$ d) $v = \left(\frac{3xP}{m}\right)^{2}$

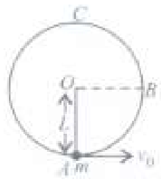
62. A block is moved from rest through a distance of 4 m along a straight line path. The mass of the block is 5 kg and the force acting on it is 20 N. If the kinetic energy acquired by the block be 40 J, at what angle to the path is the force acting?
a) 30° b) 45° c) 60° d) None of these

63. A body is moving unidirectionally under the influence of a source of constant power supplying energy. Which of the diagrams shown in figure correctly shows the displacement-time curve for its motion?

a) 
b) 
c) 
d) 

64. A ball of mass M falls from a height h on a floor which the coefficient of restitution is e. The height attained by the ball after two rebounds is
a) e^2h b) eh^2 c) e^4h d) $\frac{h}{e^4}$

65. A bob of mass m is suspended by a light string of length L. It is imparted a horizontal velocity v_0 at the lowest point A such that it completes a circle in the vertical plane.



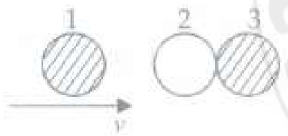
Match Column I with Column II.

Column I		Column II	
(A)	Velocity v_0 is	(p)	3
(B)	Velocity at point B is	(q)	$\sqrt{gL}$
(C)	Velocity at point C is	(r)	$\sqrt{5gL}$
(D)	Ratio of.kinetic energy at B and C is	(s)	$\sqrt{3gL}$

a) A - P. B - q, C - r, D - s b) A - q, B - r, C - s, D - P c) A - s, B - r, C - q, D - P
d) A - s, B - p, C - q, D - r

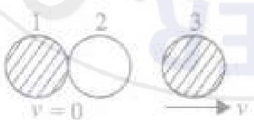
66. A raindrop of mass 1 g falling from a height of 1 km hits the ground with a speed of 50 ms^{-1}. If the resistive force is proportional to the speed of the drop, then the work done by the resistive force is (Take g = 10 m s^{-2})
a) 10 J b) -10 J c) 8.75 J d) -8.75 J

67. Work-energy theorem is valid in the presence of:
    a) external forces only b) internal forces only c) conservative forces only
    d) all types offorces
68. A spring gun of spring constant 90 N/cm is compressed 12 cm by a ball of mass 16 g. If the trigger is pulled, the velocity of the ball is:
    a) $50ms^{-1}$ b) $9ms^{-1}$ c) $40ms^{-1}$ d) $90ms^{-1}$
69. 2A ball of mass 0.2 kg is thrown vertically upwards by applying a force by hand. If the hand moves 0.2 m while applying the force and the ball goes upto 2 m height further. Find the magnitude of force. (Consider $g = 10\ m/s^2$)
    a) 22 N b) 4 N c) 16 N d) 20 N
70. A ball of mass m moving with velocity v strikes the bob of a pendulum at rest. The mass of the bob is also m: If the collision is perfectly inelastic, the height to which the bob will rise is given by
    a) $\frac{v^2}{8g}$ b) $\frac{v^2}{4g}$ c) $\frac{v^2}{2g}$ d) $\frac{v^2}{g}$
71. A box of mass 25 kg starts from rest and slides down an inclined plane 8 metre long and 5 metre high. It is found to move at the bottom at 7 m/sec. What is the force offriction?
    a) 79.6 N b) 96.6 N c) 76.6 N d) 116.6 N
72. Two identical ball bearings in contact with each other and resting on a frictionless table are hit headon by another ball bearing of the same mass moving initially with a speed v as shown in figure.



If the collision is elastic, which of the following is a possible result after collision?

a) 

b) 

c) 

d) 

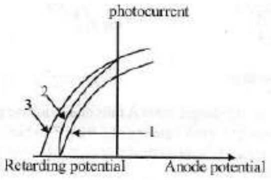
73. If momentum of a body is increased by 100%, then percentage increase in kinetic energy is:
    a) 150 % b) 200 % c) 225 % d) 300 %
74. A block of mass 10 kg, moving in the x-direction with a constant speed of 10 m s^{-1}, is subjected to a retarding force $F_r = 0.1 \times J\ m^{-1}$ during its travel from x = 20 m to x = 30 m. Its final KE will be:
    a) 250 J b) 275 J c) 450 J d) 475 J
75. A ball dropped from a height of 2 m rebounds to a height of 1.5 m after hitting the ground. Then the percentage of energy lost is:

a) 25 b) 30 c) 50 d) 100

76. A bullet loses 1/nth of its velocity passing through one plank. How many such planks are required to stop the bullet?

a) $\frac{n^2}{(2n-1)}$ b) $\frac{n^2}{(2n-1)}$ c) Infinite d) n

77. The figure shows a plot of photo current versus anode potential for a photo sensitive surface for three different radiations. Which one of the following is a correct statement?



a)
Curves (1) and (2) represent irrcident radiations of same frequency but of different intensities.

b)
Curves (2) and (3) represent incident radiations of different frequencies and different intensities.

c)
Curves (2) and (3) represent incident radiations of same frequency having same intensity.

d)
Curves (1) and (2) represent incident radiations of different frequencies and different intensities.

78. Work done in time t on a body of mass m which is accelerated from rest to a speed v in time t 1 as a function of time t is given by:

a) $\frac{1}{2}m\frac{v}{t_1}t^2$ b) $m\frac{v}{t_1}t^2$ c) $\frac{1}{2}\left(\frac{mv^2}{t_1}\right)t^2$ d) $\frac{1}{2}\left(\frac{mv^2}{t_1^2}\right)t^2$

79. A running man has half the kinetic energy than a boy of half his mass has. The man speed up by 1.0 m S^{-1} and then he has the same energy as the boy. The original speeds of the man and boy respectively are :

a) 2.4 m S^{-1}, 1.2 m S^{-1} b) 1.2 m S^{-1}, 4.4 m S^{-1} c) 2.4 m s^{-1}, 4.8 m S^{-1}
d) 4.8 m S^{-1}, 2.4 m S^{-1}

80. Work equal to 25 J is done on a mass of 2 kg to set it in motion. If whole of it is used to increase the kinetic energy, then velocity acquired by the mass (in m s^{-1}) is:

a) 5 b) 12.5 c) 25 d) 50

81. The de-Broglie wavelength of neutron in thermal equilibrium at temperature I is

____

a) $\frac{30.8}{\sqrt{T}}$ b) $\frac{3.08}{\sqrt{T}}$ c) $\frac{0.308}{\sqrt{T}}$ d) $\frac{0.0308}{\sqrt{T}}$

82. A ball loses 15.0% of its kinetic energy when it bounces back from a concrete wall. With what speed you must throw it vertically down from a height of 12.4 m to have it bounce back to the same height? (ignore air resistance)

a) 6.55 m/s b) 12.0 m/s c) 8.6 m/s d) 4.55 m/s

83. A car of mass 1000 kg moving with a speed 18 km h^{-1} on a smooth road and colliding with a horizontally mounted spring of spring constant 6.25 x 10^3 N m^{-1}. The maximum compression of the spring is :

a) 1 m b) 2 m c) 3 m d) 4 m

84. The working principle of rocket propulsion is conservation of:

a) angular momentum b) mass c) linear momentum d) kinetic energy

85. Two identical 5 kg blocks are moving with same speed of 2 m/s towards each other along a frictionless horizontal surface. The two blocks collide, stick together and come to rest. Consider the two blocks as a system. The work done by external and internal forces are respectively:

a) 0,0 b) 0.20J c) 0, -20 J d) 20 J, -20 J

86. An inelastic ball is dropped from a height of 100 m. Due to the earth, 20% of its energy is lost. To what height will the ball rise?

a) 80m b) 40m c) 60 m d) 20 m

87. A source of light is placed at a distance of 50 cm from a photocell and the stopping potential is found to be V_0. If the distance between the light source and photocell is made 25 cm, the new stopping potential will be ____________

a) $2V_0$ b) $V_0/2$ c) V_0 d) $4V_0$

88. Assertion: Work done by friction over a closed path is not zero and no potential energy can be associated with friction.

Reason: Every force encountered in mechanics have an associated potential energy.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

89. Photoelectric emission occurs only when the incident light has more than a certain minimum ____________

a) power b) wavelength c) intensity d) frequency

90. An object of mass 5 kg falls from rest through a vertical distance of 20 m and reaches ground with a velocity of 10 m/s. The work done by air resistance is: (g = 9.8 m s^{-2})

a) +730 J b) -730 J c) +980 J d) -980 J

91. One milligram of matter is converted into energy. The energy released will be :

a) 9 x 10^6 J b) 9 x 10^8 J c) 9 x 10^{10} J d) 9 x 10^{12} J

92. 300 J of work is done in sliding a 2 kg block up an inclined plane of height 10 m. Taking g = 10m s^{-2}, work done against friction is:

a) 200 J b) 100 J c) zero d) 1000 J

93. A particle moves under the effect of a force F = Cx from x = 0 to x = x_1. The work done in the process is:
a) Cx_1^2 b) $\frac{1}{2}Cx_1^2$ c) Cx_1 d) zero
94. If a ball is thrown upwards from the surface of the earth:
a) the earth remains stationary while the ball moves upwards
b) the ball remains stationary while the earth moves downwards
c) the ball and the earth move towards each other
d) the ball and the earth both move away from each other
95. In the non-relativistic regime, if the momentum, is increased by 100%, the percentage increase in kinetic energy is
a) 100 b) 200 c) 300 d) 400
96. A body is hanging from a rigid support by an inextensible string of length l. It is struck inelastically by an identical body of mass m with horizontal velocity $v = \sqrt{2gl}$, the tension in the string increases just after striking by:
a) mg b) 3 mg c) 2 mg d) none of these
97. The extra power required is:
a) 0.4 watt b) 0.08 watt c) 0.04 watt d) 0.2 watt
98. Which one of the following statements is incorrect?
a) Frictional force opposes the relative motion
b) Limiting value of static friction is directly proportional to normal reaction
c) Rolling friction is similar than sliding friction
d) Coefficient of sliding friction has dimensions of lengths
99. A rifle bullet loses 1I20th of its velocity in passing through a plank. The least number of planks requiredjust to stop the bullet is:
a) 20 b) 11 c) 14 d) 8
100. A particle at rest suddenly disintegrates into two particles of equal masses which start moving. The two fragments will
a) move in the same direction with equal speeds
b) move in any direction with any speed
c) move in opposite directions with equal speeds
d) move in opposite directions with unequal speeds
101. A 200 W sodium street lamp emits yellow light of wavelength 0.6 mm. Assuming it to be $25V_o$ efficient in converting electrical energy to light, the number of photons of yellow light it emits per second is ___________
a) 1.5×10^{20} b) 6×10^{18} c) 62×10^{20} d) 3×10^{19}
102. A gun fires bullets each of mass 1 g with velocity of 10 ms^{-1} by exerting a constant force of 5 g weight. Then the number of bullets fired per second is:
(Take g = 10 ms^{-2})
a) 50 b) 5 c) 10 d) 25 e) 15

103. A bolt of mass 0.2 kg falls from the ceiling of an elevator moving down with an uniform speed of 5 m s^{-1}. It hits the floor of the elevator (length of the elevator = 5 m) and does not rebound. The amount of heat produced by the impact is (Takeg = 10m S^{-2})

a) 5 J b) 10 J c) 15 J d) 20 J

104. A particle of mass m moving towards the east with speed v collides with another particle of the same mass and same speed v moving towards the north. If the two particles stick to each other, the new particle of mass 2m will have a speed of:

a) v/2 b) $v/\sqrt{2}$ c) $v\sqrt{2}$ d) v

105. Calculate the work done by a car against gravity in moving along a straight horizontal road. The mass of the car is 400 kg and the distance moved is 2 m:

a) zero J b) one J c) two J d) ten J

106. A bullet of mass 50 gm is fired from a gun of mass 2 kg. If the total KE produced is 2050 J, the energy of the bullet and the gun separately are:

a) 200 J, 5 J b) 2000 J, 50 J c) 5 J, 200 J d) 50 J, 2000 J

107. A particle is released from the top of two inclined rough surfaces of height h each. The angles of inclination of the two planes are 30° and 60° respectively. All other factors (e.g., coefficient of friction, mass of the block, etc.) are same in both the cases. Let K_1 and K_2 be the kinetic energies of the particle at the bottom of the plane in the two cases. Then:

a) $K_1 = K_2$ b) $K_1 > K_2$ c) $K_1 < K_2$ d) data insufficient

108. One coolie takes 1 minute to raise a suitcase through a height of 2 m but the second coolie takes 30 s to raise the same suitcase to the same height. The powers of two coolies are in the ratio of __________ .

a) 1:2 b) 1:3 c) 2:1 d) 3:1

109. The work-energy theorem states that the change in

a) kinetic energy of a particle is equal to the work done on it by the net force

b) kinetic energy of a particle is equal to the work done by one of the forces acting on it

c) potential energy of a particle is equal to the work done on it by the net force

d)

potential energy of a particle is equal to the work done by one of the forces acting on it

110. A bomb of mass 30 kg at rest explodes into two pieces of masses 18 kg and 12 kg. The velocity of 18 kg mass is 6 ms^{-1}. The kinetic energy of the other mass is __________

a) 324J b) 486J c) 256J d) 524J

111. Work is done only when:

a) applied force is strong b) applied force generates motion

c) applied force is normal to the displacement d) force is applied

112. A force acts on a 3.0 g particle in such a way that the position of the particle as a function of time is given by $x = 3t - 4t^2 + t^3$, where r is in metre and t in second. The work done during the first 4s is ______________ .

a) 570 mJ b) 450 mJ c) 490 mJ d) 528 mJ

113. Assertion: The work done by a conservative force such as gravity depends on the initial and final positions only.
Reason: The work done by a force can not be calculated if the exact nature of the force is not known.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

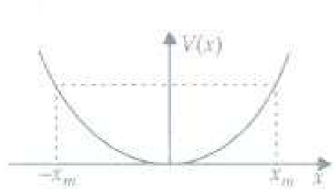
114. The work done by a body against friction always results in
a) loss of kinetic energy b) loss of potential energy c) gain of kinetic energy
d) gain of potential energy

115. In the question 161, the maximum positive displacement x IS:
a) $2\sqrt{3}m$ b) 2m c) 4m d) $\sqrt{2}m$

116. A person draws water from a 5 m deep well in a bucket of mass 2 kg of capacity 8 litre by a rope of mass I kg. What is the total work done by the person? (Assume g = 10m/sec^2)
a) 550 J b) 525 J c) 125 J d) 500 J

117. A particle projected at an angle 45° with the horizontal has the range 16 m. It explodes into two equal parts at the highest point of projection, out of which one falls vertically downwards at the point of explosion. Then the other will fall at what distance from the starting point?
a) 8 m b) 16 m c) 24 m d) 32 m

118. The potential energy function for a particle executing linear SHM is given by V(x) = $\frac{1}{2}$ where k is the force constant of the oscillator. For k = 0.5 Nm^{-1} , the graph of V(x) versus x is shown in the figure. A particle of total energy E turns back when it reaches x = ±xm. If V and K indicate the potential energy and kinetic energy, respectively of the particle at x = +x$_m$' then which of the following is correct?



a) V= 0, K= E b) V= E,K= 0 c) V < E, K = 0 d) V=0,K<E

119. In case of rifle shooting the kick will be minimum when:
a) In case of rifle shooting the kick will be minimum when:
b) a light rifle is held tightly against shoulder
c) a heavy rifle is held loosely against shoulder
d) a heavy rifle is held tightly against shoulder

120. The collision is elastic, the height to which the bob will rise will be:
a) $\frac{v^2}{8g}$ b) $\frac{v^2}{2g}$ c) $\frac{2v^2}{g}$ d) $\frac{v^2}{2}$

121. A rectangular block has dimensions 8 m x 4 m x 2 m. It has a mass of 100 kg. It is initially on the ground with the shortest side vertical. If it is to be turned so that the longestside is vertical, the work done is equal to:
a) 29.4 J b) 2.94 x 10^3 J c) 58.8 x 10^2 J d) 580 J

122. Two bodies of masses m and 4m are moving with equal kinetic energy. The ratio of their linear momenta is equal to:
a) 4 : 1 b) 1 : 1 c) 1 : 2 d) 1 : 4

123. A particle of mass m is moving in a horizontal circle of radius r, under a centripetal force equal to -(k/r^2) where k is constant. The total energy of the particle is
a) $-\frac{k}{r}$ b) $-\frac{k}{2r}$ c) $\frac{k}{2r}$ d) $\frac{2k}{r}$

124. Electrons of mass m with de-Broglie wavelength 1fall on the target in an X-ray tube. The cut-off wavelength (I_o) of the emitted X-ray is ____________
a) $\lambda_0 = \frac{2mc\lambda^2}{h}$ b) $\lambda_0 = \frac{2h}{md}$ c) $\lambda_0 = \frac{2m^2c^2\lambda^2}{h^2}$ d) $\lambda_0 = \lambda$

125. Two springs of spring constants 1000 N m^{-1} and 2000 N m^{-1} are stretched with same force. They will have potential energy in the ratio of :
a) 2:1 b) 2^2:1^2 c) 1:2 d) 1^2:2^2

126. A ball moving with velocity 2 m/s collides head on with another stationary ball of double the mass. If the coefficient of restitution is 0.5, then their velocities (in m/ s) after collision will be ____________
a) 0, 1 b) 1,1 c) 1, 0.5 d) 0, 2

127. The displacement x in metre of a particle of mass m kg moving in one dimension under the action of a force is related to the time t in seconds by the equation:
t = $\sqrt{x}$ +3 Then, the displacement of the particle, when its velocity is zero, is:
a) 3 m b) zero c) 6 m d) none of these

128. A cannon ball is fired with a velocity of 200 m/s at an angle of 60° with the horizontal. At the highest point of its flight it explodes into 3 equal fragments, one going vertically upwards with a velocity of 100 m/s, the second one falling vertically downwards with a velocity of 100 m/s. The third fragment will be moving with a velocity of:
a) 100 m/s in the horizontal direction b) 300 m/s in the horizontal direction
c) 300 m/s in a direction making an angle of 60° with the horizontal
d) 300 m/s in a direction making an angle of 60° with the horizontal

129. A bullet of mass mis fired from a rifle of mass M. If $\vec{v}$ be the velocity of the bullet, velocity acquired by the rifle is:
a) $\vec{V} = -\frac{M}{m}\vec{v}$ b) $\vec{V} = -\frac{m}{M}\vec{v}$ c) $\vec{V} = -\vec{v}$ d) $\vec{V} = +\vec{v}$

130. A body of mass m moving with velocity 3 km/h collides with a body of mass 2 m at rest. Now, the coalesced mass starts to move with a velocity __________ .
a) 1 km/h b) 2 km/h c) 3 km/h d) 4 km/h

131. In order to do work:

a) force must act at any angle to the displacement

b) force may not act along the same direction as is the displacement

c) must act along the direction of displacement

d) must act normal to the direction of displacement

132. A machine which is 75 percent efficient, uses 12 joules of energy in lifting up a I kg mass through a certain distance. The mass is then allowed to fall through that distance. The velocity at the end of its fall is: (in m s^{-1})

a) $\sqrt{24}$ b) $\sqrt{32}$ c) $\sqrt{18}$ d) $\sqrt{9}$

133. Sand drops vertically at the rate of 2 kg/see on to a conveyor belt moving horizontally with a velocity of 0.2 mlsec. Then the extra force required to keep the belt moving is :

a) 0.4 N b) 0.08 N c) 0.04 N d) 0.2 N

134. A car drives along straight level frictionless road by an engine delivering constant power. Then, velocity is directly proportional to

a) t b) $\frac{1}{\sqrt{2}}$ c) $\sqrt{t}$ d) none of these

135. A force of 10 N is applied on a body for 3 see and the corresponding displacement is 6 m. The power of the source is:

a) 20 W b) 25 W c) 40 W d) 50 W

136. A force F acting on an object varies with distance x as shown here. The force is in N and x in m. The work done by the force in moving the object from -x = 0 to x = 6 m is ____________

a) 18.0J b) 13.5J c) 9.0J d) 4.5J

137. In the question number 55, which ball can reach D?

a) 1 b) 2 c) 1 and 2 d) Cannot be predicted

138. A mass of 5 kg is moving along a circular path of radius 1 m. If the mass moves with 300 revolutions per minute, its kinetic energy would be :

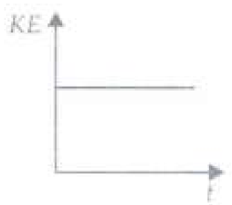
a) $250\pi^2 J$ b) $100\pi^2 J$ c) $5\pi^2 J$ d) 0 J

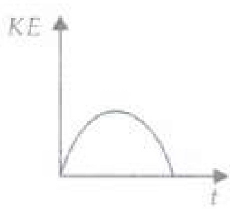
139. Two identical balls A and B having velocities of 0.5 m/s and - 0.3 m/s respectively collide elastically in one dimension. The velocities of B and A after the collision respectively will be :

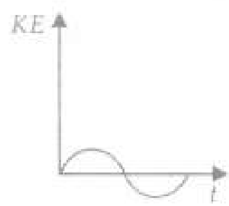
a) - 0.5 m/s and 0.3 m/s b) 0.5 m/s and - 0.3 m/s c) - 0.3 m/s and 0.5 m/s

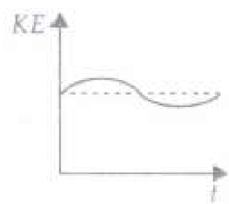
d) 0.3 m/s and 0.5 m/s

140. Which of the diagrams shown in figure most closely shows the variation in kinetic energy of the earth as it moves once around the sun in its elliptical orbit?

a) 

b) 

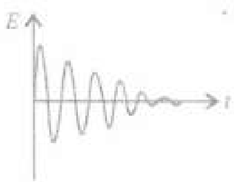
c) 

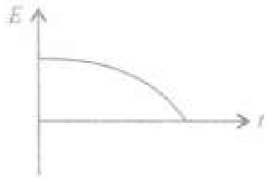
d) 

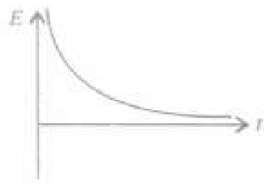
141. A bomb of mass 3.0 kg explodes in air into two pieces of masses 2.0 kg and 1.0 kg. The smaller mass goes at a speed of 80 m/s. The total energy imparted to the two fragments is: (in kJ)
a) 1.07 b) 2.14 c) 2.4 d) 4.8

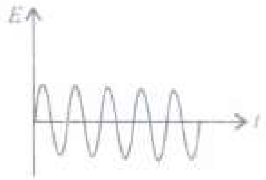
142. The potential energy of a spring when stretched through a distance x is 10 J. What is the amount of work done on the same spring to stretch it through an additional distance x :
a) 10 J b) 20 J c) 30 J d) 40 J

143. Which of the diagrams shown in figure represents variation of total mechanical energy of a pendulum oscillating in air as function of time?

a) 

b) 

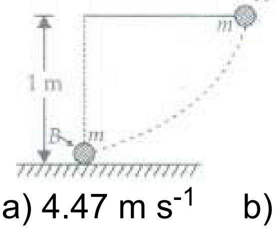
c) 

d) 

144. If the momentum of a body is increased by 50%, then the percentage increase in its kinetic energy is __________
a) 50% b) 100% c) 125% d) 200%

145. Assertion: Universe as a whole may be viewed as an isolated system.
Reason: Total energy of an isolated system remains constant.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

146. The bob A of a pendulum of mass m released from horizontal to the vertical hits another bob B of the same mass at rest on a table as shown in figure. If the length of the pendulum is 1 m, what is the speed with which bob B starts moving. (Neglect the size of the bobs and assume the collision to be elastic) (Take g = 10 m s^{-2})



a) 4.47 m s^{-1} b) 5.47 m s^{-1} c) 6.47 m s^{-1} d) 3.47 m s^{-1}

147. A rectangular film of liquid is extended from (4cm $\times$ 2cm) to (5cm $\times$ 4cm). If the workdone is 3 $\times$ 10^{-4}, the value of the surface tension of the liquid is ____________
a) 0.250Nm^{-1} b) 0.125Nm^{-1} c) 0.2Nm^{-1} d) 0.8Nm^{-1}

148. A particle of mass 1 mg has the same wavelength as an electron moving with a velocity of 3×10^6 ms^{-1}. The velocity of the parlicle is ___________

a) 2.7×10^{-18} ms^{-1} b) 9×10^{-2} ms^{-1} c) 3×10^{-31} ms^{-1} d) 2.7×10^{-21} ms^{-1}

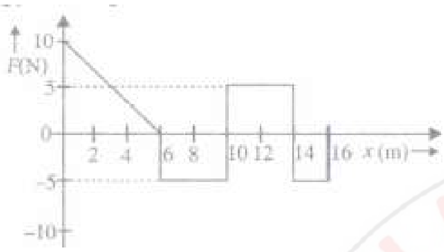
149. In the question number 15, the work done against force of friction is

a) 8.7 J b) 10.7 J c) 7.8 J d) 12.7 J

150. If we lift a body from rest to a height h and the body is in static equilibrium, then net work done is:

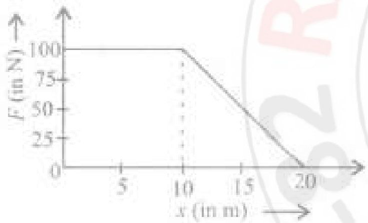
a) +ve b) -ve c) zero d) unity

151. A particle is acted upon by a force F which varies with position x as shown in figure. If the particle at x = 0 has kinetic energy of 25 J, then the kinetic energy of the particle at x = 16 m is



a) 45 J b) 30 J c) 70 J d) 20 J

152. A force F acting on an object varies with distance x as shown in the figure. The work done by the force in moving the object from x = 0 to x = 20 m is



a) 500 J b) 1000 J c) 1500 J d) 2000 J

153. A body of mass M is dropped from a height h on a sand floor. If the body penetrates x em into the sand, the average resistance offered by the sand to the body is:

a) $Mg\left(\frac{h}{x}\right)$ b) $Mg\left(1+\frac{h}{x}\right)$ c) Mgh + Mgx d) $Mg\left(1-\frac{h}{x}\right)$

154. Two particles of masses m_l ,m_2 move with initial velocities u_1 and u_2. On collision, one of the particles gets excited to higher level, after absorbing energy E. If final velocities of particle be v_1 and v_2 then we must have:

a) $\frac{1}{2}m_1u_1^2+\frac{1}{2}m_2u_2^2+\frac{1}{2}m_1v_1^2+\frac{1}{2}m_2v_2^2-E$ b) $\frac{1}{2}m_1u_1^2+\frac{1}{2}m_2u_2^2-E=\frac{1}{2}m_1v_1^2+\frac{1}{2}m_2v_2^2$

c) $\frac{1}{2}m_1u_1^2+\frac{1}{2}m_2u_2^2+E=\frac{1}{2}m_1v_1^2+\frac{1}{2}m_2v_2^2$ d) $\frac{1}{2}m_1u_1^2+\frac{1}{2}m_2u_2^2+\frac{1}{2}m_1v_1^2+\frac{1}{2}m_2v_2^2-E$

155. An engineer claims to have made an engine delivering 10 kW power with fuel consumption of 1 g/s. The calorific value of fuel is 2 kcal/g, This claim is:

a) valid b) invalid c) depends on engine design d) dependent on load

156. Assertion: The work done by the spring force in a cyclic process is zero.

Reason: Spring force is a conservative force.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

157. A shell explodes and many pieces fly off in different directions. Which of the following is conserved?
a) Kinetic energy b) Momentum c) Neither momentum nor KE
d) Momentum and KE

158. A particle moves on a rough horizontal ground with some initial velocity say v_0 . If (3/4)th of its kinetic energy is lost in friction in time to, then coefficient of friction between the particle and the ground is:
a) $\frac{v_0}{2gt_0}$ b) $\frac{v_0}{4gt_0}$ c) $\frac{3v_0}{4gt_0}$ d) $\frac{v_0}{gt_0}$

159. A 2 kg block drops vertically from a height of 40 em on a spring whose force constant K is 1960 newton per metre. Then, the maximum compression of the spring is:
a) 40 cm b) 25 cm c) 10 cm d) 5 cm

160. A motor is used to deliver water at a certain rate through a given horizontal pipe. To deliver n-times the water through the same pipe in the same time the power of the motor must be increased as follows:
a) n-times b) n^2-times c) n^3 -times d) n^4 -times

161. A man weighing 60 kg climbs up a staircase carrying a load of 20 kg on his head. The stair case has 20 steps each of height 0.2 m. Ifhe takes 10 s to climb, find his power.
a) 313.6 W b) 120.6 W c) 510 W d) 0

162. A ball falls under gravity from a height of 10 m with an initial downward velocity Vo. It collides with the ground, loses 50% of its energy in collision and then rises back to the same height. Find : (i) The initial velocity v_0 and (ii) The height to which the bal! would rise after collision if the initial velocity v_0 was directed upwards instead of downwards?
a) 14 m/s, 5 m b) 14 m/s, 10 m c) 7 m/s, 5 m d) 7 m/s, 10 m

163. Abody of mass 3 kg is under a constant force which causes a displacement s in meters in it, given by the relation s=$\frac{1}{3}t^2$, where t is in seconds. Work done by the force in 2 seconds is :
a) $\frac{3}{8}J$ b) $\frac{8}{3}J$ c) $\frac{19}{5}J$ d) $\frac{5}{19}J$

164. Two unequal masses A and B moving along a straight line are brought to rest by equal retarding forces. If A moves twice the time as B but goes only 1/3 of the distance covered by B before coming to rest, the ratio of their velocities is:
a) 1: 6 b) 6: 1 c) 1: 2 d) 2: 1

165. A man of 50 kg is standing at one end on a boat of length 25 m and mass 200 kg. If he starts running and when he reaches the other end, he has a velocity 2 m s^{-1} with respect to the boat. The final velocity (in m s^{-1}) of the boat is

a) 2/5 b) 2/3 c) 8/5 d) 8/3

166. A boy chews 100 g of ice in 5 minute. Iflatentheatoficeis 80 cal/sec, his power is:

a) 56W b) 28W c) 112 W d) 224 W

Ravi Maths Tuition Centre

Time : 1 Mins | MOTION OF SYSTEM OF PARTICLES ANDRIGID BODY 1 | Marks : 848

1. Assertion: To determine the motion of the centre of mass of a system, knowledge of internal forces of the system is required.
   Reason: For this purpose we need not to know the external forces on the system.
   a) If both assertion and reason are true and reason is the correct explanation of assertion.
   b) If both assertion and reason are true but reason is not the correct explanation of assertion
   c) If assertion is true but reason is false d) If both assertion and reason are false.
2. A round disc of moment of inertia I_2 about its axis perpendicular to its plane and passing through its centre is placed over another disc of moment of inertia I_1 rotating with an angular velocity 'ω' about the same axis. The final angular velocity of the combination of discs is :
   a) $I_2\omega/(I_1 + I_2)$ b) ω c) $I_1\omega/(I_1 + I_2)$ d) $(I_1 + I_2)\omega/I_1$
3. The moment of inertia of a thin uniform rod of mass M and length L about an axis passing through its midpoint and perpendicular to its length is I_0. Its moment of inertia about an axis passing through one of its ends and perpendicular to its length is___
   a) $I_0 + ML^{2/2}$ b) $I_0 + ML^2/4$ c) $I_0 + 2ML^2$ d) $I_0 + ML^2$
4. A solid sphere of radius R is placed on a smooth horizontal,surface. A horizontal force F is applied at height h from the lowest point. For the maximum acceleration of the centre of mass____
   a) h = R b) h = 2R c) h = 0 d) The acceleration will be same whatever h may be
5. A ring of radius R is rotating with an angular speed Wo about a horizontal axis. It is placed on a rough horizontal table. The coefficient of kinetic friction is μ_k.The time after which it starts rolling is
   a) $\frac{w_0\mu_k R}{2g}$ b) $\frac{w_0 g}{2\mu_k R}$ c) $\frac{2w_0 R}{\mu_k g}$ d) $\frac{w_0 R}{2\mu_k g}$
6. A ballet dancer, dancing on a smooth floor is spinning about a vertical axis with her arms folded with an angular velocity of 20 rad/s. When she stretches her arms fully, the spinning speed decrease as 10 rad/s, If I is the initial moment of inertia of the dancer, the new moment of inertia is
   a) 2*I* b) 3*I* c) *I/2* d) *I/3*
7. The position of the centre of mass of a cube of uniform mass density will be at
   a) the centre of one face b) the centre of the interaction of diagonals of one face
   c) the geometric centre of the cube d) the edge of a cube
8. A man is sitting with folded hands on a revolving table. Suddenly, he stretches his arms. Angular speed of the table would:

a) increase b) decrease c) remain the same d) nothing can be said

9. A B C is a triangular plate of uniform thickness. The sides are in the ratio shown in the figure. I_{AB}, I_{BC} and I_{CA} are the moments of inertia of the plate about A B, B C and C A as axes respectively. Which one of the following relations is correct?
a) $I_{AB} > I_{BC}$ b) $I_{BC} > I_{AC}$ c) $I_{AB} + I_{BC} = I_{CA}$ d) I_{CA} is maximum

10. Two rotating bodies A and B of masses m and 2 m with moments of inertia I_A *and* I_B ($I_B > I_A$) have equal kinetic energy of rotation. If L_A and L_B be their angular momenta respectively, then :
a) $L_A = L_B/2$ b) $L_A = 2L_B$ c) $L_B > L_A$ d) $L_A > L_B$

11. Match Column I with Column II

Column I		Column II	
(A)	\(\frac { Mg }{ 4 }	(P)	cube will move up.
(B)	$F > \frac{Mg}{2}$	(q)	cube will not exhibit motion.
(C)	F>Mg	(r)	cube will begin to rotate and slip at A.
(D)	$F = \frac{Mg}{4}$	(s)	Normal reaction effectively at a/3 from A, no motion.

a) A - P. B - q, C - r, D - s b) A - q, B - r, C - s, D - P c) A - r, B - q, C - P. D - s d) A - r, B - s, C - p, D - q

12. A uniform rod of length 1 m and mass 4 kg is supported on two knife-edges placed 10 cm from each end. A 60 N weight is suspended at 30 em from one end. The reactions at the knife edges is :
a) 60 N, 40 N b) 75 N, 25 N c) 65 N, 35 N d) 55 N, 45 N

13. A solid cylinder rolls up an inclined plane of inclination θ with an initial velocity v. How far does the cylinder go up the plane?
a) $\frac{3v^2}{2gsin\theta}$ b) $\frac{v^2}{4gsin\theta}$ c) $\frac{3v^2}{gsin\theta}$ d) $\frac{3v^2}{4gsin\theta}$

14. Two persons of masses 55 kg and 65 kg respectively, are at the opposite ends of a boat. The length of the boat is 3.0 m and weighs 100 kg. The 55 kg man walks upto the 65 kg man and sits with him. If the boat is in still water the centre of mass of the system shifts by_______
a) 3.0 m b) 2.3 m c) zero d) 0.75 m

15. Which of the following has the highest moment of inertia when each of them has the same mass and the same radius?
a) A ring about any of its diameter. b) A disc about any of its diameter.
c) A hollow sphere about any of its diameter. d) A solid sphere about any of its diameter.

16. Centre of mass of three particles of masses 1 kg, 2 kg and 3 kg lies at the point (1, 2, 3) and centre of mass of another system of particles 3 kg and 2 kg lies at the point (-1, 3, -2). Where should we put a particle of mass 5 kg so that the centre of mass of entire system lies at the

centre of mass of first system?

a) (0,0,0) b) (1,3,2) c) (-1,2,3) d) (3,1,8)

17. Ionized hydrogen atoms and fα-particles with same momenta enters perpendicular to a constant magnetic field, B. The ratio of their radii of their paths $r_H : r_a$ will be_____

a) 1: 2 b) 4: 1 c) 1: 4 d) 2: 1

18. A circular platform is mounted on a vertical frictionless axle. Its radius is r = 2 m and its moment of inertia I = 200 kg m^2. It is initially at rest. A 70 kg man stands on the edge of the platform and begins to walk along the edge at speed V_o = 1 m s^{-1} relative to the ground. The angular velocity of the platform is

a) 1.2 rad s^{-1} b) 0.4 rad s^{-1} c) 0.7 rad s^{-1} d) 0.7 rad s^{-1}

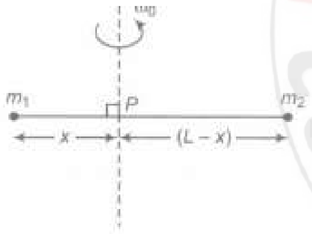
19. For which of the following does the centre of mass lie outside the body?

a) A pencil b) A shotput c) A dice d) A bangle

20. Two discs of moments of inertia Il and 12 about their respective axes, rotating with angular frequencies w_1 and w_2 respectively, are brought into contact face to face with their axes of rotation coinciding with each other. The angular frequency of the composite disc will be

a) $\frac{I_1w_1+I_2w_2}{I_1+I_2}$ b) $\frac{I_2w_1+I_1w_2}{I_1+I_2}$ c) $\frac{I_1w_1-I_2w_2}{I_1-I_2}$ d) $\frac{I_2w_1-I_1w_2}{I_1-I_2}$

21. Point masses m_1 and m_2 are placed at the opposite ends of a rigid rod of length L, and negligible mass. The rod is to be set rotating about an axis perpendicular to it. The position of point P on this rod through which the axis should pass so that the work required to set the rod rotating with angular velocity ω_0 is minimum is given by :



a) x = m_2/m_1L b) x = m_2L/(m_1+m_2) c) x = m_1L/(m_1+m_2) d) x = m_1/m_2L

22. Two particles A and B are moving in uniform circular motion in concentric circles of radii r_A and r_B with speed v_A and v_B respectively. Their time period of rotation is the same. The ratio of angular speed of A to that of B will be_____

a) $V_A : V_B$ b) $r_B : r_A$ c) 1 : 1 d) $r_A : r_B$

23. Two discs are rotating about their axes, normal to the discs and passing through the centres of the discs. Disc D_1 has 2kg mass and 0.2 m radius and initial angular velocity of 50rads^{-1}. Disc D_2 has 4 kg mass, 0.1 m radius and initial angular velocity of 200rads^{-1}. The two discs are brought in contact face to face, with their axes of rotation coincident. The final angular velocity (in rads^{-1}) of the system is____

a) 40 b) 60 c) 100 d) 120

24. Particle of mass m is moving in a horizontal circle of radius R with uniform speed v. When it moves from one point to a diametrically opposite point, its :

a) kinetic energy changes by $mv^2/4$ b) momentum does not change

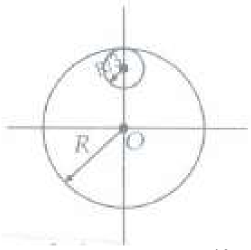
c) momentum changes by 2 mv d) kinetic energy changes by mv^2

25. When a torque acting upon a system is zero. Which of the following will be constant?

a) Force b) Linear impulse c) Linear momentum d) Angular momentum

26. Assertion : A sphere cannot roll on a smooth inclined surface.
Reason: The motion of a rigid body which is pivoted or fixed in some way is rotation.
a) If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is fals d) If both assertion and reason are false.

27. From a circular disc of radius R and mass 9M, a small disc of radius $\frac{R}{3}$ is removed as shown in figure. The moment of inertia of the remaining disc about an axis perpendicular to the plane of the disc and passing through O is



a) 4 MR^2 b) $\frac{40}{9}MR^2$ c) 40 MR^2 d) $\frac{37}{9}MR^2$

28. Two bodies have their moment of inertia 1 and 21 respectively about their axis of rotation. If their kinetic energies ofrotation are equal, their angular momenta will be in the ratio ___
a) 2 : 1 b) 1 : 2 c) $\sqrt{2}:1$ d) $1:\sqrt{2}$

29. In the question number 62, the linear acceleration of the rope is
a) 5 m s^{-2} b) 10 m s^{-2} c) 15 m s^{-2} d) 20 m s^{-2}

30. A stone of mass 1 kg tied to a light inextensible string of length L = (10/3) m is whirling in a circular path of radius L in a vertical plane. If the ratio of the maximum tension in the string to the minimum tension in the string is 4 and if g is taken to be 10 m/s^2 the speed of the stone at the highest point of the circle is :
a) 20 m/s b) 10$\sqrt{2}$ m/s c) 5$\sqrt{2}$ m/s d) 10 m/s

31. Assertion: Value of radius of gyration of a uniform rigid body depends on axis of rotation.
Reason : Radius of gyration is root mean square distance of particles of the body from the axis of rotation.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false.

32. A mass m is attached to a thin wire and whirled in a vertical circle. The wire is most likely to break when____
a) the wire is horizontal b) the mass is at the lowest point
c) inclined at an angle of 60° from vertical d) the mass is at the highest point

33. Two particles of equal mass have velocities $\vec{v}_1 = 2\hat{i}ms^{-1}$ and $\vec{v}_2 = 2\hat{j}ms^{-1}$ First particle has an acceleration $a_1 = (3\hat{i} + 3\hat{j})ms^{-2}$ while the acceleration of the other particle is zero. The centre of mass of the two. particles moves in a path of :

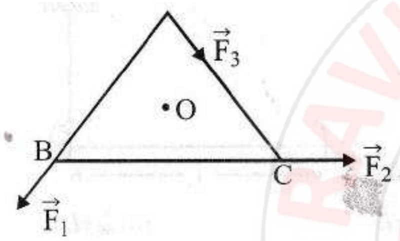
a) straight line b) parabola c) circle d) ellipse

34. A person is standing on a rotating table with metal spheres in his hands. Ifhe withdraws his hands to his chest, then the effect on his angular velocity will be
a) increase b) decrease c) remain same d) can't say

35. A dancer on ice spins faster when she folds her hand. This is due to :
a) increase in energy and increase in angular momentum
b) decrease in friction at the skates
c) constant angular momentum and increase in kinetic energy
d) increase in energy and decrease in angular momentum

36. The ratio of the radii or gyration of a circular disc to that of a circular ring, each of same mass and radius, around their respective axis is___
a) $\sqrt{3}:\sqrt{2}$ b) $1:\sqrt{2}$ c) $\sqrt{2}:1$ d) $\sqrt{2}:\sqrt{3}$

37. ABC is an equilateral triangle with O as its centre. $\vec{F}_1, \vec{F}_2$ and $\vec{F}_3$ represent three forces acting along the sides A B, B C and A C respectively. If the total torque about O is zero, the magnitude of $\vec{F}_3$ is ____________ .



a) $F_1 + F_2$ b) $F_1 - F_2$ c) $\frac{F_1+F_2}{2}$ d) $2(F_1 + F_2)$

38. The velocity of centre of mass of the system remains constant, if the total external force acting on the system is
a) minimum b) maximum c) unity d) zero

39. A car weighs 1800 kg. The distance between its front and back axles is 1.8 m. Its centre of gravity is 1 m behind the front axle. The force exerted by the level ground on each front wheel and each back wheel is (Take g = 10 ms^{-2})
a) 4000 N on each front wheel, 5000 N on each back wheel
b) 5000 N on each front wheel, 4000 N an each back wheel
c) 4500 N on each front wheel, 4500 N on each back wheel
d) 3000 N on each front wheel, 6000 N on each back wheel

40. With reference to figure of a cube of edge a and mass m, which of the following is the incorrect statement? (0 is the centre of the cube)
a) The moment of inertia of cube about z' is $I_Z' = I_Z + \frac{ma^2}{2}$
b) The moment of inertia of cube about z" is $I_Z'' = I_Z + \frac{ma^2}{2}$ c) I_x-I_y d) None of these

41. Two bodies of mass 1 kg and 3 kg have position vectors $\hat{i} + 2\hat{j} + \hat{k}$ and $-3\hat{i} - 2\hat{j} + \hat{k}$ respectively. The centre of mass of this system has a position vector:
a) $-2\hat{i} - \hat{j} + \hat{k}$ b) $2\hat{i} - \hat{j} - 2\hat{k}$ c) $-\hat{i} - \hat{j} + \hat{k}$ d) $-2\hat{i} + 2\hat{k}$

42. Two discs of same moment of inertia rotating about their regular axis passing through centre and perpendicular to the plane of disc with angular velocities ω_1 and ω_2. They are brought into contact face to face coinciding the axis of rotation. The expression for loss of energy during this process is:

a) $\frac{1}{4}I(\omega_1-\omega_2)^2$ b) $I(\omega_1-\omega_2)^2$ c) $\frac{1}{8}I(\omega_1-\omega_2)^2$ d) $\frac{1}{2}I(\omega_1+\omega_2)^2$

43. A circular disk of moment of inertia I_t, is rotating in a horizontal plane, its symmetry axis, with a constant angular speed ω_j. Another disk of moment of inertia I_b is dropped coaxially onto the rotating disk. Initially the second disk has zero angular speed. Eventually both the disks rotate with a constant angular speed ofω_f The energy lost by the initially rotating disk to friction is_____

a) $\frac{1}{2(I_t+I_b)}\omega_i^2$ b) $\frac{I_f^2}{I_t+I_b}\omega_i^2$ c) $\frac{I_b-I_t}{(I_f+I_b)}\omega_f^2$ d) $\frac{1}{2(I_t+I_b)}\omega_i^2$

44. A mass M is moving with a constant velocity parallel to x-axis. Its angular momentum w.r.t. origin

a) is zero b) remains constant c) goes on increasing d) goes on decreasing

45. A thin uniform circular ring is rolling down an inclined plane of inclination 30° without slipping. Its linear acceleration along the inclined plane will be____

a) $\frac{g}{2}$ b) $\frac{g}{3}$ c) $\frac{g}{4}$ d) $\frac{2g}{3}$

46. A flywheel rotating at 420 rpm slows down at a constant rate of 2 rad S^{-2}. The time required to stop the flywheel is

a) 22 s b) 11 s c) 44 s d) 12 s

47. A child is standing at one end of a long trolley moving with a speed v on a smooth horizontal floor. If the child starts running towards the other end of the trolley with a speed u, the centre of mass of the system (trolley + child) will move with a speed

a) zero b) (v+u) c) (v-u) d) v

48. The moment of inertia of a body about a given axis is 1.2 kg m^2. Initially, the body is at rest. In order to produce a rotational kinetic energy of 1500 joule, an angular acceleration of 25 radian/sec^2 must be applied about that axis for a duration of :

a) 4 seconds b) 2 seconds c) 8 seconds d) 10 seconds

49. A merry-go-round, made of a ring-like platform of radius R and mass M, is revolving with angular speed co. A person of mass M is standing on it. At one instant, the person jumps off the round, radially away from the centre of the round. The speed of the round afterwards is

a) $2w$ b) w c) $\frac{w}{2}$ d) 0

50. A person, with outstretched arms, is spinning on a rotating stool. He suddenly brings his arms down to his sides. Which of the following is true about his kinetic energy K and angular momentum L?

a) Both K and L increase b) Both K and L remain unchanged

c) K remains constant, L increases d) K increases but L remains constant

51. In problem 5, the centre of mass of the plate is now in the following quadrant of x-y plane,

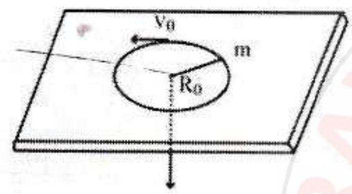
a) I b) II c) III d) IV

52. A wheel of radius 1 m rolls forward half a revolution on a horizontal ground. The magnitude of the displacement of the point of the wheel initially in contact with the ground is_____
a) p b) 2 p c) $\sqrt{2}\pi$ d) $\sqrt{\pi^2+4}$

53. A wheel of mass 5 kg and radius 0.40 m is rolling on a road without sliding with angular velocity 10 rad s^{-1}. The moment of inertia of the wheel about the axis of rotation is 0.65 kg m^2. The percentage of kinetic energy of rotation in the total kinetic energy of the wheel is
a) 22.4% b) 11.2% c) 88.8 % d) 44.8 %

54. A solid sphere rolls down two different inclined planes of the same heights but different angles of inclination. In both cases
a) the speed and time of descend will be same.
b) the speed will be same but time of descend will be different.
c) the speed will be different but time of descend will be same.
d) speed and time of descend both are different.

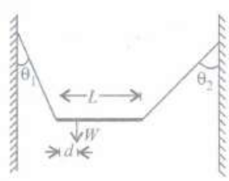
55. A rod P Q of mass M and length L is hinged at end P. The rod is kept horizontal by a massless string tied to point Q as shown in figure. When string is cut, the initial angular acceleration of the rod is____



a) g/L b) 2g/L c) 2g/3L d) 3g/2L

56. A boy suddenly comes and sits on a circular rotating table. What will remain conserved?
a) Angular velocity b) Angular momentum c) Linear momentum d) Kinetic energy

57. Anon-uniform bar of weight Wand length L is suspended by two strings of negligible weight as shown in figure. The angles made by the strings with the vertical are θ_1 and θ_2 respectively. The distance d of the centre of gravity of the bar from its left end is

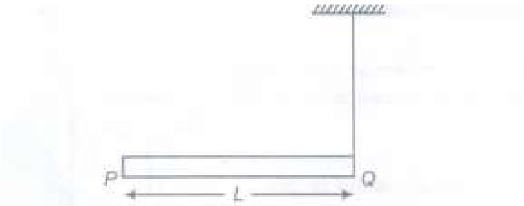


a) $L\left(\frac{tan\theta_1+tan\theta_2}{tan\theta_1}\right)$ b) $L\left(\frac{tan\theta_1}{tan\theta_1+tan\theta_2}\right)$ c) $L\left(\frac{tan\theta_2}{tan\theta_1+tan\theta_2}\right)$ d) $L\left(\frac{tan\theta_1+tan\theta_2}{tan\theta_2}\right)$

58. A tube of length L is filled completely 'with an incompressible liquid of mass M and closed at both the ends. The tube is then rotated in a horizontal plane about one of its ends with a uniform angular velocity ω The force exerted by the liquid at the other end is_____
a) $\frac{ML^2\omega}{2}$ b) $ML\omega^2$ c) $\frac{ML^2\omega^2}{2}$ d) $\frac{ML\omega^2}{2}$

59. Angular momentum of the particle rotating with a central force is constant due to
a) constant torque b) constant force c) constant linear momentum d) zero torque

60. A rod PQ of M and length L is hinged at end P. The rod is held horizontally by a massless string tied to point Q as shown in the figure. When the string is cut, the initial acceleration of the rod is



a) g/L b) 2g/L c) 2g/3L d) 3g/2L

61. In the question number 89, the force of friction acting on the cylinder is

a) $\frac{2}{3}Mgsin\theta$ b) $\frac{1}{3}Mgsin\theta$ c) $\frac{2}{5}Mgsin\theta$ d) $\frac{2}{7}Mgsin\theta$

62. The centre of mass of a system of particles does not depend upon:

a) masses of the particles b) forces acting on the particles c) position of the particles
d) relative distances between the particles

63. An automobile engine develops 100 kW power when rotating at a speed of 1800 rpm. The torque delivered by the engine is

a) $\frac{10^2}{6\pi}Nm$ b) $\frac{10^4}{6\pi}Nm$ c) $\frac{10^6}{6\pi}Nm$ d) $\frac{10^8}{6\pi}Nm$

64. A cord of negligible mass is wound round the rim of a flywheel of mass 20 kg and radius 20 cm. A steady pull of 25 N is applied on the cord. The work done by the pull when 2 m of the cord is unwound is

a) 20 J b) 25 J c) 45 J d) 50 J

65. In a spinning top, axis. moves around the vertical through its point of contact with the ground sweeping out a cone. This movement of the axis of the top around the vertical is known as

a) rotation b) translation c) precession d) rolling

66. A composite disc is to be made using cqual masses of aluminium and iron so that it has as high a moment of inertia as possible. This is possible when_____

a) the surfaces of the discs are made of iron with aluminium inside
b) the whole of aluminium is kept in the core and the iron at the outer rim of the dise
c) the whole of the iron is kept in the core and the aluminium at the outer rim of the dise
d) the whole disc is made with thin alternate sheets of iron and aluminium

67. Angular momentum is_____

a) vector (axial) b) Vector (Potar) c) Scalar d) None of these

68. The angular speed of an engine wheel making 90 revolutions per minute is :

a) 1.5 π rad/s b) 3 π rad/s c) 4.5 π rad/s d) 6 π rad/s

69. With the ground sweeping out a cone as shown in the figure. This movement of the axis of the top around the vertical is known as precession.with the ground sweeping out a cone as shown in the figure. This movement of the axis of the top around the vertical is known as precession.Centre of mass of three particles of masses 1 kg, 2 kg and 3 kg lies at the point (1, 2, 3) and centre of mass of another system of particles 3 kg and 2 kg lies at the point (-1, 3, -2). Where should we put a particle of mass 5 kg so that the centre of mass of entire system lies at the centre of mass of first system?

a) (0, 0, 0) b) (1, 3, 2) c) (-1, 2, 3) d) (3, 1, 8)

70. Assertion: If the head of a right handed screw rotates with the body, the screw advances in the direction of the angular velocity.
Reason: For rotation about a fixed axis, the angular velocity vector lies along the axis of rotation.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

71. Particle of mass m = 5 is moving with a uniform speed $v = 3\sqrt{2}$ in XOY plane along the line y =x + 4. The magnitude of the angular momentum of the particle about the origin is :
a) 60 units b) $40\sqrt{2}$ units c) zero d) 7.5 units

72. Four identical thin rods each of mass M and length l, form a square frame. Moment of inertia of this frame about an axis through the centre of the square and perpendicular to its plane is____
a) $\frac{2}{3}Ml^2$ b) $\frac{13}{3}Ml^2$ c) $\frac{1}{3}Ml^2$ d) $\frac{4}{3}Ml^2$

73. When a disc rotates with uniform angular velocity, which of the following is not true?
a) The sense of rotation remains same.
b) The orientation of the axis of rotation remains same.
c) The speed of rotation is non-zero and remains same.
d) The angular acceleration is non-zero and remains same.

74. Which of the following is the correct relation between linear velocity $\vec{v}$ and angular velocity $\vec{w}$ of a particle?
a) $\vec{v} = \vec{r} \times \vec{w}$ b) $\vec{v} = \vec{w} \times \vec{r}$ c) $\vec{w} = \vec{r} \times \vec{v}$ d) $\vec{w} = \vec{v} \times \vec{r}$

75. The speed of a homogenous solid sphere after rolling down an inclined plane of vertical height h from rest without sliding is :
a) $\sqrt{10gh/7}$ b) $\sqrt{gh}$ c) $\sqrt{6gh/5}$ d) $\sqrt{4gh/3}$

76. An athlete throws a discus from rest to a final angular velocity of 15 rad S^{-1} in 0.270 s before releasing it. During acceleration, discus moves a circular arc of radius 0.810 m. Acceleration of discus before it is released is
a) 45 ms^{-2} b) 182 ms^{-2} c) 187 ms^{-2} d) 192 ms^{-2}

77. The moments of inertia of two rotating bodies A and B are I_A and I_B ($I_A > I_B$). If their angular momenta are equal, then
a) Kinetic energy of A = Kinetic energy of B b) Kinetic energy of A > Kinetic energy of B
c) Kinetic energy of A < Kinetic energy of B
d) Kinetic energy of the two bodies cannot be compared with the given data

78. Assertion: The centre of mass of a body may lie where there is no mass.
Reason: The centre of mass has nothing to do with the mass
a) If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

79. Consider a system of two particles having masses m_1 and m_2. If the particle of mass m_1 is pushed towards the centre of mass of particles through a distance d, by what distance would the particle of mass m_2 move so as to keep the centre of mass of particles at the original position?

a) $(m_2/m_1)d$ b) $\frac{m_1}{m_1+m_2}d$ c) $(m_1/m_2)d$ d) d

80. (1) Centre of gravity of a body is the point at which the weight of the body acts.
(2) Centre of mass coincides with the centre of gravity if the earth is assumed to have infinitely large radius.
(3) To evaluate the gravitational field intensity due to any body at an external point, the entire mass of the body can be considered to be concentrated at its centre of gravity.
(4) The radius of gyration of any body rotating about an axis is the length of the perpendicular drawn from the centre of gravity of the body to the axis.
Which one of the following pairs of statements is correct?
a) (1) and (4) b) (1) and (2) c) (2) and (3) d) (3) and (4)

81. A thin rod of length L and mass M is bent at its midpoint into two halves so that the angle between them is 90°. The moment of inertia of the bent rod about an axis passing through the bending point and perpendicular to the plane defined by the two halves of the rod is_____

a) $\frac{ML^2}{24}$ b) $\frac{ML^2}{12}$ c) $\frac{ML^2}{6}$ d) $\frac{\sqrt{2}ML^2}{24}$

82. A hollow cylinder of mass M and radius R is rotating about its axis of symmetry and a solid sphere of same mass and radius is rotating about an axis passing through its centre. If torques of equal magnitude are applied to them, then the ratio of angular accelerations produced is :

a) $\frac{2}{5}$ b) $\frac{5}{2}$ c) $\frac{5}{4}$ d) $\frac{4}{5}$

83. Two bodies of mass 1 kg and 3 kg have position vectors $\hat{i}+2\hat{j}+\hat{k}$ and $-3\hat{i}-2\hat{j}+\hat{k}$ respectively. The centre of mass of this system has a position vector_______

a) $-2\hat{i}-\hat{j}+\hat{k}$ b) $2\hat{i}-\hat{j}-2\hat{k}$ c) $-\hat{i}+\hat{j}+\hat{k}$ d) $-2\hat{i}+2\hat{k}$

84. A wheel has angular acceleration of $3.0\,\text{rad/sec}^2$ and an initial angular speed of $2.00\,\text{rad/sec}$. In a time of $2\,\text{sec}$ it has rotated through an angle (in radian) of _____

a) 10 b) 4 c) 12 d) 6

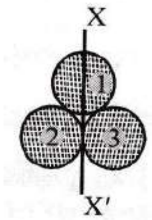
85. A solid cylinder of mass 20 kg and radius 20 cm rotates about its axis with an angular speed of 100 rad s^{-1}. The angular momentum of the cylinder about its axis is

a) 40 J s b) 400 J s c) 20 J s d) 200 J s

86. Assertion: The moment of inertia of a rigid body reduces to its minimum value, when the axis of rotation passes through its centre of gravity.
Reason: The weight of a rigid body always acts through its centre of gravity.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false d) If both assertion and reason are false.

87. Three identical spherical shells, each of mass m and radius r are placed as shown in figure. Consider an axis XX' which is touching to two shells and passing through diameter of third shell. Moment of inertia of the system consisting of these three spherical shells about XX' axis

is___



a) 3 MR^2 b) 16/5 MR^2 c) 4 MR^2 d) 11/5 MR^2

88. Assertion: The centre of gravity of a body coincides with its centre of mass only if the gravitational field does not vary from one part of the body to the other.
Reason : Centre of gravity is independent of the gravitational field.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

89. If a flywheel makes 120 rev/min, then its angular speed will be__
a) 8p rad/s b) 6 p rad/ s c) 4 p rad / s d) 2 p rad/s

90. A rigid body is said to be in partial equilibrium, when it is in
a) translational equilibrium only b) rotational equilibrium only c) either (a) or (b)
d) neither (a) nor (b)

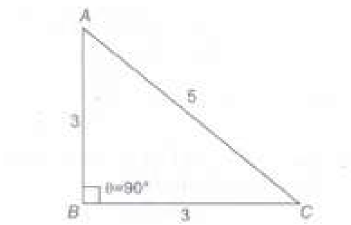
91. A solid cylinder is rolling without slipping on a plane having inclination θ and the coefficient of static friction μ_s, The relation between θ and μ_s is
a) $tan\theta > 3\mu_s$ b) $tan\theta \leq 3\mu_s$ c) $tan\theta < 3\mu_s^2$ d) None of these

92. A solid cylinder of mass M and radius R rolls without slipping down an inclined plane making an angle θ with the horizontal. Then its acceleration is
a) $\frac{1}{3}gsin\theta$ b) $\frac{2}{3}gsin\theta$ c) $\frac{2}{5}gsin\theta$ d) $\frac{2}{7}gsin\theta$

93. A wheel having moment of inertia 2 kgm^2 about its vertical axis, rotates at the rate of 60 rpm about this axis. The torque which can stop the wheel's rotation in one minute would be_____
a) $\frac{\pi}{18}$ N m b) $\frac{2\pi}{15}$ N m c) $\frac{\pi}{12}$ N m d) $\frac{\pi}{15}$ N m

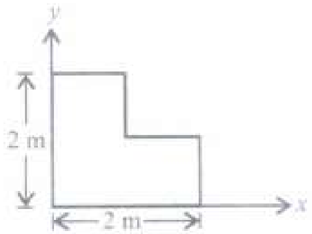
94. Three identical metal balls each of radius r are placed touching each other on a horizontal surface such that an equilateral triangle is formed with centres of three balls joined. The centre of mass of the system is located at_____
a) horizontal surface b) centre of one of the balls
c) line joining the centres of any two balls d) point of intersection of the medians

95. ABC is a triangular plate of uniform thickness. The sides are in the ratio shown in the figure. I_{AB}, I_{BC} and I_{CA} are the moments of Inertia of the plate about AB, BC and CA as axes respectively. Which one of the following relations is correct?



a) $I_{AB} > I_{BC}$ b) $I_{BC} > I_{AB}$ c) $I_{AB} + I_{BC} = I_{CA}$ d) I_{CA} is maximum

96. The x,y coordinates of the centre of mass of a uniform L-shaped lamina of mass 3 kg is



a) $\left(\frac{5}{6}m, \frac{5}{6}m\right)$ b) (1m,1m) c) $\left(\frac{6}{5}m, \frac{6}{5}m\right)$ d) (2m,2m)

97. A man stands on a rotating platform with his arms stretched holding a 5 kg weight in each hand. The angular speed of the platform is 1.2 rev s^{-1}. The moment of inertia of the man together with the platform may be taken to be constant and equal to 6 kg m^2. If the man brings his arms close to his chest with the distance of each weight from the axis changing from 100 cm to 20 cm. The new angular speed of the platform is

a) 2 rev s^{-1} b) 3 rev s^{-1} c) 5 rev s^{-1} d) 6 rev s^{-1}

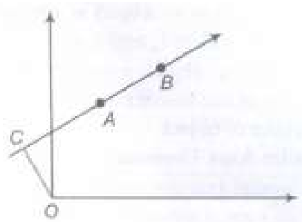
98. A solid cylinder of mass M and radius R rolls down an inclined plane of height h without slipping. The speed of its centre of mass when it reaches the bottom is_____

a) $\sqrt{2gh}$ b) $\sqrt{\frac{4gh}{3}}$ c) $\sqrt{\frac{3gh}{4}}$ d) $\sqrt{\frac{4g}{h}}$

99. When a mass is rotating in a plane about a fixed point its angular momentum is directed along

a) the radius b) the tangent the orbit c) the line at angle of 45° to the plane of rotation d) the axis of rotation

100. A particle of mass m moves in XY plane with a velocity 'v' along the straight line AB. If the angular momentum of the particle with respect to origin O is L_A when it is at A and L_B when it is at B then:



a) $L_A = L_B$ b) The relationship between L_A and L_B depends upon the slope of the line

c) $L_A < L_B$ d) $L_A > L_B$

101. A solid cylinder of mass M and radius R rolls without slipping down an inclined plane of length L and height h. What is the speed of its centre of mass when the cylinder reaches its bottom?

a) $\sqrt{4gh}$ b) $\sqrt{2gh}$ c) $\sqrt{\frac{3}{4}gh}$ d) $\sqrt{\frac{4}{3}gh}$

102. A solid cylinder of mass M and radius R rotates about its axis with angular speed (D. Its rotational kinetic energy is

a) $\frac{1}{2}MR^2w^2$ b) MR^2w^2 c) $\frac{1}{4}MR^2w^2$ d) $\frac{1}{8}MR^2w^2$

103. A child is standing with folded hands at the centre of a platform rotating about its central axis. The kinetic energy of the system is K. Now, the child stretches his arms so that moment of inertia of the system doubled. Now, the kinetic energy of the system is

a) $\frac{K}{4}$ b) $\frac{K}{2}$ c) 2 K d) 4 K

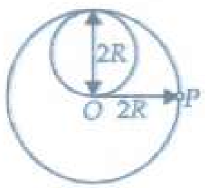
104. A disc is rotating with angular velocity ω. If a child sits on it, what is conserved?

a) Linear momentum b) Angular momentum c) Kinetic energy d) Moment of inertia

105. The centre of mass of a system of two particles of masses m_1 and m_2 is at a distance d_1 from m_l and at a distance d_2 from mass m_2 such that :

a) $\frac{d_1}{d_2}=\frac{m_2}{m_1}$ b) $\frac{d_1}{d_2}=\frac{m_1}{m_2}$ c) $\frac{d_1}{d_2}=\frac{m_1}{m_1+m_2}$ d) $\frac{d_1}{d_2}=\frac{m_2}{m_1+m_2}$

106. A lamina is made by removing a small disc of diameter 2R from a bigger disc of uniform mass density and radius 2R, as shown in the figure. The moment of inertia of this lamina about axes passing through O and P is I_O and I_p respectively. Both these axes are perpendicular to the plane of the lamina. The ratio $\frac{I_P}{I_O}$



a) 13/37 b) 37/13 c) 73/31 d) 8/13

107. At any instant, a rolling body may be considered to be in pure rotation about an axis through the point of contact axis is translating forward with speed ___________.

a) equal to centre of mass b) zero c) twice of centre of mass d) None of the above

108. The moment of inertia of a solid sphere of mass M and radius R about a tangent to the sphere is

a) $\frac{2}{5}MR^2$ b) $\frac{6}{5}MR^2$ c) $\frac{4}{5}MR^2$ d) $\frac{7}{5}MR^2$

109. Two stones of masses m and 2m are whirled in horizontal circles, the heavier one in a radius r/2 and the lighter one in radius r. The tangential speed of lighter stone is n times that of the value of heavier stone when they experience same centripetal forces. The value of n is :

a) 1 b) 2 c) 3 d) 4

110. Assertion: No real body is truly rigid

Reason : A rigid body is a body with a perfectly definite and unchanging shape. The distances between different pairs of particles of such a body do not change.

a) If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

111. A hoop of radius 2 m weighs 100 kg. It rolls along a horizontal floor so that its centre of mass has a speed of 20 cm s^{-1}. How much work has to be done to stop it?

a) 2 J b) 4 J c) 6 J d) 8 J

112. A constant torque of 1000Nm turns a wheel of moment of inertia $200\ \mathrm{kg\ m^2}$ about an axis through its centre. Its angular velocity after 3 seconds is____

a) $1 rad/s$ b) $5 rad/s$ c) $10 rad/s$ d) $15 rad/s$

113. If $\vec{F}$ is the force acting on a particle having position vector $\vec{r}$ and $\vec{\tau}$ be the torque of this force about the origin, then_______

a) $\vec{r}\cdot\vec{\tau} > 0$ and $\vec{F}\cdot\vec{\tau} < 0$ b) $\vec{r}\cdot\vec{\tau} = 0$ and $\vec{F}\cdot\vec{\tau} = 0$ c) $\vec{r}\cdot\vec{\tau} = 0$ and $\vec{F}\cdot\vec{\tau} \neq 0$

d) $\vec{r}\cdot\vec{\tau} \neq 0$ and $\vec{F}\cdot\vec{\tau} = 0$

114. A grindstone has a moment of inertia of 6 kg m^2. A constant torque is applied and the grindstone is found to have a speed of 150 rpm, 10 seconds after starting from rest. The torque is

a) $3\pi Nm$ b) 3 Nm c) $\frac{\pi}{3}Nm$ d) $4\pi Nm$

115. Which of the following relations is correct?

a) Mechanical advantage $=\frac{Effort}{Load}$ b) Load arm × Effort = Effort arm × Load

c) Load arm × Load = Effort arm × Effort d) None of these

116. Two discs of moments of inertia 11 and 12 about their respective axes (normal to the disc and passing through the centre), and rotating with angular speed w_1 and w_2 are brought into contact face to face with their axes of rotation coinciding with each other. What is the loss in kinetic energy of the system in the process?

a) $\frac{I_1I_2(w_1-w_2)^2}{2(I_1+I_2)}$ b) $\frac{I_1I_2(w_1-w_2)^2}{(I_1+I_2)}$ c) $\frac{I_1I_2(w_1+w_2)^2}{(I_1-I_2)}$ d) $\frac{I_1I_2(w_1+w_2)^2}{2(I_1-I_2)}$

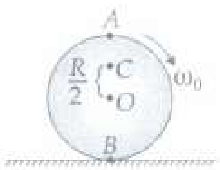
117. A solid cylinder of mass 50 kg and radius 0.5 m is free to rotate about the horizontal axis. A massless string is wound round the cylinder with one end attached to it and other hanging freely. Tension in the string required to produce an angular acceleration of 2 revolutions S^{-2} is______ .

a) 25 N b) 50 N c) 78.5 N d) 157 N

118. If the linear density (mass per unit length) of a rod of length 3 m is proportional to x, where x is the distance from one end of the rod, the distance of the centre of gravity of the rod from this end is_____

a) 25 m b) 1 m c) 1.5 m d) 2 m

119. A disc rotating about its axis with angular speed w_0 is placed lightly R {"C ~ - (1)0 (without any translational push) on a perfectly frictionless table. The radius of the disc is R. Let v_A, v_B and v_C be the magnitudes of linear velocities of the points A, B and C on the disc as shown. Then



a) $v_A > v_B > v_C$ b) $v_A < v_B < v_C$ c) $v_A = v_B < v_C$ d) $v_A = v_B > v_C$

120. Total angular momentum of a rotating body is conserved, if the net torque acting on the body is

a) zero b) maximum c) minimum d) unity

121. The instantaneous angular position of a point on a rotating wheel is given by the equation $q(t) = 2t^3 - 6t^2$. The torque on the wheel becomes zero at __________ .

a) t = 1 s b) t = 0.5 s c) t = 0.25 s d) t = 2 s

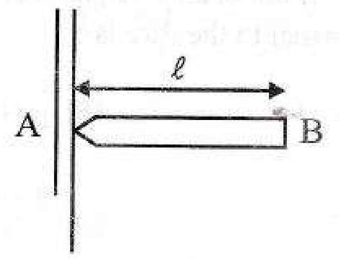
122. In the question number 66, if wheel starts from rest, what is the kinetic energy of the wheel when 2 m of the cord is unwound?

a) 20 J b) 25 J c) 45 J d) 50 J

123. A circular platform is mounted on a frictionless vertical axle, its radius R=2 m and its moment of inertia about the axle is 200 kgm^2. It is initially at rest. A50 kg man stands on the edge of the platform and begins to walk along the edge at the speed of $1\ ms^{-1}$ relative to the ground. Time taken by the man to complete one revolution is______

a) p s b) $\frac{3\pi}{2}s$ c) 2ps d) $\frac{\pi}{2}s$

124. A uniform rod AB of length l, and mass m is free to rotate about point A. The rod is released from rest in the horizontal position. Given that the moment of inertia of the rod about A is $ml^2/3$, ths initial angular acceleration of the rod will be_____



a) $\frac{mg\ell}{2}$ b) $\frac{3}{2}g\ell$ c) $\frac{3g}{2\ell}$ d) $\frac{2g}{3\ell}$

125. A thin circular ring of mass M and radius r is rotating about its axis with a constant angular velocity ω. Four objects each of mass m, are kept gently to the opposite ends of two perpendicular diameters of the ring. The angular velocity of the ring will be____

a) $\frac{(M-4m)\omega}{M+4m}$ b) $\frac{M\omega}{4m}$ c) $\frac{M\omega}{M+4m}$ d) $\frac{(M+4m)\omega}{M}$

126. A spherical ball rolls on a table without slipping. Then, the fraction of its total energy associated with rotation is_____

a) $\frac{2}{5}$ b) $\frac{2}{7}$ c) $\frac{3}{5}$ d) $\frac{3}{7}$

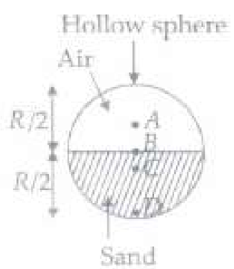
127. Assertion: The position of centre of mass does not depend upon the reference frame.
Reason: Centre of mass depends only upon the rest mass of the body.

a) If both assertion and reason are true and reason is the correct explanation of assertion

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

128. Which of the following points is the likely position of the centre of mass of the. system shown in figure?

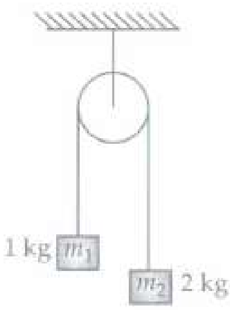


a) A b) B c) C d) D

129. The density of a non-uniform rod oflength 1m is given by p(x) = a(l + bx^2) where a and b are constants and 0≤x≤1. The centre of mass of the rod will be at

a) $\frac{3(2+b)}{4(3+b)}$ b) $\frac{4(2+b)}{3(3+b)}$ c) $\frac{3(3+b)}{4(2+b)}$ d) $\frac{4(3+b)}{3(2+b)}$

130. Two masses m_1=1 kg and m_2=2 kg are connected by a light inextensible string and suspended by means of a weightless pulley as shown in the figure. Assuming that both the masses start from rest, the distance travelled by the centre of mass in two seconds is (Take g=10ms^{-2})



a) $\frac{20}{9}m$ b) $\frac{40}{9}m$ c) $\frac{2}{3}m$ d) $\frac{1}{3}m$

131. A thin circular ring of mass M and radius R is rotating in a horizontal plane about an axis vertical to its plane with a constant angular velocity w. If two objects each of mass m be attached gently to the opposite ends of a diameter of the ring, the ring will then rotate with an angular velocity____

a) $\frac{\omega M}{M+2m}$ b) $\frac{\omega(M+2m)}{M}$ c) $\frac{\omega M}{M+m}$ d) $\frac{\omega(M-2m)}{M+2m}$

132. To maintain a rotor at a uniform angular speed of 100 rad s^{-1}, an engine needs to transmit torque of 100 N m. The power of the engine is

a) 10 kW b) 100 kW c) 10 MW d) 100 MW

133. The position of a particle is given by $\vec{r} = \hat{i} + 2\hat{j} - \hat{k}$ and its linear momentum is given by $\vec{p} = 3\hat{i} + 4\hat{j} - 2\hat{k}$. Then its angular momentum about the origin is perpendicular to

a) y-axis b) z-axis c) yz-plane d) x-axis

134. The moment of inertia of disc of mass M and radius R about an axis, which is tangential to circumference of disc and parallel to its diameter:

a) (3/2) MR^2 b) (2/5) MR^2 c) (5/4) MR^2 d) (4/4) MR^2

135. The angular speed of an engine wheel making 90 rev/min is____

a) 1.5prad/s b) 3prad/s c) 4.5prad/s d) 6prad/s

136. Let I be the moment of inertia of a uniform square plate about an axis AB that passes through its centre and is parallel to two of its sides. CD is a line in the plane of the plate that passes through the centre of the plate and makes an angle θ with AB. The moment of inertia of the plate about the axis CD is then equal to

a) I b) $I\sin^2\theta$ c) $I\cos^2\theta$ d) $I\cos^2(\theta/2)$

137. The centre of mass of a body

a) lies always at the geometrical centre b) lies always inside the body

c) lies always outside the body d) may lie within or outside the body

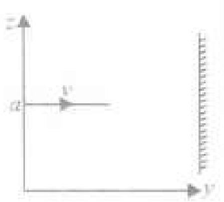
138. Three particles of masses 1 kg, $\frac{3}{2}$ kg, and 2 kg are located at the vertices of an equilateral triangle of side *a*. The *x*, *y* coordinates of the centre of mass are :

a) $\left(\frac{5a}{9}, \frac{2a}{3\sqrt{3}}\right)$ b) $\left(\frac{2a}{3\sqrt{3}}, \frac{5a}{9}\right)$ c) $\left(\frac{5a}{9}, \frac{2a}{\sqrt{3}}\right)$ d) $\left(\frac{2a}{\sqrt{3}}, \frac{5a}{9}\right)$

139. The moment of inertia of a body about a given axis is 1.2 kgm^2. In intially, the body is at rest. In order to produce a rotational kinetic energy of 1500 J, an angular acceleration of $25 \mathrm{rad/s^2}$ must be applied about that axis for a duration of___

a) 4 s b) 2 s c) 8 s d) 10 s

140. A particle of mass m is moving in yz-plane with a uniform velocity v with its trajectory running parallel to +ve y-axis and intersecting z-axis at z = a. The change in its angular momentum about the origin as it bounces elastically from a wall at y = constant is



a) $mva\hat{e}_x$ b) $2mva\hat{e}_x$ c) $ymv\hat{e}_x$ d) $2ymv\hat{e}_x$

141. A ball of mass 0.25 kg attached to the end of a string of length 1.96 m is moving in a horizontal circle. The string will break if the tension is more than 25 N. What is the maximum speed with which the ball can be moved?

a) $14 \mathrm{~m/s}$ b) $3 \mathrm{~m/s}$ c) $3.92 \mathrm{~m/s}$ d) $5 \mathrm{~m/s}$

142. A rod of we ight W is supported by two parallel knife edges A and B and is in equilibrium in a horizontal position. The knives are at a distance d from each other. The centre of mass of the rod is at distance x from l. The normal reaction on A is_____

a) $\frac{Wd}{x}$ b) $\frac{W(d-x)}{x}$ c) $\frac{W(d-x)}{d}$ d) $\frac{Wx}{d}$

143. Which of the following statements is not correct?

a) During rolling, the instantaneous speed of the point of contact is zero.

b) During rolling, the instantaneous acceleration of the point of contact is zero.

c) For perfect rolling motion, work done against friction is zero

d)

A wheel moving down a perfectly frictionless inclined plane will slip but not roll on the plane

144. Moment of couple is called

a) angular momentum b) force c) torque d) impulse

145. A fly wheel rotating about a fixed axis has a kinetic energy of 360 joule when its angular speed is 30 radian/sec. The moment of inertia of the wheel about the axis of rotation is :

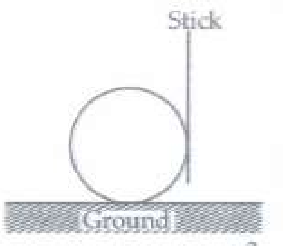
a) 0.6 kg/m^2 b) 0.15 kgm^2 c) 0.8 kg m^2 d) 0.75 kg m^2

146. A light rod of length l has two masses m_1 *and* m_2 attached to its two ends. The moment of inertia of the system about an axis perpendicular to the rod and passing through the centre of mass is :

a) $[m_1m_2/(m_1m_2)] \times l^2$ b) $[(m_1m_2)/m_1m_2] \times l^2$ c) $(m_1 + m_2) \times l^2$ d) $\sqrt{m_1m_2} \times l^2$

147. A uniform ladder 3 m long weighing 20 kg leans against a frictionless wall. Its foot rest on a rough floor 1 m from the wall. The reaction forces of the wall and floor are
a) $25\sqrt{2}N, 203N$ b) $50\sqrt{2}N, 230N$ c) $203N, 25\sqrt{2}N$ d) $230N, 50\sqrt{2}N$

148. A boy is pushing a ring of mass 2 kg and radius 0.5 m with a stick as shown in the figure. The stick applies a force of 2 N on the ring and rolls it without slipping with an acceleration of 0.3 m/s^2. The coefficient of friction between the ground and the ring is large enough that rolling always occurs. Then the coefficient of friction between the stick and the ring is :



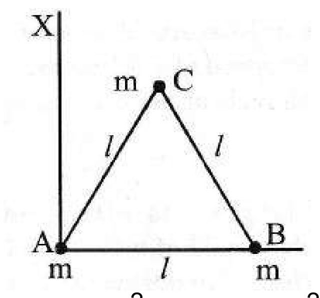
a) 0.4 b) 0.8 c) 0.2 d) 0.5

149. Three bodies, a ring, a solid cylinder and a solid sphere roll down the same inclined plane without slipping. They start from rest. The radii of the bodies are identical. Which of the bodies reaches the ground with maximum velocity?
a) Ring b) Solid cylinder c) Solid sphere d) All reach the ground with same velocity

150. The ratio of the accelerations for a solid sphere (mass ' m ' and radius ' R ') rolling down an incline of angle ' θ ' without slipping and slipping down the incline without rolling is _____
a) 5: 7 b) 2: 3 c) 2: 5 d) 7: 5

151. A child is standing with his two arms outstretched at the centre of a turntable that is rotating about its central axis with an angular speed w_0. Now, the child folds his hands back so that moment of inertia becomes 3 times the initial value. The new angular speed is
a) $3w_0$ b) $\frac{w_0}{3}$ c) $6w_0$ d) $\frac{w_0}{6}$

152. Three particles, each of mass m gram, are situated at the vertices of an equilateral triangle ABC of side/cm (as shown in the figure). The moment of inertia of the system about a line AX perpendicular to AB and in the plane of ABC,in gram cm^2 units will be ____________ .

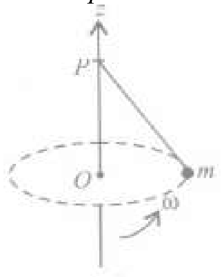


a) 3/2 ml^2 b) 3/4 ml^2 c) 2 ml^2 d) 5/4 ml^2

153. Moment of inertia of a uniform circular disc about a diameter is I. Its moment of inertia about an axis perpendicular to its plane and passing through a point on its rim will be____
a) 5 b) 61 c) 31 d) 41

154. A body is rotating with angular velocity $\vec{w} = (3\hat{i} - 4\hat{j} + \hat{k})$. The linear velocity of a point having position vector $\vec{r} = (5\hat{i} - 6\hat{j} + 6\hat{k})$ is
a) $6\hat{i} + 2\hat{j} - 3\hat{k}$ b) $18\hat{i} + 3\hat{j} - 2\hat{k}$ c) $-18\hat{i} - 13\hat{j} + 2\hat{k}$ d) $6\hat{i} - 2\hat{j} + 8\hat{k}$

155. A small mass m is attached to a Z massless string whose other end is fixed at P as shown in figure. The mass is undergoing circular motion in x-y plane with centre 0 and constant angular speed *w*. If the angular momentum of the system, calculated about 0 and P are denoted by $\vec{L}_O$ and $\vec{L}_p$ respectively, then



a) $\vec{L}_O$ and $\vec{L}_p$ do not vary with time. b) $\vec{L}_O$ varies with time while $\vec{L}_p$ remains constant.

c) $\vec{L}_O$ remains constant while $\vec{L}_p$ varies with time. d) $\vec{L}_O$ and $\vec{L}_p$ both vary with time.

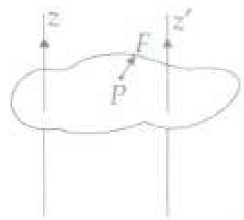
156. Two masses each of mass *M* are attached to the end of a rigid massless rod of length *L*. The moment of inertia of the system about an axis passing through centre of mass and perpendicular to its length is

a) $\frac{ML^2}{4}$ b) $\frac{ML^2}{2}$ c) ML^2 d) $2ML^2$

157. A gramophone record is revolving with an angular velocity ω. A coin is placed at a distance r from the centre of the record. The static coefficient of friction is μ. The coin will revolve with the record if_______

a) $r = \mu g \omega^2$ b) $r < \frac{\omega^2}{\mu g}$ c) $r \leq \frac{\mu g}{\omega^2}$ d) $r \geq \frac{\mu g}{\omega^2}$

158. Figure shows a lamina in x-y plane. Two axes z and z' pass perpendicular to its plane. A force F acts in the plane of lamina at point P as shown. Which of the following statements is incorrect?



(The point P is closer to z'-axis than the z-axis).

a) Torque τ' caused by F about z axis is along $\hat{k}$.

b) Torque τ' caused by *F* about z' axis is along $-\hat{k}$.

c) Torque caused by *F* about z axis is greater in magnitude than that about z' axis.

d) Total torque is given by $\tau = \tau + \tau'$.

159. When an explosive shell travelling in a parabolic path under the effect of gravity explodes in the mid air, the centre of mass of the fragments will move

a) vertically downwards b) along the original parabolic path

c) vertically upwards and then vertically downwards

d) horizontally followed by parabolic path

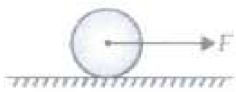
160. The moment of inertia of a body depends upon

a) mass of the body b) axis of rotation of the body c) shape and size of the body
d) all of these

161. A solid sphere, disc and solid cylinder all of the same Thass and made of the same material are allowed to roll down (from rest) on the inclined palne, then_____
a) solid sphere reaches the bottom first b) solid sphere, reaches the bottom last
c) disc will reach the bottom first d) all reach the bottom at the same time

162. An automobile engine develops 100 kW when rotating at a speed of 1800 rev/min. What torque does it deliver:
a) 350 N-m b) 440 N-m c) 531 N-m d) 628 N-m

163. A uniform disc of mass M and radius R, is resting on a table on its rim. The coefficient of friction between disc and table is μ, Now the disc is pulled with a force F as shown in the figure. What is the maximum value of F for which the disc rolls without slipping?



a) μMg b) $2\mu Mg$ c) $3\mu Mg$ d) $4\mu Mg$

164. A couple produces ___________ .
a) no motion b) linear and rotational motion c) purely rotational motion
d) purely linear motion

165. A rope of negligible mass is wound round a hollow cylinder of mass 3 kg and radius 40 cm. If the rope is pulled with a force of 30 N, then the angular acceleration produced in the cylinder is
a) 15 rad s^{-2} b) 20 rad s^{-2} c) 25 rad s^{-2} d) 30 rad s^{-2}

166. A ball rolls without slipping. The radius of gyration of the ball about an axis passing through its centre of mass is K. If radius of the ball be R, then the fraction of total energy associated with its rotational energy will be____
a) $\frac{R^2}{K^2+R^2}$ b) $\frac{K^2+R^2}{R^2}$ c) $\frac{K^2}{R^2}$ d) $\frac{K^2}{K^2+R^2}$

167. The ratio of radii of gyration of a circular ring and a circular disc, of the same mass and radius, about an axis passing through their centres and perpendicular to their planes are___
a) $\sqrt{2}:1$ b) $1:\sqrt{2}$ c) 3: 2 d) 2: 1

168. Which of the following principles a circus acrobat employs in his performance?
a) Conservation of energy b) Conservation of linear momentum c) Conservation of mass
d) Conservation of angular momentum

169. A metre stick is balanced on a knife edge at its centre. When two coins, each of mass 5 g are put one on top of the other at the 12 ern mark, the stick is found to be balanced at 45 cm. The mass of the metre stick is
a) 56g b) 66g c) 76g d) 86g

170. A tangential force F acts at the top of a disc of mass m and radius R. If it rolls without slipping. Then
a) Acceleration of disc $=\frac{2F}{3m}$ b) Friction force between disc and surface $=\frac{2F}{3}$
c) Acceleration of disc = $\frac{6F}{5m}$ d) Friction force between disc and surface is $\frac{F}{m}$

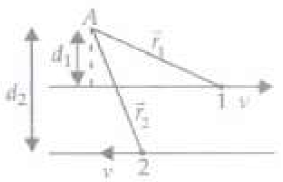
171. In a carbon monoxide molecule, the carbon and the oxygen atoms are separated by a distance 1.12×10^{-10} m. The distance of the centre of mass from the carbon atom is_____

a) 0.64×10^{-10} m b) 0.56×10^{-10} m c) 0.51×10^{-10} m d) 0.48×10^{-10} m

172. The radius of gyration of an uniform rod of length *l* about an axis passing through one of its ends and perpendicular to its length is

a) $\frac{1}{\sqrt{2}}$ b) $\frac{1}{3}$ c) $\frac{1}{\sqrt{3}}$ d) $\frac{1}{2}$

173. Figure shows two identical particles 1 and 2, each of mass m, moving in opposite directions with same speed v along parallel lines. At a particular instant, $\vec{r_1}$ and $\vec{r_2}$ are their respective position vectors drawn from point A which is in the plane of the parallel lines. Which of the following is the correct statement?



$\otimes$ represents a unit vector going into the page.

$\odot$ represents a unit vector coming out of the page.

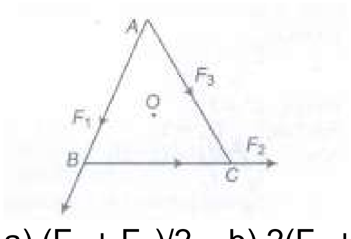
a) Angular momentum $\vec{L_1}$ of particle 1 about A is $\vec{L_1} = mv\vec{r_1}\odot$

b) Angular momentum $\vec{L_2}$ of particle 2 about A is $\vec{L_2} = mv\vec{r_2}\odot$

c) Total angular momentum of the system about A is $\vec{L} = mv(\vec{r_1} + \vec{r_2})\odot$

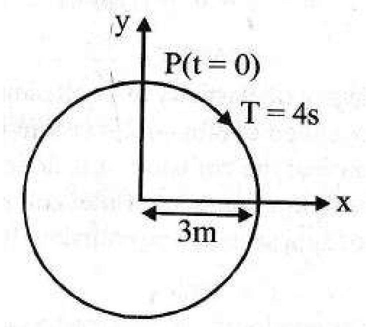
d) Total angular momentum of the system about A is $\vec{L} = mv(d_2 + d_1)\otimes$

174. O is the centre of an equilateral triangle ABC. F_1, F_2 and F_3 are three forces acting along the sides AB, BC and AC as shown here. What should be the magnitude of F_3, so that the total torque about O is zero?



a) $(F_1 + F_2)/2$ b) $2(F_1 + F_2)$ c) $(F_1 + F_2)$ d) $(F_1 - F_2)$

175. The radius of circle, the period of revolution, initial position and sense of revolution are indicated in the fig.



y- projection of the radius vector of rotating particle p is____

a) $y(t) = 4\sin\left(\frac{\pi t}{2}\right)$, where y in m b) $y(t) = 3\cos\left(\frac{3\pi t}{2}\right)$, where y in m c) $y(t) = 3\cos\left(\frac{\pi t}{2}\right)$, where y in m

d) $y(t) = -3\cos 2pt$, where y in m

176. A particle of mass m=5 kg is moving with a uniform speed $v = 3\sqrt{2}$ in the XOY plane along the line Y=X+4. The magnitude of the angular momentum of the particle about the origin is _____________ .

a) 60 unit b) $40\sqrt{2}$ unit c) zero d) 7.5 unit

177. The moment of inertia of a dise of mass M and radius R about a tangent to its rim in its plane is_____

a) $\frac{2}{3}MR^2$ b) $\frac{3}{2}MR^2$ c) $\frac{4}{5}MR^2$ d) $\frac{5}{4}MR^2$

178. A cart of mass M is tied to one end of a massless rope of length 10m. The other end of the rope is in the hands of a man of massM. The entire system is on a smooth horizontal surface. The man is at x=0 and the cart at x=10 m. If the man pulls the cart by the rope, the man and the cart will meet at the point._____

a) they will never meet b) x=10m c) x=5m d) x=0

179. The moment of inertia of a thin uniform rod of mass M and length L about an axis passing through its midpoint and perpendicular to its length is I_0, Its moment of inertia about an axis passing through one of its ends and perpendicular to its length is :

a) $I_0 + (ML^2)$ b) $I_0 + (ML^2/2)$ c) $I_0 + (ML^2/4)$ d) $I_0 + (2ML^2)$

180. If a sphere is rolling, the ratio of the translational energy to total kinetic energy is given by ___________ .

a) 7: 10 b) 2: 5 c) 10: 7 d) 5: 7

181. A solid sphere of mass m and radius R is rotating about its diameter. A solid cylinder of the same mass and same radius is also rotating about its geometrical axis with an angular speed twice that of the sphere. The ratio of their kinetic energies of rotation (E_{sphere} / $E_{cylinder}$) will be

a) 2:3 b) 1:5 c) 1:4 d) 3:1

182. The moment of inertia of a uniform circular disc of radius R and mass M about an axis passing from the edge of the disc and normal to the disc is___

a) MR^2 b) 1/2 MR^2 c) 3/2 MR^2 d) 7/2 MR^2

183. When a solid sphere rolls without slipping down an inclined plane making an angle 8 with the horizontal, the acceleration of its centre of mass is a. If the same sphere slides without friction, its acceleration a' will be

a) $\frac{7}{2}a$ b) $\frac{5}{7}a$ c) $\frac{7}{5}a$ d) $\frac{5}{2}a$

184. Which of the following statements are correct?

(i) Centre of mass of a body always coincides with the centre of gravity of the body.

(ii) Centre of mass of a body is the point at which the total gravitational torque on the body is zero.

(iii) A couple on a body produce both translational and rotational motion in a body.

(iv) Mechanical advantage greater than one means that small effort can be used to lift a large load.

a) (ii) and (iv) b) (i) and (ii) c) (ii) and (iii) d) (iii) and (iv)

185. A uniform cube of mass M and side a is placed on a frictionless horizontal surface. A vertical force F is applied to edge as shown in figure. Match Column I with Column II.

Column I		Column II	
(A)	For translational equilibrium	(p)	Mk^2
(B)	For rotational equilibrium	(q)	Angular acceleration
(C)	Moment of inertia of a body	(r)	$\sum \vec{F} = 0$
(D)	Torque is required to produce	(s)	$\sum \vec{\tau} = 0$

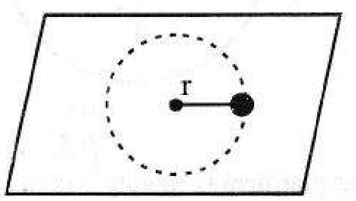
a) A - P, B - q, C - s, D - r b) A - r, B - s, C - q, D - P c) A - q, B - r, C - p, D - s
d) A - s, B - P. C - r, D - q

186. Assertion: A boiled egg can be easily distinguished from a raw unboiled egg by spinning.
Reason : The hard boiled egg has a moment of inertia which is more than that of the raw egg.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false.

187. A stone of mass m, tied to the end of a string, is whirled around in a horizontal circle. (Neglect the force due to gravity). The length of the string is reduced gradually keeping the angular momentum of the stone about the centre of the circle constant. Then, the tension in the string is given by $T = Ar^n$ where A is a constant, r is the instantaneous radius of the circle and n is
a) -3 b) 3 c) 2 d) -4

188. Analogue of mass in rotational motion is
a) moment of inertia b) torque c) radius of gyration d) angular momentum

189. A small mass attached to a string rotates on frictionless table top as shown. If the tension in the string is increased by pulling the string causing the radius of the circular motion to decrease by a factor of 2 , the kinetic energy of the mass will be___

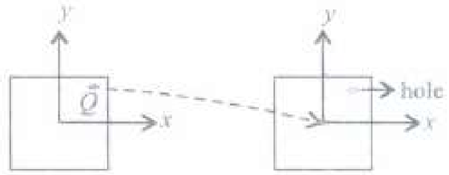


a) remain constant b) increase by a factor of 2 c) increase by a factor of 4
d) decrease by a factor of 2

190. Consider a particle of mass m having linear momentum $\vec{p}$ at position $\vec{r}$ relative to the origin O. Let $\vec{L}$ be the angular momentum of the particle with respect to the origin. Which of the following equations correctly relate(s) $\vec{r}$, $\vec{p}$ and $\vec{L}$?

a) $\frac{d\vec{L}}{dt} + \vec{r} \times \frac{d\vec{p}}{dt} = 0$ b) $\frac{d\vec{L}}{dt} + \frac{d\vec{r}}{dt} \times \vec{p} = 0$ c) $\frac{d\vec{L}}{dt} - \frac{d\vec{r}}{dt} \times \vec{p} = 0$ d) $\frac{d\vec{L}}{dt} - \vec{r} \times \frac{d\vec{p}}{dt} = 0$

191. A uniform square plate has a small piece Q of an irregular shape removed and glued to the centre of the plate leaving a hole behind. The moment of inertia about the z-axis is then



a) increased b) decreased c) the same d) changed in unpredicted manner

192. A body is rolling down an inclined plane. If kinetic energy of rotation is 40% of kinetic energy in translatory state, then the body is a :
a) ring b) cylinder c) hollow ball d) solid ball

193. Angular momentum L and rotational kinetic energy K_R of a rigid body are related to each other by the relation. (I = moment of inertia)
a) K_R=2IL b) $K_R = \frac{L^2}{2I}$ c) $K_R = \frac{2I}{L}$ d) $K_R = \frac{L^2}{I}$

194. The reduced mass of two particles having masses m and 2 m is
a) 2 m b) 3 m c) $\frac{2m}{3}$ d) $\frac{m}{2}$

195. Two particles which are initially at rest, move towards each other under the action of their internal attraction. If their speeds are v and 2 v at any instant, then the speed of centre of mass of the system will be ____________ .
a) 2 v b) zero c) 1.5 d) v

196. Assertion: A rigid body not fixed in some way can have either pure translation or a combination of translation and rotation.
Reason: In rotation about a fixed axis, every particle of the rigid body moves in a circle which lies in a plane perpendicular to the axis and has its centre on the axis.
a) If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

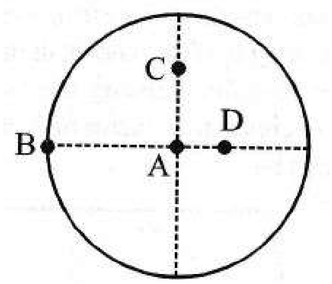
197. Assertion: A girl sits on a rolling chair, when she stretch her arms horizontally, her speed is reduced.
Reason : Principle of conservation of angular momentum is applicable in this situation.
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false.

198. The angular momentum of a body with mass (m) moment of inertia (I) and angular velocity (w) rad/s is equal to :
a) 0 b) 60^2 c) $\frac{I}{0}$ d) $\frac{1}{\omega^2}$

199. The objects, A (a solid sphere), B (a thin circular disk) and C (a circular ring), each have the same mass M and radius R. They all spin with the same angular speed w about their own symmetry axes. The amounts of work (W) required to bring them to rest, would satisfy the relation_____

a) $W_B > W_A > W_C$ b) $W_A > W_B > W_C$ c) $W_C > W_B > W_A$ d) $W_A > W_C > W_B$

200. The moment of inertia of a uniform circular disc is maximum about an axis perpendicular to the disc and passing through



a) B b) C c) D d) A

201. A ring of mass m and radius r rotates about an axis passing through its centre and perpendicular to its plane with angular velocity ω. Its kinetic energy is___

a) $\frac{1}{2}mr^2\omega^2$ b) $mr\omega^2$ c) $mr^2\omega^2$ d) $\frac{1}{3}mr^2\omega^2$

202. A disc is rotating with angular velocity & about its axis. A force $\vec{F}$ acts at a point whose position vector with respect to the axis of rotation is $\vec{r}$. The power associated with the torque due to the force is given by

a) $(\vec{r} \times \vec{F}).\vec{w}$ b) $(\vec{r} \times \vec{F}) \times \vec{w}$ c) $\vec{r}.(\vec{F} \times \vec{w})$ d) $\vec{r} \times (\vec{F}.\vec{w})$

203. Two racing cars of masses m and 4 m are moving in circles of radii r and 2 r respectively. If their speeds are such that each makes a complete circle in the same time, then the ratio of the angular speeds of the first to the second car is____

a) 4: 1 b) 2: 1 c) 1: 1 d) 8: 1

204. The force $7\hat{i} + 3\hat{j} - 5\hat{k}$ acts on a particle whose position vector is $\hat{i} - \hat{j} + \hat{k}$. What is the torque of a given force about the origin?

a) $2\hat{i} + 12\hat{j} + 10\hat{k}$ b) $2\hat{i} + 10\hat{j} + 12\hat{k}$ c) $2\hat{i} + 10\hat{j} + 10\hat{k}$ d) $10\hat{i} + 2\hat{j} + \hat{k}$

205. The ratio of the radii of gyration of a circular disc about a tangential axis in the plane of the disc and of a circular ring of the same radius about a tangential axis in the plane of the ring is_____

a) $1:\sqrt{2}$ b) 1: 3 c) 2: 1 d) $\sqrt{5}:\sqrt{6}$

206. A homogeneous disc of mass 2 kg and radius 15 cm is rotating about its axis (which is fixed) with an angular velocity of 4 radian/see with an angular velocity of 4 radian/sec. The linear momentum of the disc is:

a) 1.2 kg m/s b) 1.0 kg m/s c) 0.6 kg m/s d) none of above

207. Which of the following statements is incorrect?

a) A pair of equal and opposite forces with different lines of action is known as couple.

b) A couple produces rotation without translation.

c) When we open the lid of a bottle by turning it, our fingers apply a couple to the lid.

d) Moment of a couple depends on the point about which we take the moment.

208. A rod of weight W is supported by two parallel knife edges A and B and is in equilibrium in a horizontal position. The knives are at a distance d from each other. The centre of mass of the rod is at distance x from A. The normal reaction on A is RA and on B is R_B, then $\frac{R_A}{R_B} is$:

a) $\frac{d}{d-x}$ b) $\frac{d-x}{d}$ c) $\frac{d-x}{x}$ d) $\frac{x}{d-x}$

209. A drum of radius R and mass M, rolls down without slipping along an inclined plane of angle θ. The fractional force:

a) dissipates energy as heat b) decreases the rotational motion

c) decreases the rotational and transational motion

d) converts transational energy to rotational energy

210. The direction of the angular velocity vector is along

a) the tangent to the circular path b) the inward radius c) the outward radius

d) the axis of rotation

211. A mass m moves in a circle on a smooth horizontal plane with velocity v_0 at a radius R_0. The mass is attached to string which passes through a smooth hole in the plane as shown. The tension in the string is increased gradually and finally m moves in a circle of radius $R_0/2$ The final value of the kinetic energy is___

a) 1/4 mv_0^2 b) 2 mv_0^2 c) 1/2 mv_0^2 d) mv_0^2

212. The z component of the angular momentum of a particle whose position vector is $\vec{r}$ with components x, y and z and linear momentum is $\vec{p}$ with components P_x, P_y and P_z is :

a) xp_y-yp_x b) yp_z-zp_y c) zp_x-xp_z d) xp_y+yp_x

213. Assertion: The moment of inertia of a rigid body depends only on the mass of the body, its shape and size.

Reason: Moment of inertia I = MR2 , where M is the mass of the body and R is the radius vector.

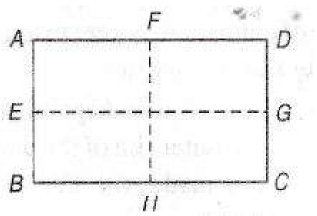
a) If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

214. In a rectangle A B C D(B C=2 A B) The moment of inertia is minimum along axis through_____



a) BC b) BD c) HF d) EG

215. A small object of uniform density rolls up a curved surface with an initial velocity ' v '. It reaches upto a maximum height of $\frac{3v^2}{4g}$ with respect to the initial position. The object is a_____

a) solid sphere b) hollow sphere c) disc d) ring

216. G at x=40 cm and 400 g at the x-axis: 300 g at origin, 500 centre of 40 cm and 400 g at x=70 cm. The distance of the ____________ .

a) 40 cm b) 45 cm c) 50 cm d) 30 cm

217. Which of the following statements is correct?

a) For a general translational motion, momentum $\vec{p}$ and velocity $\vec{v}$ need not be parallel.

b)

For a general rotational motion, angular momentum $\vec{L}$. and angular velocity $\vec{w}$ are always parallel.

c) For a general translational motion, acceleration $\vec{a}$ and velocity $\vec{v}$ are always parallel.

d)

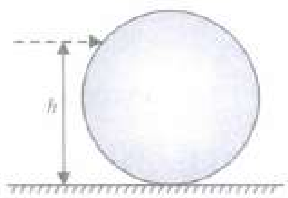
For a general rotational motion, angular momentum $\vec{L}$ and angular velocity $\vec{w}$ need not be parallel.

218. Assertion: The motion of a ceiling fan is rotational only.
Reason: The motion of a rigid body which is pivoted or fixed in some way is rotation.
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

219. A solid homogeneous sphere of mass M and radius R is moving on a rough horizontal surface, partly rolling and partly sliding. During this kind of motion of the sphere___
a) total kinetic energy is conserved
b)
the angular momentum of the sphere about the point of contact with the plane is conserved
c) only the rotational kinetic energy about the centre of mass is conserved
d) angular momentum about the centre of mass is conserved

220. Two particles of mass 5 kg and 10 kg respectively are attached to the two ends of a rigid rod of length 1 m with negligible mass. The centre of mass of the system from the 5 kg particle of nearly at a distance of____
a) 80 cm b) 33 cm c) 50 cm d) 67 cm

221. A uniform sphere of mass M and radius R is placed on a rough horizontal surface h (Figure). The sphere is struck horizontally at a height h from the floor. Match Column I with Column II.



Column I		Column II	
(A)	$h=\frac{R}{2}$	(p)	Sphere rolls without slipping with a constant velocity and no loss of energy.
(B)	h=R	(q)	Sphere spins clockwise, loses energy by friction.

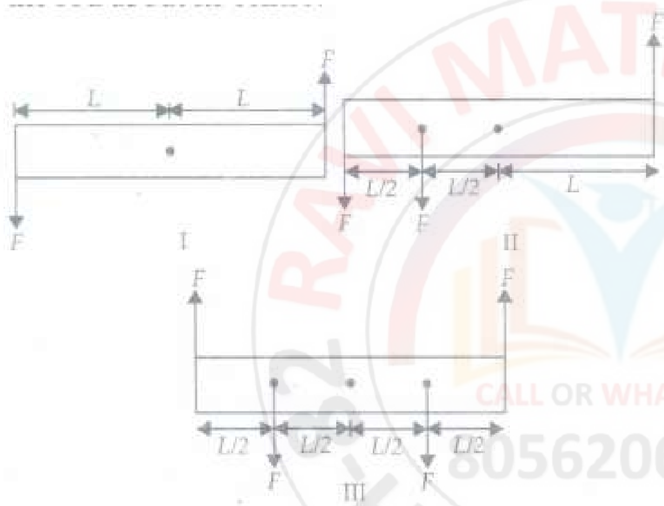
(C)	$h = \frac{3}{2}R$	(r)	Sphere spins anti-clockwise, loses energy by friction.
(D)	$h = \frac{7}{5}R$	(s)	Sphere has only a translational motion, loses energy by friction.

a) A - r, B - s, C - q, D - P b) A - s, B - p, C - r, D - q c) A - q, B - r, C - p, D - s
d) A - p, B - q, C - s, D - r

222. A particle is projected at time t = 0 from a point P on the ground with a speed v_o, at an angle of 45° to the horizontal The angular momentum of the particle about P at time t = v_o/g is

a) $\frac{mv_0^3}{2\sqrt{2}g}$ b) $\frac{mv_0^3}{\sqrt{2}g}$ c) $\frac{3mv_0^3}{\sqrt{2}g}$ d) $\frac{\sqrt{2}mv_0^3}{g}$

223. A rigid rod oflength 2L is acted upon by some forces. All forces labelled as F have the same magnitude. Which cases have a non-zero net torque acting on the rod about its centre?



a) I and II only b) II and III only c) I and III only d) The net torque is zero in all cases.

224. Assertion: If there are no external forces, the centre of mass of a double star moves like a free particle.

Reason: If we go to the centre of mass frame, then we find that the two stars are moving in a circle about the centre of mass, which is at rest.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

225. The angular speed of a motor wheel is increased from 1200 rpm to 3120 rpm in 16 seconds. The angular acceleration of the motor wheel is

a) $2\pi \text{ rad s}^{-2}$ b) $4\pi \text{ rad s}^{-2}$ c) $6\pi \text{ rad s}^{-2}$ d) $8\pi \text{ rad s}^{-2}$

226. Find the torque about the origin when a force of $3\hat{j}$N acts as on a particle whose position vector is $2\hat{k}$m ____

a) $6\hat{k}$Nm b) $6\hat{i}$Nm c) $6\hat{j}$Nm d) $-6\hat{i}$Nm

227. Moment of the couple is called

a) angular momentum b) force c) torque d) impulse

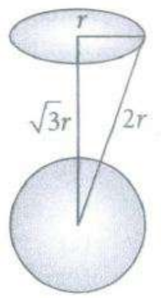
Ravi Maths Tuition Centre

Time : 1 Mins **GRAVITATION 1 1** **Marks : 1414**

1. Value of g is
   a) maximum at poles b) maximum at equator c) same everywhere
   d) minimum at poles

2. (A) An artificial satellite is moving in a circular orbit of the earth. If the gravitational pull suddenly disappears, then it moves with the same speed tangential to the original orbit.
   (R) The orbital speed of a satellite decreases with the increase in radius of the orbit.
   a)
   If both assertion and reason are true and reason is the correct explanation of assertion
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion
   c) If assertion is true but reason is false.
   d) If both assertion and reason are false.
   e) If assertion is false but reason is true.

3. A uniform ring of mass m and radius r is placed directly above a uniform sphere of mass M and of equal radius. The centre of the ring is directly above the centre of the sphere at a distance r$\sqrt{3}$ as shown in the figure. The gravitational force exerted by the sphere on the ring will be



a) $\frac{GMm}{8r^2}$ b) $\frac{GMm}{4r^2}$ c) $\sqrt{3}\frac{GMm}{8r^2}$ d) $\frac{GMm}{8r^2\sqrt{3}}$

4. A research satellite of mass 200 kg circles the earth in an orbit radius $\frac{3R_E}{2}$, where R_E is the radius of the earth. Assuming the gravitational pull on a mass of 1 kg on the earth's surface to be 10 N, the pull on the satellite will be
   a) 890 N b) 889 N c) 885 N d) 892 N
5. During a journey from earth to the moon and back, the greatest energy required from the space-ship rockets is to overcome:
   a) The earth's gravity at take b) The moon's gravity at lunar landing
   c) The moon's gravity at lunar take off
   d) The point where the pull of the earth and moon are equal but opposite
6. If the earth loses its gravity, then for a body:
   a) weight becomes zero, but not the mass b) mass becomes zero, but not weight
   c) neither mass nor weight is zero d) both mass and weight are zero
7. The mass and diameter of a planet are two times those of the earth. If a seconds pendulum is taken to it, the time period of the pendulum (in seconds) is:
   a) $\frac{1}{\sqrt{2}}$ b) $\frac{1}{2}$ c) 2 d) $2\sqrt{2}$
8. The escape velocity of a particle of mass m varies as:
   a) m^2 b) m c) m^0 d) m^{-1}
9. Taking that the earth revolves round the sun in a circular orbit of radius 15×10^{10} m with a time period of 1 year, the time taken by another planet, which is at a distance of 540×10^{10} m, to revolve round the sun in a circular orbit once, will be:
   a) 144 years b) 72 years c) 36 years d) 216 years
10. To put in the orbit, the satellite should be fired as a projectile with:
   a) escape velocity b) twice the escape velocity c) thrice the escape velocity
   d) none of these
11. For a satellite moving in an orbit around the Earth, the ratio of kinetic energy to potential energy is
   a) 2 b) 1/2 c) $1/\sqrt{2}$ d) $\sqrt{2}$
12. Consider a planet whose mass and diameter were both half that of the earth. The gravitational potential energy of an object on its surface compared to that on the earth's surface will be?
   a) Same b) One-half c) Double d) One-fourth
13. An astronaut orbiting the Earth in a circular orbit 120 km above the surface of Earth, gently drops a spoon out of space-ship. The spoon will :
   a) Fall vertically down to the E b) Move towards the moon
   c) Will move along with space-ship

d) Will move in an irregular way then fall down to earth.

14. A particle of mass m is placed at the centre of a uniform spherical shell of mass 3m and radius R. The gravitational potential on the surface of the shell is

a) $-\frac{Gm}{R}$ b) $-\frac{3Gm}{R}$ c) $-\frac{4Gm}{R}$ d) $-\frac{2Gm}{R}$

15. Three particles are projected vertically upward from a point on the surface of earth with velocities

$$v_1 = \sqrt{\frac{2gR}{3}};\ v_2 = \sqrt{gR};\ v_3 = \sqrt{\frac{4gR}{3}}$$

respectively, where g is acceleration due to gravity on the surface of earth. If the maximum height attained are $h_1 > h_2$ and h_3 respectively, then $h_1 : h_2 : h_3$ is

a) 1:2:3 b) 2:3:4 c) 1:2:4 d) 1:3:5

16. If g_o, g_h and g_d be the acceleration due to gravity at the earth's surface, at height h and at a depth d respectively, then:

a) $g_o > g_h$ and $g_o > g_d$ b) $g_o < g_h$ and $g_o < d$ c) $g_o > g_h$ and $g_o < g_d$

d) $g_o < g_h$ and $g_o > g_d$

17. Two spheres each of mass M and radius R are separated by a distance of r. The gravitational potential at the midpoint of the line joining the centres of the spheres is

a) $-\frac{GM}{r}$ b) $-\frac{2GM}{r}$ c) $-\frac{GM}{2r}$ d) $-\frac{4GM}{r}$

18. For a satellite moving in on orbit around earth the ration of its potenial energy to kinetic energy is

a) 1 b) -1 c) 2 d) -2

19. (A) For the planets orbiting around the sun, angular speed, linear speed, KE changes with time, but angular momentum remains constant.

(R) No torque is acting on the rotating planet, so its angular momentum is constant.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

20. In a gravitational field, at a point where the gravitational potential is zero:

a) The gravitational field is necessarily zero

b) The gravitational field is not necessarily

c) Nothing can be said definitely about the gravitational field d) None of these

21. At surface of Earth weight of a person is 72 N then his weight at height R/2 from surface of Earth is (R= radius of earth)

a) 28N b) 16N c) 32N d) 72N

22. A ball is dropped from a spacecraft revolving around the earth at a height of 120 km. What will happen to the ball?

a) It will go very far in the space b) It will fall down on the earth gradually

c) It will move with the same speed, tangentially to the space-craft

d)

It will continue to move with the same speed along the original orbit of space-craft

23. A satellite S is moving in an elliptical orbit around the earth. The mass of the satellite is very small compared to the mass of the earth. Then:

a) the acceleration of S is always directed towards the centre of the earth

b)

the angular momentum of S about the centre of the earth changes in direction, but its magnitude remains constant

c) the total mechanical energy of S varies periodically with time

d) the linear momentum of S remains constant in magnitude

24. Two stars of masses m_1 and m_2 are parts of a binary star system. The radii of their orbits are r_1 and r_2 respectively, measured from the centre of mass of the system. The magnitude of gravitational force m1 exerts on m_2 is

a) $\frac{m_1 m_2 G}{(r_1+r_2)^2}$ b) $\frac{m_1 G}{(r_1+r_2)^2}$ c) $\frac{m_2 G}{(r_1+r_2)^2}$ d) $\frac{G(m_1+m_2)}{(r_1+r_2)^2}$

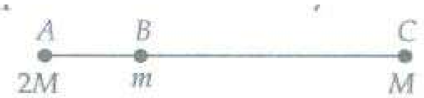
25. If the radius of the earth's orbit is made one-fourth, the duration of a year will become:

a) 8 times b) 4 times c) $\frac{1}{8}$ time d) $\frac{1}{4}$ time

26. The height at which the weight of a body becomes 1/16th, its weight on the surface of Earth (radius R), is:

a) SR b) 15R c) 3R d) 4R

27. Particles of masses 2M, m and M are respectively at points A, B and C with AB = l/2(BC). m is muchmuch smallerthanMand at time t=0, they are allat rest. At subsequent times before any collision takes place



a) m will remain at rest. b) m will move towards M. c) m will move towards 2M.
d) m will have oscillatory motion.

28. A body hanging from a spring stretches it by 1 cm at the earth's surface. How much will the same body stretch the spring at a place 16400 km above the earth's surface? (Radius of the earth = 6400 km)
a) 1.28 cm b) 0.64 cm c) 3.6 cm d) 0.12 cm

29. The angular speed of rotation of the earth is :
a) 7.3×10^{-5} rad S^{-1} b) 7.3×10^{-4} rad S^{-1} c) 7.3×10^{-6} rad S^{-1}
d) 7.3×10^{-3} rad S^{-1}

30. An infinite number of point masses each equal to mare placed at x = 1, x = 2, x = 4, x = 8 .... What is the total gravitational potential at x = 0?
a) - Gm b) -2 Gm c) -4 Gm d) -8 Gm

31. A rocket is fired vertically from the surface of the earth with a speed v. How far from the earth does the rocket go before returning to the earth? (where RE is the radius of the earth and g is acceleration due to gravity)
a) $\frac{R_E v^2}{gR_E - v^2}$ b) $\frac{R_E v^2}{gR_E + v^2}$ c) $\frac{R_E v^2}{2gR_E - v^2}$ d) $\frac{R_E v^2}{2gR_E + v^2}$

32. Assuming that earth and mars move in circular orbits around the sun, with the martian orbit being 1.52 times the orbital radius of the earth. The length of the martian year in days is :
a) $(1.52)^{2/3} \times 365$ b) $(1.52)^{3/2} \times 365$ c) $(1.52)^2 \times 365$ d) $(1.52)^3 \times 365$

33. A satellite is revolving around the earth in a circular orbit four times the radius of the parking orbit. What will be the time-period of the satellite?
a) 2 days b) 4 days c) 16 days d) None of these

34. How much work per kilogram need to be done to shift a 1 kg mass from the surface of the earth to infinity? (Take acceleration due to gravity = g and radius of the earth = R)
a) g/R b) R/g c) gR d) g/R^2

35. (A) We cannot move even a finger without disturbing all the stars.
(R) Every body in this universe attracts every other body with a force which is inversely proportional to the square of distance between them.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

36. Let A be area swept out by the line joining the earth and the sun during Feb. 1991. The area swept out by the line during a typical week in Feb. 1991 is:
a) A b) 2A c) 4A d) $\frac{A}{4}$

37. (A) A person in an artificial satellite revolving around the earth feels weightlessness.
(R) There is no gravitational force on the satellite.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false.
d) If both assertion and reason are false.
e) If assertion is false but reason is true.

38. The escape velocity of 10 g body from the earth is 11.2 km s^{-1}. Ignoring air resistance, the escape velocity of 10 kg of the iron ball from the earth will be
a) 0.0112 km s^{-1} b) 0.112 km s^{-1} c) 11.2 km s^{-1} d) 0.56 km s^{-1}

39. If the earth shrinks such that its mass does not change but radius decreases to one quarter of its original value, then one complete day will take:
a) 96 hrs b) 48 hrs c) 6 hrs d) 1.5 hrs

40. How much energy will be necessary for making a body of 500 kg escape from the earth? (g = 9.8 m/s^2, radius of the earth = 6.4 x 10^6 m)
a) About 9.8 x 10^6 J b) About 6.4 x 10^8 J c) About 3.1 x 10^{10} J
d) About 27.4 x 10^{12} J

41. If there were a smaller gravitational effect, which of the following forces do you think would alter in some respect :
a) Viscous forces b) As it depends on the weight of the body
c) Electrostatic force d) None of the above

42. (A) A spherically symmetric shell produces no gravitational field anywhere.
(R) The field due to various mass elements cancels out, everywhere for a spherically symmetric shell.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false.

d) If both assertion and reason are false.

e) If assertion is false but reason is true.

43. If the earth is supposed to be a sphere of radius R, g 300 is the value of acceleration due to gravity at latitude of 30° and g at the equator, the value of g - g 30^0 is:

a) (1/4) ω^2R b) (3/4) ω^2R c) ω^2R d) (1/2) ω^2R

44. A spherical planet has a mass M_P and diameter D_P. A particular of mass m falling freely near the surface of this planet will experience an acceleration due to gravity, equal to_____

a) $4GM_P/D_P^2$ b) GM_Pm/D_P^2 c) GM_P/D_P^2 d) $4GM_Pm/D_P^2$

45. The orbit of geostationary satellite is circular, the time period of satellite depends on (i) mass of the satellite (ii) mass of the earth (iii) radius of the orbit (iv) height of the satellite from the surface of the earth

a) (i) only b) (i) and (ii) c) (i), (ii) and (iii) d) (ii), (iii) and (iv)

46. If the change in the value of gat a height h above the surface of the earth is the same as at a depth x below it when both x and h are much smaller than the radius of the earth, then:

a) x = h b) x = 2h c) $x = \frac{h}{2}$ d) $x = \frac{h}{3}$

47. The escape velocity from the Earth is about 11 km/second. The escape velocity from a planet having twice the radius and the same mean density as the Earth is :

a) 22 km/sec b) 11 km/sec c) 5.5 km/sec d) 5.5 km/sec

48. A satellite is launched into a circular orbit of radius R around the earth while a second satellite is launched into an orbit of radius 1.02R. The percentage difference in the time period is:

a) 0.7 % b) 1.0 % c) 1.5 % d) 3.0 %

49. If the gravitational force between two objects were proportional to 1/R; where R is separation between them, then a particle in circular orbit under such a force would have its orbital speed v proportional to:

a) $1/R^2$ b) R^O c) R^I d) 1/R

50. A ball is dropped from a satellite revolving around the Earth at a height of 120km. The ball will:

a)

continue to move with same speed along a straight line tangentially to the satellite at that time

b) continue to move with the same speed along the original orbit of satellite

c) fall down to earth gradually d) go far away in space

51. The work done to raise a mass m from the surface of the earth to a height h, which is equal to the radius of the earth, is____

a) 2mgR b) $\frac{1}{2}mgR$ c) $\frac{3}{2}$mgR d) mgR

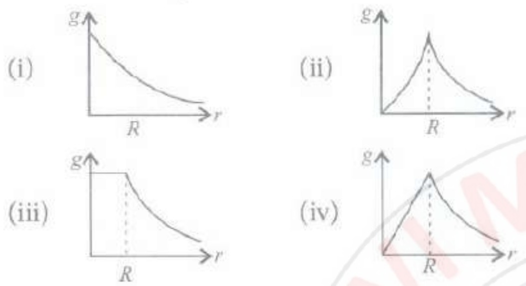
52. If r denotes the distance between the sun and the earth, then the angular momentum of the earth around the sun is proportional to:

a) $r^{3/2}$ b) r c) $\sqrt{r}$ d) r^2 e) r^3

53. The condition for a uniform spherical mass mofradius r to be a black hole is: (G = gravitational constant and g = acceleration due to gravity)

a) $(2Gm/r)^{1/2} \leq c$ b) $(2gm/r)^{1/2} = c$ c) $(2Gm/ r)^{1/2} \geq c$ d) $(gm/ r)^{1/2} \geq c$

54. The dependence of acceleration due to gravity g on the distance r from the centre of the earth assumed to be a sphere of radius R of uniform density is as shown in the figure.



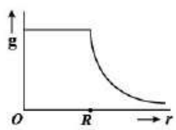
The correct figure is

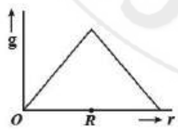
a) (i) b) (ii) c) (iii) d) (iv)

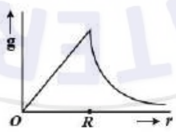
55. If a graph is plotted between T^2 and r^3 for a planet, then its slope will be (where Ms is the mass of the sun)

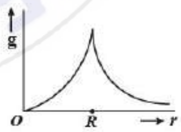
a) $\frac{4\pi^2}{GM_S}$ b) $\frac{GM_S}{4\pi}$ c) $4\pi GM_S$ d) GM_S

56. Starting form the centre of the carth having radius R, the variation of g (acceleration due to gravity) is shown by

a) 

b) 

c) 

d) 

57. Mass of the moon is 7.34 x 10^{22} kg. If the acceleration due to gravity on the moon is 1.4 m/s^2, the radius of the moon is: (G = 6.667 x 10^{11} Nm^2/Kg^2)

a) 0.56 x 10^4 m b) 1.87 x 10^6 m c) 1.92 x 10^6 m d) 1.01 x 10^8 m

58. Black Hole is

a) super surface of atmosphere b) ozone layer

c) super dense planetary material d) none of these

59. A satellite is orbiting around the earth with total energy E. What will happen if the satellite's kinetic energy is made 2 E?

a) Radius of the orbit is doubled b) Radius of the orbit is halved

c) Period of revolution is doubled d) Satellite escapes away

60. Different points in earth are at slightly different distances from the sun and hence experience different forces due to gravitation. For a rigid body, we know that if various forces act at various points in it, the resultant motion is as if a net force acts on the centre of mass causing translation and a net torque at the centre of mass causing rotation around an axis through the centre of mass. For the earth sun system (approximating the earth as a uniform density sphere)
   a) the torque is zero b) the torque causes the earth to spin.
   c)
   the rigid body result is not applicable since the earth is not even approximately a rigid body.
   d) the torque causesthe earth to movearound the sun
61. An artificial satellite moving in a circular orbit around the earth has a total energy E_0. Its potential energy is
   a) $-E_0$ b) E_0 c) $2E_0$ d) $-2E_0$
62. A planet is moving in an elliptical orbit around the Sun. If T, V, E and L stand respectively for its kinetic energy, gravitational potential energy, total energy and magnitude of angular momentum about the center of force, which of the following is correct?
   a) T is conserved b) V is always positive c) E is always negative
   d) L is conserved but direction of vector L changes continuously
63. A satellite with kinetic energy E is revolving round the earth in a circular orbit. The minimum additional kinetic energy required for it to escape into outer space is:
   a) $\sqrt{2}$E b) 2E c) E/$\sqrt{2}$ d) E/2 e) E
64. A body is suspended on a spring balance in a ship sailing along the equator with a speed V. If $\omega$is the angular speed of the earth and Wo is the scale reading when the ship is at rest, the scale reading when the ship is sailing will be very close to:
   a) W_0 b) $W_0(1+\frac{2\omega V}{g})$ c) $W_0(1\pm\frac{2\omega V}{g})$ d) none of these
65. A satellite revolves around the Earth in an elliptical orbit. Its speed:
   a) is the same at all points in the orbit b) is greatest when it is closest to the Earth
   c) is greatest when it is farthest from the Earth
   d)
   goes on increasing or decreasing continuously depending upon the mass of the satellite
66. The acceleration due to gravity g and density of the earth ρ are related by which of the following relations?
   (where G is the gravitational constant and R_E is the radius of the earth)
   a) $\rho=\frac{4\pi GR_E}{3g}$ b) $\rho=\frac{3g}{4\pi GGR_E}$ c) $\rho=\frac{3G}{4\pi gR_E}$ d) $\rho=\frac{4\pi gR_E}{3G}$

67. For a satellite escape velocity is $111\ \text{km/s}$. If the satellite is launched at angle of 60° with the vertical, then escape velocity will be______

a) $11\ \text{km/s}$ b) $11\sqrt{3}\ \text{km/s}$ c) $\frac{11}{\sqrt{3}}\ \text{km/s}$ d) $33\ \text{km/s}$

68. A planet is moving in an elliptical orbit around the sun. If T,U,E and L stand for its kinetic energy, gravitational potential energy, total energy and magnitude of angular momentum about the centre of force, which of the following is correct?

a) T is conserved b) U is always positive c) E is always negative

d) L is conserved but direction of vector L changes continuously

69. A satellite which is geostationary in a particular orbit is taken to another orbit, the distance of which is twice that of earlier orbit. The time period of the satellite in the second orbit is:

a) 24 hrs b) 48 hrs c) $48\sqrt{2}$ hrs d) $\frac{48}{\sqrt{2}}$ hrs

70. A satellite is moving around the earth with speed u in a circular orbit of radius r. If the orbit radius is decreased by 1%, the speed ofthe satellite will:

a) increase by 1% b) increase by 0.5% c) decrease by 1%

d) decrease by 0.5%

71. The mass of a planet is six times that of the earth. The radius of the planet is twice that of the earth. If the escape velocity from the earth is v, then the escape velocity from the planet is:

a) $\sqrt{3}$v b) $\sqrt{2}$v c) v d) $\sqrt{5}$v e) $\sqrt{12}$v

72. (A) Gravitational potential of earth at every place on it is negative.

(R) Everybody on the earth is bound by the attraction of the earth.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true

73. (A) Weight of an object on the earth is more in mid-night than it is at the noon.

(R) At noon gravitational pull on the object by the sun and the earth are oppositely directed and in the mid-night they are in the same direction.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

e) If assertion is false but reason is true.

74. Weightlessness experienced while orbiting the Earth in space-ship, is the result of
a) Inertia b) Acceleration c) Zero gravity d) Free fall towards earth

75. A planet is revolving around the sun in elliptical orbit. Its closest distance from the sun is rand farthest distance is R. If the orbital velocity of the planet closest to the sun be v, then what is the velocity at the farthest point?
a) $\frac{vr}{R}$ b) $\frac{vR}{r}$ c) $v\sqrt{\frac{r}{R}}$ d) $v\sqrt{\frac{R}{r}}$

76. The escape velocity of a body from the earth is u. What is the escape velocity from a planet whose mass and radius are twice those of the earth?
a) 2u b) u c) 4u d) 16u

77. A particle of mass m is subjected to an attractive central force of magnitude k/r^2, k being a constant. If at the instant when the particle is at an extreme position in its closed orbit, at a distance a from the centre of force, its speed is (k/2ma), if the distance of other extreme position is b. Then a/b is
a) 2 b) 3 c) 4 d) 5

78. Two identical spheres of radius R made of the same material are kept at a distance d apart. Then the gravitational attraction between them is proportional to
a) d^{-2} b) d^2 c) d^4 d) d

79. A particle of mass m is thrown upwards from the surface of the earth, with a velocity u. The mass and the radius of the earth are, respectively, M and R, G is gravitational constant and g is acceleration due to gravity on the surface of the earth. The minimum value of u so that the particle does not return back to earth, is ______________ .
a) $\sqrt{\frac{2GM}{R}}$ b) $\sqrt{\frac{2GM}{R^2}}$ c) $\sqrt{2gR^2}$ d) $\sqrt{\frac{2GM}{R^2}}$

80. A comet orbits the sun in a highly elliptical orbit. Which of the following quantities remains constant throughout its orbit?
(i) Linear speed

(ii) Angular speed
(iii) Angular momentum
(iv) Kinetic energy
(v) Potential energy
(vi) Total energy
a) (i), (ii), (iii) b) (iii), (iv), (v) c) (iii) and (vi) d) (ii), (iii) and (vi)

81. The escape velocity of a sphere of mass m is given by (G = universal gravitational constant, $M_e =$ mass of the earth and $R_e =$ radius of the earth)____

a) $\sqrt{\frac{GM_e}{R_e}}$ b) $\sqrt{\frac{2GM_e}{R_e}}$ c) $\sqrt{\frac{2GM}{R_e}}$ d) $\frac{GM_e}{R_e^2}$

82. A satellite of mass m is orbiting around the Earth in a circular orbit with a velocity v. What will be its total energy?
a) (3/4) mv^2 b) (1/2) mv^2 c) mv^2 d) -(1/2) mv^2

83. A geostationary satellite is orbiting the earth at a height of 5 R above that surface of the earth, R being the radius of the earth. The time period of another satellite in hours at a height of 2 R from the surface of the earth is_____
a) 5 b) 10 c) $6\sqrt{2}$ d) $\frac{6}{\sqrt{2}}$

84. If the earth were to suddenly contract to half the present radius (without any external torque acting on it), by how much would the day be decreased? [Assume the earth to be a perfect solid sphere of moment of inertia (2/5) MR^2 .]
a) 8 hours b) 6 hours c) 4 hours d) 2 hours e) 1 hours

85. A spherical hole is made in a solid sphere of radius R. The mass of the sphere before hollowing was M. The gravitational field at the centre of the hole due to the remaining mass is:
a) Zero b) $\frac{GM}{8R^2}$ c) $\frac{GM}{2R^2}$ d) $\frac{GM}{R^2}$

86. Which of the following statements is correct regarding the gravitational force?
a) The gravitational force is dependent on the intervening medium
b) The gravitational force is a non-conservative force
c) The gravitational force forms action-reaction pair
d) The gravitational force is a non-central force

87. You are given 32 identical balls all of equal weight except 1 which is heavier than the others. You are given a beam balance but no weight box. What is the minimum number of weighings required to identify the balls of different weight?
a) 3 b) 4 c) 5 d) 6

88. (A) The difference in the value of acceleration due to gravity at poles and equator is proportional to square of angular velocity of earth.

(R) The value of acceleration due to gravity is minimum at the equator and maximum at the pole.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true

89. The mass and diameter of a planet have twice the value of the corresponding parameters of Earth. Acceleration due to gravity on the surface of the planet is:

a) 9.8m/sec^2 b) 4.9m/sec^2 c) 980m/sec^2 d) 19.6m/sec^2

90. A point mass m is placed inside a spherical shell of radius R and mass M at a distance $\frac{R}{2}$ from the centre of the shell. The gravitational force exerted by the shell on the point mass is

a) $\frac{GMm}{R^2}$ b) $\frac{2GMm}{R^2}$ c) zero d) $\frac{4GMm}{R^2}$

91. Two astronauts have deserted their spaceship in a region of space far from the gravitational attraction of any other body. Each has a mass of 100 kg and they are 100 m apart. They are initially at rest relative to one another. How long will it be before the gravitational attraction brings them 1 em closer together?

a) 2.52 days b) 1.41 days c) 0.70 days d) 1.41 sce

92. If three particles each ofmassM are placed at the corners of an equilateral triangle of side a, the potential energy of the system and the work done if the side of the triangle is changed from a to 2a, are:

a) $\frac{3GM}{a^2}, \frac{3GM}{2a}$ b) $-\frac{3GM^2}{a}, \frac{3GM^2}{2a}$ c) $-\frac{3GM^2}{a^2}, \frac{3GM^2}{4a^2}$ d) $-\frac{3GM^2}{a}, \frac{3GM}{2a}$

93. The radii of circular orbits of two satellites A and B of the earth, are 4R and R, respectively. If the speed of satellite A is 3V then the speed of satellite B will be

______

a) 3V/4 b) 6V c) 12V d) 3V/2

94. Assertion: The motion of a particle under the central force is always confined to a plane.

Reason: Angular momentum is always conserved in the motion under a central force.

a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

95. Assertion: Geostationary satellites appear fixed from any point on earth.
Reason: The time period of geostationary satellite is 24 hours.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

96. The escape speed of a body on the earth's surface is 112 km s^{-1}. A body is projected with thrice of this speed. The speed of the body when it escapes the gravitational pull of earth is
a) 11.2 km s^{-1} b) $22.4\sqrt{2}$ km s^{-1} c) $\frac{22.4}{\sqrt{2}}$ km s^{-1} d) $22.4\sqrt{3}$ km s^{-1}

97. The time period of a geostationary satellite at a height 36000 km is 24 hrs. A spy satellite orbits very close to the earth surface (R = 6400 km). What will be its time period?
a) 4 hrs b) 1 hr c) 2 hrs d) 1.5 hrs

98. Orbit velocity of an object of mass m is proportional to:
a) m^0 b) m c) m^2 d) $\frac{1}{m}$

99. Two spheres of masses m and M are situated in air and the gravitational force between them is F. The space around the masses is now filled with a liquid of specific gravity 3 . The gravitational force will now be ____
a) $\frac{F}{9}$ b) 3 F c) F d) F/3

100. The escape velocity for a body projected vertically upwards from the surface of the earth is II kmlsec. If the body is projected at an angle of 45° with the vertical, the escape velocity will be:
a) $11/\sqrt{2}$ km/ sec b) $11\sqrt{2}$ km /sec c) 2 km/ sec d) 11 km/ sec

101. The distance of Netune and Saturn from Sun are nearly 1013 and 101 meters respectively. Assuming that they move in circular orbits, their periodic times will be in the ratio

a) $\sqrt{10}$ b) 100 c) $10\sqrt{10}$ d) $1\sqrt{10}$

102. The largest and the shortest distance of the earth from the sun are r_1 and r_2 Its distance from the sun when it is perpendicular to the major axis of the orbit drawn from the sun__

a) $\frac{r_1+r_2}{4}$ b) $\frac{r_1+r_2}{r_1-r_2}$ c) $\frac{2r_1r_2}{r_1+r_2}$ d) $\frac{r_1+r_2}{3}$

103. The mass of the moon is about 1.2% of the mass of the earth. Compared to the gravitational force the earth exerts on the moon, the gravitational force the moon exerts on the earth:

a) is the same b) is smaller c) is greater d) varies with its phase

104. The escape velocity from the surface of the earth is v_e. The escape velocity from the surface of a planet whose mass and radius are three times those of the earth, will be____

a) v_e b) $3v_e$ c) $9v_e$ d) $\frac{1}{3v_e}$

105. Kepler's third law states that square of period of revolution (T) of a planet around the sun, is proportional to third power of average distance r between sun and planet i . e. $T_2 = K\mu^3$ where R⁻ is conistant. If the masses of sun and planet are M and m respectively then as per Newton's law of gravitation force of attraction between them is $\frac{GMm}{r^2}$, here G is gravitational constant. The relation between G and K is described as _____

a) $GMK = 4\pi^2$ b) K=G c) $K = \frac{1}{G}$ d) $GK = 4\pi^2$

106. The escape velocity on a planet, four times the radius of the earth and having 9 times acceleration due to gravity is:

a) 67.2 km/sec b) 37.4 km/sec c) 403.2 km/sec d) 422.2 km/sec

107. The radius in kilometres to which the present radius of the earth (R = 6400 km) to be compressed so that the escape velocity is increased 10 times, is:

a) 6.4 b) 64 c) 640 d) 4800

108. Two identical spheres each of mass M and radius R are separated by a distance 10R. The gravitational force on mass m placed at the midpoint of the line joining the centres of the spheres is

a) Zero b) $\frac{2GMm}{25R^2}$ c) $\frac{GMm}{25R^2}$ d) $\frac{GMm}{100R^2}$

109. Radius of orbit of satellite of the earth is R. Its kinetic energy is proportional to:

a) 1/R b) -1/R c) R d) $1/R^{3/2}$

110. A roller coaster is designed such that riders experience "weightlessness" as they go round the top of a hill whose radius of curvature is 20 m. The speed of the car at the top of the hill is between _____________.

a) 14 m/s and 15 m/s b) 15 m/s and 16 m/s c) 16 m/s and 17 m/s
d) 13 m/s and 14 m/s

111. A satellite is placed in a circular orbit around the earth at such a height that it always remains stationary with respect to the earth's surface. In such a case, its height (in km) from the earth's surface is:

a) 32000 b) 36000 c) 6400 d) 4800

112. A projectile is fired vertically upwards from the surface of earth with a velocity of kv_e where ve is the escape velocity and k < 1. Neglecting air resistance, the maximum height to which it will rise, measured from the centre of the earth, is (R_E = radius earth)

a) $\frac{R_E}{1-k^2}$ b) $\frac{R_E}{k^2}$ c) $\frac{1-k^2}{R_E}$ d) $\frac{k^2}{R_E}$

113. A particle of mass ' m ' is kept at rest at a height 3 R from the surface of earth, where ' R ' is radius of earth and 'M' is mass of earth. The minimum speed with which it should be projected, so that it does not return back, is (g is acceleration due to gravity on the surface of earth)_____

a) $\left(\frac{GM}{R}\right)^{\frac{1}{2}}$ b) $\left(\frac{GM}{2R}\right)^{\frac{1}{2}}$ c) $\left(\frac{gR}{4}\right)^{\frac{1}{2}}$ d) $\left(\frac{2g}{4}\right)^{\frac{1}{2}}$

114. If the earth were to suddenly contract to $\frac{1}{n}$th of its present radius without any change in its mass, the duration of the new day will be nearly:

a) $\frac{24}{n^2}hr$ b) 24 n hr c) $\frac{24}{n}hr$ d) 24 n^2 hr

115. A non-homogeneous sphere of radius R has the following density variation:

$$\rho\begin{cases}\rho o; r \le R/3\\ \rho o/2; (R/3) < r \le (3R/4)\\ \rho o \quad /8; (3R/4) < r \le R\end{cases}$$

The gravitational field at a distance 2R from the centre of the sphere is

a) $0.1\pi GR\rho o$ b) $0.2\pi GR\rho o$ c) $0.3\pi GR\rho o$ d) $0.4\pi GR\rho o$

116. If the polar ice caps of the earth melt, how will it affect the length of day?

a) Length of day would remain unchange b) Length of day would increase

c) Length of day would decrease d) None of the above

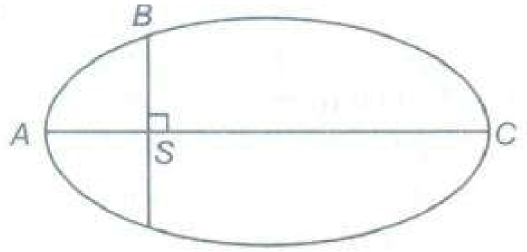
117. Two identical solid copper spheres of radius R are placed in contact with each other. The gravitational attraction between them is proportional to:

a) R^2 b) R^{-2} c) R^4 d) R^{-4}

118. A body is projected upwards with a velocity of 4 x 11.2 km/s from the surface of the earth. What will be the velocity of the body when it escapes the gravitational pull of the earth?

a) 11.2 km/s b) 2 x 11.2 km/s c) 3 x 11.2 km/s d) $\sqrt{15} \times$ 11.2 km/s

119. The kinetic energies of a planet in an elliptical orbit about the Sun, at positions A, B and Care K_A, KBand K_C respectively. AC is the major axis and SB is perpendicular to AC at the position of the Sun S as shown in the figure. Then



a) $K_B > K_A > K_C$ b) $K_A > K_B > K_C$ c) $K_A < K_B < K_C$ d) $K_B < K_A < K_C$

120. The time period Y of the moon of planet mars (mass M_m) is related to its orbital radius R as (G = Gravitational constant)

a) $T_2 = \frac{4\pi^2 R^3}{GM_m}$ b) $T_2 = \frac{4\pi^2 GR^3}{M_m}$ c) $T_2 = \frac{2\pi^2 GR^3}{M_m}$ d) $T^2 = 4\pi M_m GR^3$

121. If distance between the earth and the sun become four times, then time period becomes:

a) 4 times b) 8 times c) 1/4 times d) 1/8 times

122. The earth's radius is R and acceleration due to gravity at its surface is g. If a body of mass m is sent to a height h = $\frac{R}{5}$ from the earth's surface, the potential energy increases by:

a) mgh b) $\frac{4}{5}$ mgh c) $\frac{5}{6}$ mgh d) $\frac{6}{7}$ mgh

123. Assertion: The gravitational force on a particle inside a spherical shell is zero.

Reason: The shell shields other bodies outside it from exerting gravitational forces on a particle inside.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

124. The orbital velocity of a satellite very near to the surface of the earth is v.What will be its orbital velocity at an altitude 7 times the radius of the earth?

a) $v/\sqrt{2}$ b) v/2 c) $v2/\sqrt{2}$ d) v/4

125. Both earth and moon are subjected to the gravitational force of the sun. As observed from the sun, the orbit of the moon
a) will be elliptical
b) will not be strictly elliptical because the total gravitational force on it is not central
c) is not elliptical but will necessarily be a closed curve
d)
deviates considerably from being elliptical due to the influence of planets other than earth

126. Suppose radius of the moon's orbit around the earth is doubled. Then its period around the earth will become:
a) 1/2 times b) $\sqrt{2}$ times c) $2^{2/3}$ times d) $2^{3/2}$ times

127. Two satellites of earth, S_1 and S_2 are moving in the same orbit. The mass of S_1 is four times the mass of S_2; Which one of the following statements is true?
a) The potential energies of earth satellites in the two cases are equal
b) S_1 and S_2 are moving with the same speed
c) The kinetic energies of the two satellites are equal
d) The time period of S_1 is four times that of S_2

128. The radius of orbit of a planet is two times that of the Earth. The time period of planet is :
a) 4.2 years b) 2.8 years c) 5.6 years d) 8.4 years

129. The eccentricity of Earth's orbit is 0.0167.The ratio of its maximum speed in its orbit to its minimum speed is:
a) 2.507 b) 1.033 c) 8.324 d) 1.000

130. The escape velocity from the surface of the earth is (where R_E is the radius of the earth)
a) $\sqrt{2gR_E}$ b) $\sqrt{gR_E}$ c) $2\sqrt{gR_E}$ d) $\sqrt{3gR_E}$

131. In the question number 51, the potential at the centre is

a) $-2\frac{Gm}{l}$ b) $-3\sqrt{2}\frac{Gm}{l}$ c) $-2\sqrt{2}\frac{Gm}{l}$ d) $-4\sqrt{2}\frac{Gm}{l}$

132. Radius of orbit of satellite of Earth is R. Its kinetic energy is proportional to :
a) 1/R b) $1/\sqrt{R}$ c) R d) 1/R3/2

133. If a body weighing 40 kg is taken inside the earth to a depth to $\frac{1}{4}$ th radius of the earth, the weight of the body at that point is:
a) 40 kg-wt b) 10 kg-wt c) 30 kg-wt d) zero

134. A synchronous satellite goes around the earth once in every 24 h. What is the radius of orbit of the synchronous satellite in terms of the earth's radius? (Given: Mass of the earth, $M_E = 5.98 \times 10^{24}$ kg, radius of the earth, $R_E = 6.37 \times 10^6$ m, universal constant of gravitation, $G = 6.67 \times 10^{-11}$ N m^2 kg^{-2})
a) 2.4 R_E b) 3.6 R_E c) 4.8 R_E d) 6.6 R_E

135. A black hole is an object whose gravitational field is so strong that even light cannot escape from it. To what approximate radius would earth (mass = 5.98×10^{24} kg) have to be compressed to be a black hole?
a) 10^{-9} m b) 10^{-6} m c) 10^{-2} m d) 100 m

136. Assertion: For a free falling object, the net external force is just the weight of the object.
Reason: In this case the downward acceleration of the object is equal of the acceleration due to gravity.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

137. Potential energy of a satellite having mass 'm' and rotating at a height of 6.4 x 106 m from the Earth centre is :
a) - 0.5 mgRe b) - mgRe c) -2 mgRe d) 4 mgRe

138. For a satellite moving in an orbit around the earth, the ratio of kinetic energy to potential energy is____
a) $\frac{1}{2}$ b) $\frac{1}{\sqrt{2}}$ c) 2 d) $\sqrt{2}$

139. A satellite S is moving in an elliptical orbit aroundthe Earth. The mass of the satellite is very small as compared to the mass of the Earth. Then,
a)
the angular momentum of S about the centre of the Earth changes in direction, but its magnitude remains constant
b) the total mechanical energy of S varies periodically with time
c) the linear momentum of S remains constant in magnitude
d) the acceleration of S is always directed towards the centre of the Earth

140. If there were a reduction in gravitational effect, which ofthe following forces do you think would change in some respect?
a) Magnetic force b) Electrostatic force c) Viscous force d) Archimedes' uplift

141. (A) Even when orbit of a satellite is elliptical, its plane of rotation passes through the centre of earth.
(R) According to law of conservation of angular momentum plane of rotation of satellite always remain same.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

142. Which of the following Kepler's laws is also known as harmonic law?
a) First law b) Second law c) Third law d) None of these

143. A satellite of mass m is orbiting the earth at a height h from its surface. If M is the mass of the earth and R its radius, then how much energy must be spent to pull the satellite out of the earth's gravitational field?
a) $\frac{2GmM}{(R+h)^2}$ b) $\frac{GmM}{2(R+h)^2}$ c) $\frac{2GmM}{(R+h)}$ d) $\frac{GmM}{2(R+h)}$

144. How many times more, the mass of the original star is to be larger than that of the sun for the formation of 'Black Hole'?
a) 2 b) 6 c) 8 d) 10

145. The acceleration due to gravity is g at a point distant rfrom the centre ofthe earth of radius R. If r <R. then:
a) $g \propto r$ b) $g \propto r^2$ c) $g \propto r^{-1}$ d) $g \propto r^{-2}$

146. Imagine a planet whose diameter and mass are one half of those of the earth. The day's temperature of this planet reaches upto 800 K. (Escape velocity on the surface of the earth is 11.2 km/sec, k = 1.38 x 10^{-23} Jik and mass of oxygen molecule = 5.3 x 10^{-26} kg.) Among the following, choose the wrong statement.
a) Oxygen molecules escape from the planet.
b) Oxygen molecules cannot escape from the planet.
c) Oxygen molecules mayor may not escape. d) None of the above.

147. The acceleration due to gravity at a height 1 km above the Earth is the same as at a depth d below the surface of Earth. Then
a) d = 2km b) d = 1/2km c) d = 1km d) d = 3/2km

148. Which of the following statements is correct regarding the universal gravitational constant G?

a) G has same value in all systems of units.

b) The value of G is same everywhere in the universe

c) The value of G was first experimentally determined by Johannes Kepler

d) G is a vector quantity

149. (A) One does not experience gravitational force in daily life due to objects of same size.

(R) Value of gravitational constant is very small.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

e) If assertion is false but reason is true.

150. If the radius of orbit of a satellite is changed by a factor of 4, then time period is changed by a factor of:

a) 4 b) 6 c) 8 d) none of these

151. A satellite is orbiting around the earth. By what percentage should we increase its velocity so as to enable it to escape away from the earth?

a) 41.4% b) 50% c) 82.8% d) 100%

152. Kepler's second law is a consequence of

a) conservation of energ b) conservation of linear momentum

c) conservation of angular momentum d) conservation of mass

153. Which of the following statements is true?

a) A geostationary satellite goes around the earth in east-west direction.

b) A geostationary satellite goes around the earth in west-east direction.

c) The time period of a geostationary satellite is 48 hrs.

d)

The angle between the equatorial plane and the orbital plane of geostationary satellite is 90°.

154. Two satellites of earth, S_1 and S_2, are moving in the same orbit. The mass of S_1 is four times the mass of S_2? Which one of the following statements is true?

a) The potential energies of earth satellites in the two cases are equal

b) S_1 and S_2 are moving with the same speed.

c) The kinetic energies of the two satellites are equal

d) The time period of S_1 is four times that of S_2

155. Work done in taking a mass from one point to another in a gravitational field depends on:

a) the end points only b) the path followed c) the velocity of the mass

d) both the length of the path and the end points

156. If the gravitational force between two objects were proportional to $\frac{1}{R}$ (and not as $\frac{1}{R^2}$), where R is separation between them, then a particle in circular orbit under such a force would have its orbital speed v proportional to____

a) $\frac{1}{R^2}$ b) R^0 c) R d) 1/R

157. The distances from the centre of the earth where the weights of the body are zero and one-fourth that of the weight of body on the surface of the earth are: (Assume R is the radius of the earth)

a) 0, $\frac{R}{4}$ b) 0, $\frac{3R}{4}$ c) $\frac{R}{4}$, 0 d) $\frac{3R}{4}$, 0

158. **Assertion:** The planets move slower when they are farther from the Sun than when they are nearer.

Reason : Angular velocity of a planet is a constant quantity.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertionand reason are true but reason is not the correct explanationof assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

159. A saturn year is 29.5 times the earth year. How far is the saturn from the sun if the earth is 1.5 x 10^8 km away from the sun?

a) 1.4 x 10^6 km b) 1.4 x 10^7 km c) 1.4 x 10^8 km d) 1.4 x 10^9 km

160. A satellite of mass m is orbiting the earth (of radius R) at a height h from its surface. The total energy of the satellite in terms of got the value of acceleration due to gravity at the earth's surface, is

a) $mg_oR^2/2(R+h)$ b) $-mg_oR^2/2(R+h)$ c) $2mg_oR^2/(R+h)$ d) $-2mg_oR^2/(R+h)$

161. The time period of an earth satellite in a circular orbit of radius R is 2 days and its orbital velocity is v_0. If time period of another satellite in a circular orbit is 16 days then

a) its radius of orbit is 4R and orbital velocity is v_0

b) its radius of orbit is 4R and orbital velocity is $\frac{v_0}{2}$

c) its radius of orbit is 2R and orbital velocity is v_0

d) its radius of orbit is 2R and orbital velocity is $\frac{v_0}{2}$

162. Weightlessness in satellite is due to

a) zero gravitational acceleration b) zero acceleration c) zero mass

d) None of these

163. The radii of circular orbits of two satellites A and B of the earth, are 4R and R, respectively. If the speed of satellite A is 3 V, then the speed of satellite B will be:

a) 3V/4 b) 6V c) 12V d) 3V/2

164. The gravitational potential due to the earth at infinite distance from it is zero. Let the gravitational potential at a point P be -5 J/kg . Suppose, we arbitrarily assume the gravitational potential at infinity to be + 10 J/kg , then the gravitational potential at P will be:

a) -5 J/Kg b) + 5 J/Kg c) -15 J/Kg d) + 15 J/Kg

165. A synchronous relay satellite reflects TV signals and transmits TV programmes from one part of the world to the other because its:

a)

period of revolution is greater than the period of rotation of the earth about its axis

b) period of revolution is less than the period of rotation of the earth about its axis

c) period of revolution is equal to the period of rotation of the earth about its axis

d) mass is less than the mass of the earth

166. A projectile is fired vertically upwards. It escapes from the earth, when fired with velocity v. If it is to be fired at 45° to the horizontal, what should be its velocity to enable it to escape from the gravitational pull of the earth?

a) $\sqrt{2}v$ b) $v/\sqrt{2}$ c) v d) Some other velocity

167. Match the Column I with Column II.

Column I		Column II	
(A)	Kepler's first law	(P)	$T^2 \propto a^3$
(B)	Kepler's second law	(q)	Inverse square law
(C)	Kepler's third law	(r)	Orbit of planet is elliptical
(D)	Newton's law of gravitation	(s)	Law of conservation of angular momentum

a) A - s, B - p, C - q, D - r b) A - p, B - q, C - r, D -s c) A - r, B - s, C - p, D - q

d) A - s, B - P. C - q, D - s

168. The potential energy of a satellite, having mass m, rotating at a height of 6.4×10^6 m from the earth surface, is____

a) $-mgR_e$ b) $-0.67mgR_e$ c) $-0.5mgR_e$ d) $-0.33mgR_e$

169. Assertion: The gravitational attraction of moon is much less than that of earth.

Reason: Moon is the natural satellite of the earth.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false   d) If both assertion and reason are false

170. Two satellites of earth, S_1 and S_2 are moving in the same orbit. The mass of S_1 is four times the mass of S_2? Which one of the following statements is true?

a) 14m/s and 15m/s   b) 15m/s and 16m/s   c) 16m/s and 17m/s

d) 13m/s and 14m/s

171. The radius of a planet is 1/4 of the earth's radius and its acceleration due to gravity is double that of the earth's acceleration due to gravity. How many times will the escape velocity at the planet's surface be as compared to its value on the earth's surface?

a) $\frac{1}{\sqrt{2}}$ b) $\sqrt{2}$ c) $2\sqrt{2}$ d) 2

172. Choose the wrong option.

a)

Inertial mass. is a measure of difficulty of accelerating a body by an external force whereas the gravitational mass isrelevant in determining the gravitational force on it by an external mass.

b) That the gravitational mass and inertial mass are equal is an experimental result.

c)

That the acceleration due to the gravity on Earth is the same for all bodies and is due to the equality of gravitational mass and inertial mass.

d)

Gravitational mass of a particle like proton can depend on the presence of neighbouring heavy objects but the inertial mass cannot.

173. A pendulum beats seconds on the earth. Its time period on a stationary satellite of the earth will be:

a) Zero   b) 1 s   c) 2 s   d) infinity

174. By what percentage the energy of a satellite has to be increased to shift it from an orbit of radius r to 3/2 r?

a) 66.7 %   b) 33.3 %   c) 75 %   d) 20.3 %

175. From a solid sphere of mass M and radius R, a spherical portion R/2 of radius is removed, as shown in the figure. Taking gravitational potential V = 0 at r = ∞, the potential at the centre of the cavity thus formed is (G = gravitational constant)

a) $\frac{-2GM}{3R}$ b) $\frac{-2GM}{R}$ c) $\frac{-GM}{2R}$ d) $\frac{-GM}{R}$

176. The period of moon's rotation around the earth is nearly 29 days. If moon's mass were 2 fold its present value, and all other things remain unchanged, the period of Moon's rotation would be nearly

a) $29\sqrt{2}$ days b) $\frac{29}{\sqrt{2}}$ days c) 29 x 2 days d) 29 days

177. The potential energy of a satellite having mass rn and rotating at a height of 6. 4 x 10^6 m from the earth's surface is: (Giyen R = 6.4 x 10^6 m)

a) mgR b) 0.67 mgR c) -mgR/2 d) 0.33 mgR

178. The ratio of escape velocity at earth (V_e) to the escape velocity at a planet (V_p) whose radius and mean density are twice as that of earth is:

a) 1 : 2 b) 1 : $2\sqrt{2}$ c) 1 : 4 d) 1 : $\sqrt{2}$

179. The ratio of the kinetic energy required to be given to the satellite to escape the earth's gravitational field to then kinetic energy required to be given so that the satellite moves in circular orbit just above the earth's atmosphere is:

a) one b) two c) half d) infinity

180. The height at which the acceleration due to gravity decreases by 36 % of its value on the surface of the earth is: (Assume radius of the earth is R)

a) $\frac{R}{4}$ b) $\frac{R}{2}$ c) $\frac{R}{6}$ d) 4 R

181. The largest and the shortest distance of the Earth from the Sun are r_1 and r_2 Its distance from the Sun when it is at perpendicular to the major-axis of the orbit drawn from the Sun is :

a) $(r_1 + r_2)/4$ b) $(r_1 + r_2)/ (r_1 - r_2)$ c) $2(r_1 \times r_2)/ (r_1 + r_2)$ d) $(r_1 + r_2)/ 3$

182. LANDSAT series of satellite move in near polar orbits at an altitude of

a) 3600 km b) 3000 km c) 918 km d) 512 km

183. If the radius of the earth decreases by 10%, the mass remaining unchanged, what will happen to the acceleration due to gravity?

a) Decreases by 19% b) Increases by 19% c) Decreases by more than 19%
d) Increases by more than 19%

184. A body weighs 72 N on the surface of the earth. What is the gravitational force on it, at a height equal to half the radius of the earth?

a) 24 N b) 48 N c) 32 N d) 30 N

185. The acceleration due to gravity increases by 0.5% when we go from the equator to the poles. What will be the time period of the pendulum at the equator which beats seconds at the poles?
a) 1.950 s b) 1.995 s c) 2.050 s d) 2. 005 s

186. If the earth were to cease rotating about its own axis. The increase in the value of g in CGS system at a place of latitude of 45° will be:
a) 2.68 b) 1.68 c) 3.36 d) 0.34

187. (A) We cannot move even a finger without disturbing all the stars of the universe.
(R) Everybody in the universe attracts every other body with a force which is inversely proportional to the square of distance between them.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false.
d) If both assertion and reason are false.
e) If assertion is false but reason is true.

188. The satellite of mass m is orbiting around the earth in a circular orbit with a velocity v. What will be its total energy?

a) $\frac{3}{4}mv^2$ b) $\frac{1}{2}mv^2$ c) m^2 d) $-\left(\frac{1}{2}\right)mv^2$

189. If the orbital velocity of the moon is increased by 41.4% of its present value, then the:
a) moon will orbit around the earth with double velocity
b) radius of moon's orbit will become double
c) moon will become a stationary satellite
d) moon will leave its orbit and escape into space

190. Which of the following statements is incorrect regarding the polar satellite?
a) A polar satellite goes around the earth's pole in north-south direction.
b) Polar satellites are used to study topography of Moon, Venus and Mars.
c) A polar satellite is a high altitude satellite
d) The time period of polar satellite is about 100 minutes.

191. The radius of the earth is 4 times that of the moon and its mass is 80 times that of the moon. If the acceleration due to gravity on the surface of the earth is 10 m/s^2, that on the surface of the moon will be:
a) 1 m/s^2 b) 2 m/s^2 c) 3 m/s^2 d) 4 m/s^2

192. Two spherical bodies of mass M and 5 M and radii R and 2 R respectively are released in free space fwhith initial separation between their centres equal to 12 R. If eyattract each other due to gravitational force only, then the distance covered by the smaller body just before collision, is:
a) 1.5 R b) 2.5 R c) 4.5 R d) 7.5 R

193. If a planet of given density were made larger, its force of attraction for an object on its surface would increase because of the planet's greater mass but would decrease because of greater separation from the object to the centre of the planet. Which effect predominates?
a) Increase in radius b) Increase in mass c) Both affect the attraction equally
d) None of the above

194. The period of a satellite in a circular orbit around a planet is independent of :
a) The mass of the planet b) The radius of the planet
c) The mass of the satellite d) All the three parameters (a), (b) and (c)

195. A particle of mass m is thrown upwards from the surface of the Earth, with a velocity u. The mass and the radius of the Earth are, respectively. Mand R. G is gravitational constant and g is acceleration due to gravity on the surface of the Earth. The minimum value of u so that the particle does not return back to earth, is
a) $\sqrt{2GM/R}$ b) $\sqrt{2GM/R^2}$ c) $\sqrt{2gR^2}$ d) $\sqrt{GM/R^2}$

196. A satellite is orbiting the earth in a circular orbit of radius r. Its
a) kinetic energy varies as r b) angular momentum varies as $\frac{1}{\sqrt{r}}$
c) mear momentum vanes as $\frac{1}{r}$ d) frequency of revolution varies as $\frac{1}{r^{3/2}}$

197. The mass of the earth is 81 times that of the moon and the radius ofthe earth is 3.5 times that of the moon. The ratio of the escape velocity on the surface of the earth to that on the surface of the moon will be:
a) 0.2 b) 2.57 c) 4.81 d) 0.39

198. A simple pendulum has a time period T_1 when on the earth's surface and T_2 when taken to a height 2R above the earth's surface, where R is the radius of the earth. The value of (T_1/T_2) is:
a) 1/9 b) 1/3 c) $\sqrt{3}$ d) 9 e) 3

199. Observers on the 10th, 5th and ground floor of a tall building measure the velocity of a certain raindrop by some accurate method. Surprisingly the velocity of the raindrop measured by the three observers was found to be the same. This is because:
a) there is no gravitational force acting on the drop
b)
gravitational force on the raindrop is balanced by the force produced by the surrounding air

c)
gravitational force on the raindrop is balanced by the upward force of attraction produced by the cloud

d) data is insufficient to predict e) none of the above

200. (A) Earth has an atmosphere but the moon does not.
(R) Moon is very small in comparison to earth.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

201. A hydrogen balloon released on the moon would:
a) climb with an acceleration of $\frac{9.8}{6} ms^{-2}$ b) climb with an acceleration of9.8x 6m s-^{2}
c) neither climb nor fall d) fall with an acceleration of

202. A satellite is revolving around the sun in a circular orbit with uniform velocity v. If the gravitational field suddenly disappears, the velocity of the satellite will be:
a) Zero b) v c) 2v d) infinity

203. At the surface of a certain planet acceleration due to gravity is one-quarter of that on the earth. If a brass ball is transported to this planet, then which one of the following statements is not correct?
a)
The mass of the brass ball on this planet is a quarter of its mass as measured on the earth.
b)
The weight of the brass ball on this planet is a quarter of the weight as measured on the earth.
c) The brass ball has same mass on the other planet as on the earth.
d) The brass ball has the same volume on the other planet as on the earth.

204. If a planet of given density were made larger (keeping its density unchanged) its force of attraction for an object on its surface would increase because of increased mass of the planet but would decrease because of larger separation between the centre of the planet and its surface. Which effect would dominate?
a) Increase in mass b) Increase in radius c) Both affect the attraction equally
d) None of the above

205. Two identical spheres of same material are in contact with each other. If r be the radius of the sphere, then gravitational attraction between them is proportional to:
a) r b) r^2 c) r^3 d) r^4

206. Earth is flattened at the poles and bulges at the equator. This is due to the fact that
a) the earth revolves around the sun in an elliptical orbit
b) the angular velocity of spinning about its axis is more at the equator
c) the centrifugal force is more at the equator than at poles d) none of these

207. A spherical planet far out in space has a mass M_o and diameter D_o .A particle of mass m falling near the surface of this planet will experience an acceleration due to gravity which is equal to:
a) $\frac{M_0}{D_0^2}$ b) $4m\frac{M_0}{D_0^2}$ c) $\frac{4M_0G}{D_0^2}$ d) $m\frac{M_0}{D_0^2}$

208. The metallic bob of a simple pendulum has the relative density S. The time period of this pendulum is T. If the metallic bob is immersed in water, then the new time period is given by:
a) $T=(\frac{\rho-1}{\rho})$ b) $\frac{\rho}{(\rho-1)}T$ c) $\sqrt{(\frac{\rho-1}{\rho})T}$ d) $\sqrt{\frac{\rho}{(\rho-1)}T}$

209. A person will get more quantity of matter (in kg-wt) at:
a) poles b) at latitude of 60° c) equator d) satellite

210. In a certain region of space, the gravitational field is given by -k/r, where r is the distance and k is a constant. If the gravitational potential at $r = r_o$ be V_o, then what is the expression for the gravitational potential (V)?
a) k log (r/ r_0) b) k log (r_0 / r) c) V_o + k log (r /r_0) d) Vo + k log (r_0 / r)

211. The period of a satellite in a circular orbit of radius R is T, the period of another satellite in a circular orbit of radius 4R is
a) 4T b) T/4 c) 8T d) T/8

212. A particle of mass M is situated at the centre of a spherical shell of same mass and radius R. The gravitational potential at a point situated $\frac{R}{2}$ distance from the centre will be
a) $-\frac{3GM}{R}$ b) $-\frac{2GM}{R}$ c) $-\frac{GM}{R}$ d) $-\frac{4GM}{R}$

213. With what velocity should a particle be projected so that its height becomes equal to radius of earth?
a) $\left(\frac{GM}{R}\right)^{1/2}$ b) $\left(\frac{8GM}{R}\right)^{1/2}$ c) $\left(\frac{2GM}{R}\right)^{1/2}$ d) $\left(\frac{4GM}{R}\right)^{1/2}$

214. Two satellites of masses M_1 and M_2 are revolving around the earth in circular orbits of radii r_1 and r_2. The ratio of their speeds V_1 / v_2 is

a) $\frac{r_1}{r_2}$ b) $\frac{r_2}{r_1}$ c) $\sqrt{\frac{r_1}{r_2}}$ d) $\sqrt{\frac{r_2}{r_1}}$

215. An earth satellite is moved from one stable circular orbit to a farther stable circular orbit. Which one of the following quantities increases?
a) Linear orbital speed b) Gravitational force c) Centripetal acceleration
d) Gravitational potential energy

216. The escape velocity from the earth is 11.2 km/s. The escape velocity from a planet having twice the radius and the same mean density as the earth is:
a) 22.4 km/s b) 11.2 km/s c) 5.6 km/s d) 15.8 km/s

217. A thin rod of length L is bent to form a circle. Its mass is M. What force will act on the mass m placed at the centre of the circle?
a) $\frac{4\pi^2 GMm}{L^2}$ b) $\frac{GMm}{4\pi^2 L^2}$ c) $\frac{2\pi GMm}{L^2}$ d) Zero

218. Kepler's third law states that square of period of revolution (T) of a planet around the Sun, is proportional to third power of average distance r between the Sun and planet, i.e., $T^2=Kr^3$, here K is constant. If the masses of the Sun and planet are M and m respectively, then as per Newton's law of gravitation force of attraction between them is $F=GMm/r^2$, here G is gravitational constant. The relation between G and K is described as
a) $GK=4\pi^2$ b) $GMK=4\pi^2$ c) K=G d) K=l/G

219. Assertion: When distance between two bodies is doubled and also mass of each body is doubled, gravitational force between them remains the same.
Reason: According to Newton's law of gravitation, force is directly proportional to product of the mass of bodies and inversely proportional to the square of the distance between them.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

220. A particle of mass 10^9 is kept on the surface of a uniform sphere of mass 100 kg and radius 10 cm. Find the work to be done against the gravitational force between them to take the particle far away from the sphere. (You may take G = 6.67×10^{-11} N-m^2/kg^2)
a) 6.67×10^{-9} J b) 6.67×10^{-10} J c) 13.34×10^{-10} J d) 3.33×10^{-10} J

221. The escape velocity of a sphere of mass m from earth having mass Mand radius R is given by:

a) $\sqrt{2GM/R}$ b) $2\sqrt{GM/R}$ c) $\sqrt{2GMm/R}$ d) $\sqrt{GM/R}$

222. The moon has a mass of $\frac{1}{81}$ that of the earth and a radius of $\frac{1}{4}$ that of the earth. The escape speed from the surface of the earth is 11.2 km/s. The escape speed from the surface of the moon is:

a) 1.25 Km/s b) 2.49 Km/s c) 3.7 Km/s d) 5.6 Km/s

223. Assuming earth to be a sphere of uniform density, what is the value of ' g ' in a mine 100 km below the earth's surface?

(Given, R=6400 km)____

a) $9.65\ m/s^2$ b) $7.65\ m/s^2$ c) $5.06\ m/s^2$ d) $3.10\ m/s^2$

224. What is the ratio of potential energy to kinetic energy of the moon orbiting around the earth?

a) 1 : 4 b) 1 : 2 c) 4 : 1 d) 2 : 1

225. (A) Moon travellers tie heavy weight at their back before landing on moon.

(R) The value of 'g' is small at moon.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

e) If assertion is false but reason is true.

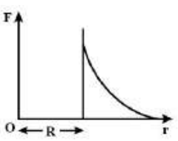
226. A satellite is revolving round the earth in an orbit of radius r with time period T. If the satellite is revolving round the earth in an orbit of radius r+ (△r<<r) with time period $T+\Delta T$, then:

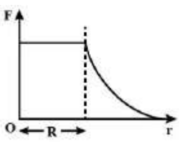
a) $\frac{\Delta T}{T}=\frac{2}{3}\frac{\Delta r}{r}$ b) $\frac{\Delta T}{T}=\frac{3}{2}\frac{\Delta r}{r}$ c) $\frac{\Delta T}{T}=\frac{\Delta r}{r}$ d) $\frac{\Delta T}{T}=-\frac{\Delta r}{r}$

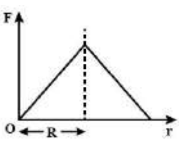
227. A satellite of mass m goes round the earth along a circular path of radius r. Let m_E be the mass of the earth and R_E its radius. Then, the linear speed of the satellite depends on:

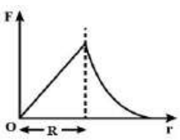
a) m, m_E, r b) m, R_E, r c) M_E only d) m_E and r

228. Which one of the following plots represents the variation of gravitational field on a particle with distance r due to a thin spherical shell of radius R? (r is measured from the centre of the spherical shell)______

a) 

b) 

c) 

d) 

229. The areal velocity and the angular momentum of the planet are related by which of the following relations?
(where m_p is the mass of the planet)

a) $\frac{\Delta\vec{A}}{\Delta t} = \frac{\vec{L}}{2m_p}$ b) $\frac{\Delta\vec{A}}{\Delta t} = \frac{\vec{L}}{m_p}$ c) $\frac{\Delta\vec{A}}{\Delta t} = \frac{2\vec{L}}{m_p}$ d) $\frac{\Delta\vec{A}}{\Delta t} = \frac{\vec{L}}{\sqrt{2}m_p}$

230. If the radius of the earth's orbit around the sun is R and the time period of revolution of the earth around the sun is T. The mass of the sun is:

a) $\frac{GT^3}{4\pi^2R^2}$ b) $\frac{4\pi^2R^2}{GT^2}$ c) $\sqrt{\frac{4\pi^2R^3}{GT^2}}$ d) $[\frac{4\pi^2R^3}{GT^2}]^{1/3}$

231. If M_E is the mass of the earth and R_E its radius, the ratio of the acceleration due to gravity and the gravitational constant is

a) $\frac{R_E^2}{M_E}$ b) $\frac{M_E}{R_E^2}$ c) $M_ER^2_E$ d) $\frac{M_E}{R_E}$

232. Satellite of mass m is in a circular orbit of radius $2R_E$ about the earth. The energy required to transfer it to a circular orbit of radius $4R_E$ is (where M_E and R_E is the mass and radius of the earth respectively)

a) $\frac{GM_Em}{2R_E}$ b) $\frac{GM_Em}{4R_E}$ c) $\frac{GM_Em}{8R_E}$ d) $\frac{GM_Em}{16R_E}$

233. A second pendulum is mounted in a rocket. Its period of oscillation decreases when the rocket____

a) comes down with uniform acceleration
b) moves round the earth in a geostationary orbit
c) moves up with a uniform velocity d) moves up with uniform acceleration

234. A simple pendulum is taken from the equator to the pole. Its period:

a) decreases b) increases c) remains the same
d) decreases and then increases e) becomes infinity

235. A body of mass m rises to height h = R/5 from the Earth's surface, where R is earth's radius. If g is acceleration due to gravity at Earth's surface, the increase in potential energy is :

a) mgh b) 4/5 mgh c) 5/6 mgh d) 6/1 mgh

236. The mean radius ofthe earth is R, its angular speed about its own axis is ω and the acceleration due to gravity at the earth's surface is g. The cube of the radius of orbit of geostationary satellite will be:

a) $(R^2 g/\omega)$ b) $(R^2\omega/g)$ c) (Rg/ω^2) d) (R^2g/ω^2)

237. An iron ball and a wooden ball of the same radius are released from a height 'h' in vacuum. The time taken by both of them to reach the ground is :

a) Unequal b) Exactly equal c) Roughly equal d) Zero

238. In the question number 72, the change in potential energy is

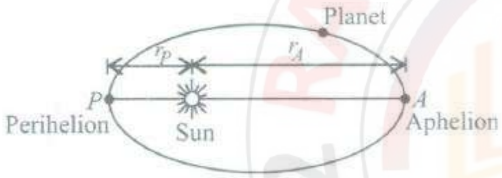
a) $\frac{GM_E m}{8R_E}$ b) $\frac{GM_E m}{16R_E}$ c) $\frac{GM_E m}{2R_E}$ d) $\frac{GM_E m}{4R_E}$

239. In some region, the gravitational field is zero. The gravitational potential in this region:
a) must be variable b) must be constant c) cannot be zero d) must be zero

240. A rubber ball is dropped from a height of 5 m on a planet where the acceleration due to gravity is not known. On bouncing it rises to 1.8 m. The ball loses its velocity on bouncing by a factor of _____
a) 16 / 25 b) 2/5 c) 3 / 5 d) 9 / 25

241. Infinite number of bodies, each of mass 2 kg are situated on x-axis at distances 1 m, 2 m, 4 m, 8 m, respectively, from the origin. The resulting gravitational potential due to this system at the origin will be___
a) -8/3 G b) -4/3 G c) - 4G d) -G

242. A planet orbits the sun in an elliptical Nth as shown in the figure. Let V_p and V_A be speed of the planet when at perihelion and aphelion respectively. Which of the following relations is correct?



a) $\frac{r_P}{r_A} = \frac{v_A}{v_P}$ b) $\frac{r_P}{r_A} = \frac{v_P}{v_A}$ c) $\frac{r_P}{r_A} = \sqrt{\frac{v_P}{v_A}}$ d) $\frac{r_P}{r_A} = \sqrt{\frac{v_A}{v_p}}$

243. The masses and radii of the earth and the moon are M_1, R_1 and M_2, R_2 respectively. Their centres are at distance d apart. The minimum speed with which a particle of mass m should be projected from a point midway the two centres so as to escape to infinity is:
a) $\sqrt{\frac{2G(M_1+M_2)}{d}}$ b) $\sqrt{\frac{4G(M_1+M_2)}{d}}$ c) $\sqrt{\frac{4GM_1+M_2}{d}}$ d) $\sqrt{\frac{G(M_1+M_2)}{d}}$

244. If g = acceleration due to gravity and V be gravitational potential at a distance r from the centre of the earth (where r > R), then what is the relation between g and V ?
a) g = V/r b) g =-dV /dr c) $g = d^2 V/ dr^2$ d) $g = - V^2 /r^2$

245. A particle of mass M is situated at the center of a spherical shell of same mass and radius a. The gravitational potential at a point situated at a/2 distance from the centre, will be
a) - 3GM/a b) - 2GM/a c) - GM/a d) - 4GM/a

246. Two concentric shells have masses M and m and their radii are R and r respectively, where R > r. What is the gravitational potential at their common centre?

a) $-\frac{GM}{R}$ b) $-\frac{GM}{r}$ c) $-G[\frac{M}{R}-\frac{m}{r}]$ d) $-G[\frac{M}{R}+\frac{m}{r}]$

247. A body is at rest on the surface of the earth. Which of the following statements is correct?

a) No force is acting on the body. b) Only weight of the body acts on it.

c) Net downward force is equal to the net upward force.

d) None of the above statement is correct.

248. What effect occurs on the frequency of a pendulum, if it is taken from the earth's surface to deep into a mine?

a) Increases b) Decreases c) First increases then decreases d) No effect

249. A satellite is to be placed in equatorial geostationary orbit around earth for communication. The height of such a satellite is

[M_E = 6 X 10^{24}kg, RE = 6400 km, T = 24 h, G = 6.67 X 10^{-11} N m2 kg^{-2}]

a) 3.57 x 10^5 m b) 3.57 x 10^6 m c) 3.57 x 10^7 m d) 3.57 x 10^8 m

250. Which of the following is different from the other?

a) Period of satellite orbiting around the earth very near to its surface.

b) Period of simple pendulum of infinite length.

c) Period of the moon around the earth.

d)

Period of the body dropped in a tunnel bored across the earth and through its centre.

251. A tunnel is dug along a diameter of the earth of mass M_e and radius R_e . The force on a particle of mass m placed in the tunnel at a distance r from the centre is:

a) $\frac{GM_em}{R_e^3}r$ b) $\frac{GM_em}{R_e^3r}$ c) $\frac{GM_emR_e^3}{r}$ d) $\frac{GM_em}{R_e^2}r$

252. The Earth is assumed to be a sphere of radius R. A platform is arranged at a height R from the surface of the Earth. The escape velocity of a body from this platform is tv, where V is its escape velocity from the surface of the Earth. The value off is :

a) $1/\sqrt{2}$ b) $1/\sqrt{3}$ c) 1/2 d) $\sqrt{2}$

253. The ratio of the energy required to raise a satellite upto a height h above the earth to the kinetic energy of the satellite into the orbit there is: (R = radius of the earth)

a) h : R b) R : 2h c) 2h : R d) R : h

254. Two air bubbles in water:

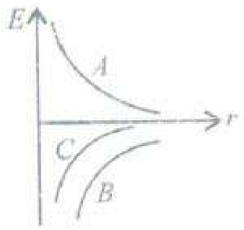
a) attract each other b) repel each other c) do not exert any force on each other

d) may attract or repel depending upon the distance between them

255. How much deep inside the earth (radius R) should a man go, so that his weight becomes one-fourth ofthat on the earth's surface?

a) $\frac{R}{4}$ b) $\frac{R}{2}$ c) $\frac{3R}{4}$ d) None of these

256. Figure shows the variations of energy E with the orbit radius r of a satellite in circular motion. Choose the correct statement.



a)
A shows the kinetic energy, B shows the total energy and C the potential energy of the satellite
b)
A and B are kinetic energy and potential energy respectively and C the total energy of the satellite
c)
A and B are the potential energy and kinetic energy respectively and C the total energy of the satellite
d)
C and A are the kinetic and potential energies and B the total energy of the satellite

257. In the question number 15, the ratio of the velocity of the satellite at apogee and perigee is
a) $\frac{1}{2}$ b) $\frac{1}{3}$ c) $\frac{1}{4}$ d) $\frac{1}{6}$

258. The two planets have radii r_1 and r_2 and their densities ρ_1 and ρ_2 respectively. The ratio of acceleration due to gravity on them will be:
a) $r_1\rho_1 : r_2\rho_2$ b) $r_1\rho_1^2 : r_2\rho_2^2$ c) $r_1^2\rho_1 : r_2^2\rho_2$ d) $r_1\rho_2 : r_2\rho_1$

259. Two satellites S_1 and S_2 are revolving round a planet in coplanar and concentric circular orbits of radii R_1 and R_2 in the same direction respectively. Their respective periods of revolution are 1 hr and 8 hr. The radius of the orbit of satellite S_1 is equal to 10^4 km. Their relative speed when they are the closest (in kmph) is:
a) $\pi/2 \times 10^4$ b) $\pi \times 10^4$ c) $2\pi \times 10^4$ d) $4\pi \times 10^4$

260. A satellite A of mass m is at a distance r from the surface of the carth. Another satellite B of mass 2 m is at a distance of 2 r from the earth's surface. Their time periods are in the ratio of____
a) 1: 2 b) 1: 16 c) 1: 32 d) $1:2\sqrt{2}$

261. The magnitudes of gravitational field at distances r_1 and r_2 from the centre of a uniform sphere of radius R and mass M are F_1 and F_2 respectively. Then:

a) $\frac{F_1}{F_2}=\frac{r_1}{r_2}$ if r_1 2 b) $\frac{F_1}{F_2}=\frac{r_2^2}{r_1^2}$ if $r_1 > R$ and $r_2 > R$ c) both (a) and (b)

d) none of the above

262. A small body of mass m falls to the earth from infinite distance away. What will be its velocity on reaching the earth? (Radius of the earth = R, acceleration due to gravity on the surface of the earth is g)

a) gR b) 2gR c) $\sqrt{gR}$ d) $\sqrt{2gR}$

263. Imagine a new planet having the same density as that of Earth but it is 3 times bigger than the Earth in size. If the acceleration due to gravity on the surface of Earth is g and that on the surface of the new planet is g', then

a) g = g/9 b) g = 27g c) g = 9 g d) g'=3g

264. A satellite which is geostationary in a particular orbit is taken to another orbit Its distance from the centre of Earth in new orbit is 2 times that of the earlier orbit. The time period in the second orbit is :

a) 4.8 hours b) $48\sqrt{2}$ c) 24 hours d) $24\sqrt{2}$

265. Which of the following planets has two moons phobos and deimos?

a) Jupiter b) Saturn c) Mars d) Earth

266. Venus looks brighter than other planets because:

a) it is heavier than other planets b) it has higher density than other planets

c) it is closer to the earth than other planets d) it has no atmosphere

267. Two bodies of masses m_1, and m_2 are initially at rest at infinite distance apart. They are then allowed to move towards each other under mutual gravitational attraction. Their relative velocity of approach at a separation distance r between them is:

a) $[2G\frac{(m_1-m_2)}{r}]^{1/2}$ b) $[\frac{2G}{r}(m_1-m_2)]^{1/2}$ c) $[\frac{r}{2G(m_1-m_2)}]^{1/2}$ d) $[\frac{2G}{r}(m_1m_2)]^{1/2}$

268. If v_e is the escape velocity, v_o, the orbital velocity and v, the velocity of an object around the earth, then the total mechanical energy of the body is + ve when:

a) $v < v_o$ b) $v < v_e$ c) $v = v_e$ d) $v > v_e$

269. Which of the following statements is correct regarding a geostationary satellite?

a) A geostationary satellite goes around the earth in east-west direction.

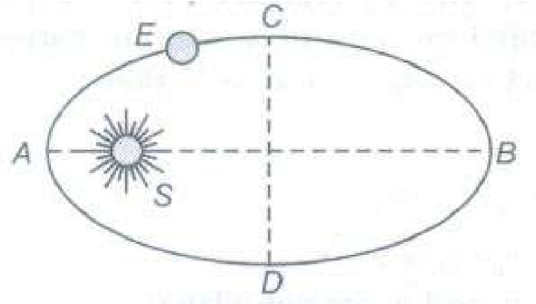
b) A geostationary satellite goes around the earth in west-east direction.

c) The time-period of a geostationary satellite is 48 hours.

d)

The angle between the equatorial plane and the orbital plane of geostationary satellite is 90°.

270. The Earth E moves in an elliptical orbit with the Sun S at one of the foci as shown in figure. Its speed of motion will be maximum at the point:



a) C b) A c) B d) D

271. Escape velocity on the earth:
a) is less than that on the moon b) depends upon the mass of the body
c) depends upon the direction of projection
d) depends upon the height from which it is projected

272. If a satellite is orbiting the Earth very close to its surface, then the orbital velocity mainly depends on:
a) The mass of the satellite only b) The radius of the Earth only
c) The orbital radius only d) The mass of the Earth only

273. What will happen to the weight of the body at the south pole, ifthe earth stops rotating about its polar axis?
a) No change b) Increases c) Decreases but does not become zero
d) Reduces to zero

274. Imagine a new planet having the same density as that of earth but it is 3 times bigger than the earth in size. If the acceleration due to the gravity on the surface of earth is g and that on the surface of the new planet is g', then_____
a) $g' = g/9$ b) $g' = 27g$ c) $g' = 9g$ d) $g' = 3g$

275. If V_e is escape velocity and V_o is orbital velocity of a satellite for orbit close to the Earth's surface, then these are related by :
a) $V_o = \sqrt{2}V_e$ b) $V_o = V_e$ c) $V_e = \sqrt{2V_0}$ d) $V_e = \sqrt{2}V_0$

276. The time period of an earth satellite in circular orbit is independent of:
a) the mass of the satellite b) radius of its orbit
c) both the mass of satellite and radius of the orbit
d) neither the mass of satellite nor the radius of its orbit

277. Two spheres of masses m and M are situated in air and the gravitational force between them is F. The space around the masses is now filled with a liquid of specific gravity 3. The gravitational force will now be :
a) F/9 b) 3F c) F d) F/3

278. What is the escape velocity for a body on the surface of a planet on which the acceleration due to gravity is $(3.1)^2$ ms^2 andwhoseradiusis 8100 km?
a) 2790 km/sec b) 27.9 km/sec c) $27.9/\sqrt{5}$ km/sec d) $27.9\sqrt{5}$ km/sec
e) $2.79/\sqrt{5}$ km/sec

279. When the distance between the earth and the sun is halved, the duration of year will become:
a) more b) less c) can't be determined d) none of these

280. When you move from equator to pole, the value of acceleration due to gravity (g):
a) increases b) decreases c) remains the same d) increases then decreases

281. The ratio of the earth's orbital angular momentum (about the sun) to its mass is 4.4 x 10^{15}m 2/s. The area enclosed by the earth's orbit is approximately:
a) 7 x 10^{22} m^2 b) 6.02 x 10^{23} m^2 c) 7 x 10^{23} m^2 d) none of these

282. The orbital velocity at a height h above the surface of the earth is 90% of that near the surface of the earth. If the escape velocity at the surface of the earth be v, then its value at the height h will be:
a) 0.99 v b) 0.90 v c) 0.81 v d) 0.11 v

283. If a rocket is fired with a speed v =$2\sqrt{gR}$ near the earth's surface and coasts upwards, its speed in the intersteller space is:
a) $4\sqrt{gR}$ b) $\sqrt{2gR}$ c) $\sqrt{gR}$ d) $\sqrt{4gR}$

284. (A) Earth is continuously pulling moon towards its centre but moon does not fall to earth.
(R) Attraction of sun on moon is greater than that of earth on moon
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false
d) If both assertion and reason are false. e) If assertion is false but reason is true.

285. Consider an earth satellite so positioned that it appears stationary to an observer on the earth and serves the purpose of a fixed relay station for intercontinental transmission of TV and other communications. If the radius of the earth is 6400 km and the acceleration due to gravity on the surface of the earth is 9.8 km/sec^2 , the height of the satellite above the surface of the earth is:
a) 42,400 km b) 36,000 km c) 6,400 km d) 12,800 km

286. In our solar system, the inter-planetary region has chunks of matter (much smaller in size compared to planets) called asteroids. They

a)

will not move around the sun since they have very small masses compared to sun.

b)

will move in an irregular way because of their small masses and will drift awayinto outer space

c) will move around the sun in closed orbits but not obey Kepler's laws.

d) will move in orbits like planets and obey Kepler's laws

287. Find ratio of acceleration due to gravity g at depth d and at height h, where d = 2h.

a) 1 : 1 b) 1 : 2 c) 2 : 1 d) 1 : 4

288. An object weighs ION at the north pole of the earth. In a geostationary satellite distant 7R from the centre of the earth (of radius R), the true weight and the apparent weight are:

a) ON, ON b) 0.2N, ON c) 0.2 N, 9.8 N d) 0.2 N, 0.2 N

289. According to Kepler's law, the period of revolution of a planet (T)and its mean distance from the sun (R) are related by the equation:

a) T^2R = constant b) T^2R^{-3} = constant c) TR^3 = constant d) T^3R^3 = constant

290. A projectile attains the escape velocity when:

a) kinetic energy> potential energy b) potential energy> kinetic energy

c) both energies are equal d) no relation between them

291. The values of the acceleration of free fall g on the surface of two planets are the same provided the planets have the same:

a) mass b) radius c) mass/radius d) mass/$(\text{radius})^2$

292. Mass of the earth has been determined through :

a) use of Kepler's $\frac{T^2}{R^3}$ constancy law

b) sampling the density of earth's crust and using earth's radius

c) Cavendish's determination of G and using earth's radius and g at its surface

d) use of periods of satellites at different heights above earth's surface

293. A body is orbiting very close to the earth's surface with kinetic energy KE. The energy required to completely escape from it is:

a) $\sqrt{2}$ KE b) KE c) KE/$\sqrt{2}$ d) none of these

294. Gravitational force between two point masses m and M separated by a distance is F. Now if a point mass 2m is placed next to m in contact with it, the force on M due to m and the total force on M are:

a) 2F, F b) F, 2F c) F, 3F d) F, F

295. Assertion: The force between two finite rigid bodies is not necessarily along the line joining their centre of mass.

Reason: Gravitational force between two particles is central.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

296. Assertion: The total energy of a satellite is negative.

Reason: Gravitational potential energy of an object is negative.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

297. An asteroid of mass m is approaching earth, initially at a distance 10 R_E with speed Vi' It hits earth with a speed v_i(R_E and M_E are radius and mass of earth), then

a) $v_f^2 = v_i^2 + \frac{2Gm}{R_E}\left(1 + \frac{1}{10}\right)$ b) $v_f^2 = v_i^2 + \frac{2GM_E}{R_E}\left(1 + \frac{1}{10}\right)$ c) $v_f^2 = v_i^2 + \frac{2GM_E}{R_E}\left(1 - \frac{1}{10}\right)$

d) $v_f^2 = v_i^2 + \frac{2Gm}{R_E}\left(1 - \frac{1}{10}\right)$

298. Match the Column I with Column II. For a satellite in circular orbit,

Column I		Column II	
(A)	Kinetic energy	(p)	$-\frac{GM_E m}{2r}$
(B)	Potential energy	(q)	$\sqrt{\frac{GM_E}{r}}$
(C)	Total energy	(r)	$-\frac{GM_E m}{r}$
(D)	Orbital velocity	(s)	$\frac{GM_E m}{2r}$

(where M_E is the mass of the earth, m is mass of the satellite and r is the radius of the orbit)

a) A - r, B - s, C - q, D - P b) A - q, B - p, C - r, D - s c) A - p, B - q, C - s, D - r

d) A - s, B - r, C - p, D - q

299. Two satellites S and S' revolve around the earth at distances 3R and 6R from the centre of the earth. Their periods of revolution will be in the ratio:

a) 1 : 2 b) 2 : 1 c) 1 : $2^{1.5}$ d) 1 : $2^{0.67}$

300. Mass of the earth is 81 times the mass of the moon and the distance between the earth and the moon is 60 times the radius of the earth. If R is the radius of the earth, then the distance between the moon and the point on the line joining the moon and the earth, where the gravitational force becomes zero is:

a) 30R b) 15R c) 6R d) 5R

301. Which one of the following statements is correct?

a)

The energy required to rocket an orbiting satellite out of earth's gravitational influence is more than the energy required to project a stationary object at the same height (as the satellite) out of earth's influence.

b)

If the zero of potential energy is at infinity, the total energy of an orbiting satellite is negative of potential energy.

c) The first artificial satellite Sputnik I was launched in the year 1950.

d)

The orbital speed of the SYNCOMS (Synchronous communications satellite) is 3.07×10^2 m S^{-1}.

302. Two planets are revolving around the earth with velocities V_1 and V_2 and in radii r_1 and r_2 ($r_1 > r_2$) respectively. Then:

a) $v_1 = v_2$ b) $v_1 > v_2$ c) $v_1 < v_2$ d) $\frac{v_1}{r_1} = \frac{v_2}{r_2}$

303. A satellite is launched in a direction parallel to the surface of earth from a height 390 km with a speed 30.3 Mm hr^{-1}. Speed of the satellite as it reaches its maximum altitude of 3770 km, is:

a) 22.02 Mm hr^{-1} b) 22.20 Mm hr^{-1} c) 20.22 Mm hr^{-1} d) 22.82 Mm hr^{-1}

304. If M = mass of the earth, R = radius of the earth, then what is the gravitational potential at a distance r = R/2 from its centre?

a) $-\frac{GM}{R}$ b) $-\frac{3}{2}\frac{GM}{R}$ c) $-\frac{8GM}{11R}$ d) $-\frac{11GM}{8R}$

305. (A) Escape velocity of a satellite is greater than its orbital velocity.

(R) Orbit of a satellite is within the gravitational field of planet whereas escaping is beyond the gravitational field of planet.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

306. Three uniform spheres, with masses m_A= 350 kg, m_B= 2000 kg and me = 500 kg, have the (x, y) coordinates (0,0) em, (-80,0) cm and (40,0) em respectively. The gravitational potential energy, U, of the system and change in its value in terms of increase or decrease, if the sphere of mass me is removed, may be given as:
a) U = -1.92×10^{-4} J and its value shall decrease if the sphere B is removed.
b) U = -1.92×10^{-4} J and its value shall increase if the sphere B is removed.
c) U = -1.43×10^{-4} J and its value shall decrease if m_B is removed.
d) U = -1.43×10^{-4}J and its value shall increase if m^B is removed.

307. The potential energy of a satellite having mass (m) and revolving at a height of 6400 km from the earth is:
a) 2 mg R_e b) mg R_e c) 0.5 mg R_e d) 0

308. Which of the following statements is correct?
a) Acceleration due to gravity increases with increasing altitude
b) Acceleration due to gravity increases with increasing depth
c) Acceleration due to gravity increases with increasing latitude
d) Acceleration due to gravity is independent of the mass of the earth

309. (A) Two satellites A and B are in the same orbit around the earth, B being behind A. Satellite B can overtake satellite A by increasing its speed.
(R) Orbital speeds of two satellite in same orbit may different.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false.
d) If both assertion and reason are false. e) If assertion is false but reason is true.

310. Assertion: A man sitting in a closed cabin which is falling freely does not experience any gravity.
Reason: Inertial and gravitational mass are equivalent.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

311. The escape velocity of a projectile on the earth's surface is 11.2 k ms^{-1} .A body is projected out with thrice this speed. The speed of the body far away from the earth will be:
a) 2.4 kms^{-1} b) 31.7 kms^{-1} c) 33.6 kms^{-1} d) none of these

312. An astronaut experiences weightlessness in a space satellite. It is because
a) the gravitational force is small at that location in space.
b) the gravitational force is large at that location in space.
c) the astronaut experiences no gravity.
d) the gravitational force is infinitely large at that location in space.

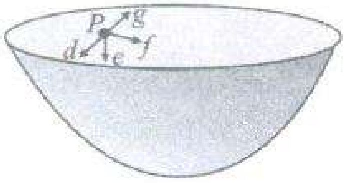
313. At what height from the earth's surface the acceleration due to gravity will be half the value of g at the surface? (Re = 6400 km)
a) 3050 km b) 3240 km c) 2650 km d) None of these

314. Imagine a light planet revolving around a very massive star in a circular orbit of radius r with a period of revolution T. If the gravitational force of attraction between the planet and the star is proportional to $r^{5/2}$, then the square of the time period will be proportional to:
a) r^3 b) r^3 c) $r^{2.5}$ d) $r^{3.5}$

315. Two satellites S_1 and S_2 revolve round a planet in coplanar circular orbits in the same sense. Their periods of revolution are 1 hour and 8 hour respectively. The radius of the orbit of S_1 is 10^4 km. When S_2 is closest to S_1 the speed of S_2 relative to S_1 (in km/h)
a) $\pi * 10^4$ b) $-\pi * 10^4$ c) $\pi * 10^5$ d) $-\pi * 10^5$

316. If the mass of the Sun were ten times smaller and the universal gravitational constant were ten times larger in magnitude, which of the following is not correct?
a) Time period of a simple pendulum on the Earth would decrease
b) Walking on the ground would become more difficult c) Raindrops will fall faster
d) 'g' on the Earth will not change

317. The direction of gravitational intensity at point P of a hemispherical shell of uniform mass density is indicated by the arrow



a) d b) e c) f d) g

318. The effect of rotation of the earth on the value of acceleration due to gravity is:
a) maximum at the equator and minimum at the poles
b) minimum at the equator and maximum at the poles c) maximum at both places
d) minimum at both places

319. The Earth is assumed to be a sphere of radius R. A platform is arranged at a height R from the surface of the Earth. The escape velocity of a body from this platform is f v, where v is its escape velocity from the surface of the Earth. The value of f is______
a) $\frac{1}{\sqrt{2}}$ b) $\frac{1}{3}$ c) $\frac{1}{2}$ d) $\sqrt{2}$

320. A skylab of mass mkg is first launched from the surface of the earth in a circular orbit of radius 2R (from the centre of the earth) and then it is shifted from this circular orbit to another circular orbit of radius 3R. The minimum energy required to place the lab in the first orbit and to shift the lab from first orbit to the second orbit are:
a) $\frac{3}{4}mgR, \frac{mgR}{6}$ b) $\frac{3}{4}mgR, \frac{mgR}{12}$ c) mgR,mgR d) 2 mgR,mgR

321. The eccentricity of the earth's orbit is 0.0167. The ratio of its maximum speed in its orbit to its minimum speed is:
a) 2.507 b) 1.0339 c) 8.324 d) 1.000

322. Two astronauts are floating in gravitational free space after having lost contact with their spaceship. The two astronauts_____
a) Keep floating at the same distance beween them b) move towards each other
c) move away from each other d) will become stationary

323. The total energy of a satellite moving with an orbital velocity v around the earth is:
a) $\frac{1}{2}mv^2$ b) $-\frac{1}{2}mv^2$ c) mv^2 d) $\frac{3}{2}mv^2$

324. A particle of mass m is situated at the centre of spherical shell of mass M and radius. The magnitude of the gravitational potential at a point situated at a/2 distance from the centre will be____
a) $\frac{2GM}{a}$ b) $\frac{3GM}{a}$ c) $\frac{4GM}{a}$ d) $\frac{GM}{a}$

325. (A) Space rockets are usually launched in the equatorial line from west to east.
(R) The acceleration due to gravity is minimum at the equ.ator and the earth rotates from west to east a,bout its axis.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

326. Two spherical bodies of mass M and 5M and radii R and 2R released in free space with initial separation between their centres equal to 12R. If they attract each other due to gravitational force only, then the distance covered by the smaller body before collision is :
a) 4.5 R b) 7.5 R c) 1.5 R d) 2.5 R

327. The acceleration ofa body due to the attraction of the earth (radius R) at a distance 2R from the surface of the earth is: (g = acceleration due to gravity at the surface of the earth)
a) g/9 b) g/3 c) g/4 d) g

328. The mass of moon is 1% of mass of earth. The ratio of gravitational pull of earth on moon and that of moon on earth will be
a) 1:1 b) 1:10 c) 1:100 d) 2:1

329. A small planet is revolving around a very massive star in a circular orbit of radius R with a period of revolution T. If the gravitational force between the planet and the star were proportional to $R^{-5/2}$, then T would be proportional to
a) $R^{3/2}$ b) $R^{3/5}$ c) $R^{7/5}$ d) $R^{7/4}$

330. A body is thrown upward from the earth surface with velocity 5 m/s and from a planet surface with velocity 3 m/s. Both follow the same path. What is the projectile acceleration due to gravity on the planet?
a) 2 m/s^2 b) 3.5 m/s^2 c) 4 m/s^2 d) 5 m/s^2

331. The earth is an approximate sphere. If the interior contained matter which is not of the same density everywhere, then on the surface of the earth, the acceleration due to gravity
a) will be directed towards the centre but not the same everywhere
b) will have the same value everywhere but not directed towards the centre
c) will be same everywhere in magnitude directed towards the centre
d) cannot be zero at any point

332. Assertion: Astronauts in a satellite moving around the earth are in a weightless condition.

Reason: The satellite and its contents are falling freely at the same rate.

a)

If both assertion and reason are true but reason is not the correct explanation of assertion

b) If assertion is true but reason is false c) If both assertion and reason are false

d)

If both assertion and reason are true and reason is the correct explanation of assertion

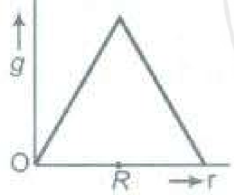
333. If value of acceleration due to gravity at the surface of a sphere is am, then its value will be $a_m/3$ at a distance _____________ from the centre.

a) $\sqrt{3}$r b) r/$\sqrt{3}$ c) 2$\sqrt{3}$r d) r/3

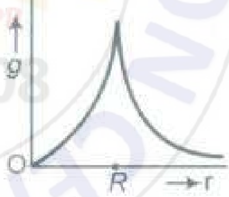
334. Imagine earth is rotating at a very high speed such that weight of a body at the equator is zero. Then number of hours in a day is :

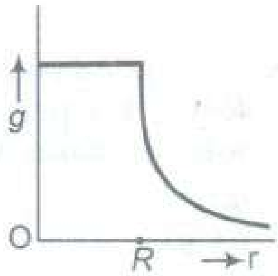
a) $\frac{2\pi}{3600}\sqrt{\frac{g}{R}}$ b) $\frac{2\pi}{3600}\sqrt{\frac{R}{g}}$ c) $\frac{3600}{2\pi}\sqrt{\frac{g}{R}}$ d) $\frac{3600}{2\pi}\sqrt{\frac{R}{g}}$

335. Starting from the centre of the Earth having radius R, the variation of g (acceleration due to gravity) is shown by

a)


b)


c)


d)


336. Force of gravity is least at:

a) The equator b) The poles c) A point in between equator and any pole

d) None of these

337. A satellite goes along an elliptical path around the earth. The rate of change of arc length swept by the satellite is proportional to:

a) r b) r^2 c) $r^{1/2}$ d) r^{-1}

338. A remote sensing satellite of Earth revolves in a circular orbit at a height of 0.25×10^6 m above the surface of Earth. If Earth's radius is 6.38x 106 and g=9.8 m/s^2, then the orbital speed of the satellite is:
a) 7.76km/s b) 8.5km/s c) 9.13km/s d) 6.67km/s

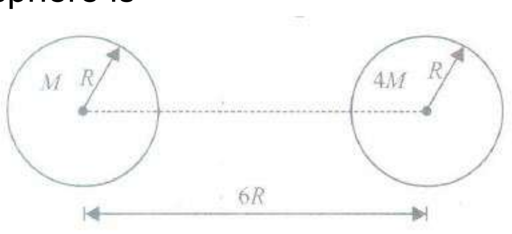
339. A satellite of mass m is orbiting around the earth at a height h above the surface of the earth. Mass of the earth is M and its radius is R. The angular momentum of the satellite is independent of:
a) m b) M c) h d) none of these

340. If Rm is the radius of the moon's orbit round the earth, am the acceleration ofthe moon towards the centre of the earth and Re, the radius of the earth, then am is equal to: (if g is the acceleration due to gravity on the surface of the earth)
a) $(\frac{R_e}{R_m})g$ b) $(\frac{R_m}{R_e})g$ c) $(\frac{R_e}{R_m})^2 g$ d) $(\frac{R_m}{R_e})^2 g$

341. Two stars each of mass M and radius R are approaching each other for a head -on collision. They start approaching each other when their separation is r > > R. If their speeds at this separation are negligible, the speed v with which they collide would be
a) $v = \sqrt{GM\left(\frac{1}{R} - \frac{1}{R}\right)}$ b) $v = \sqrt{GM\left(\frac{1}{2R} - \frac{1}{R}\right)}$ c) $v = \sqrt{GM\left(\frac{1}{2R} + \frac{1}{R}\right)}$ d) $v = \sqrt{GM\left(\frac{1}{2R} + \frac{1}{R}\right)}$

342. The escape velocity of a body on the surface of the earth is 11.2 km/s. If the earth's mass increases to twice its present value and the radius of the earth becomes half, the escape velocity would become_____
a) 44.8 km/s b) 22.4 km/s c) 11.2 km/s (remain unchanged) d) 5.6 km/s

343. Two uniform solid spheres of equal radii R, but mass M and 4M have a centre to centre separation 6R, as shown in figure. A projectile of mass m is projected from the surface of the sphere of mass M directly towards the centre of the second sphere. The minimum speed of the projectile so that it reaches the surface of the second sphere is



a) $\sqrt{\frac{4}{5}\frac{GM}{R}}$ b) $\sqrt{\frac{5}{4}\frac{GM}{R}}$ c) $\sqrt{\frac{3}{5}\frac{GM}{R}}$ d) $\sqrt{\frac{5}{3}\frac{GM}{R}}$

344. The depth at which the value of acceleration due to gravity becomes 1/n times the value at the surface is: (R be the radius of the earth)
a) R/n b) R/n^2 c) R(n-1)/n d) Rn/(n-1) e) Rn

345. The period of revolution of planet A around the Sun is 8 times that of B. The distance of A from the Sun is how many times greater than that of B from the Sun?

a) 2 b) 3 c) 4 d) 5

346. Satellites orbiting the earth have a finite life and sometimes debris of satellites fall to the earth. This is because,

a) the solar cells and batteries in satellites run out

b) the laws of gravitation predict a trajectory spiralling inwards

c)

of viscous forces causing the speed of the satellite and hence height to gradually decrease

d) of collisions with other satellites

347. If mass M is split into two parts m and (M - m) which are then separated by a distance, the ratio of $\frac{m}{M}$ that maximises the gravitational force between the two parts is:

a) 1:2 b) 1:1 c) 2:1 d) 1:4

348. Weight of a body of mass m decreases by 1% when it is raised to height h above the earth's surface. Ifthe body is taken to a depth h in a mine, change in its weight is:

a) 2% decrease b) 0.5% decrease c) 1% increase d) 0.5% increase

349. A satellite moves in elliptical orbit about a planet. The maximum and minimum velocities of satellite are 3×10^4 m/s and 1×10^3 m/s respectively. What is the minimum distance of satellite from planet if maximum distance is 4×10^4 km?

a) 4×10^3 km b) 3×10^3 km c) $4/3 \times 10^3$ km d) 1×10^3 km

350. Two equal masses m and m are hung from a balance whose scale pans differ in vertical height by 'h'. The error in weighing in terms of density of the earth ρ is:

a) π Gpmh b) $\frac{1}{3}\pi$ Gpmh c) $\frac{8}{3}\pi$ Gpmh d) $\frac{4}{3}\pi$ Gpmh

351. For a satellite escape velocity is 11 km/s. If the satellite is launched at an angle of 60° with the vertical, then escape velocity will be :

a) 11 km/s b) $11\sqrt{3}$ km/s c) $11\sqrt{3}$ km/s d) 33 km/s

352. A satellite is launched into a circular orbit of radius R around the earth. A second satellite is launched into an orbit of radius 1.0 IR. The time period of the second satellite is larger than that of the first one by approximately:

a) 0.5% b) 1.5% c) 1% d) 3.0%

353. A spaceship is launched into a circular orbit close to the surface of the earth. The additional velocity now imparted to the spaceship in the orbit to overcome the gravitational pull is:

a) 11.2 km/sec b) 8 km/sec c) 3.2 km/sec d) 1.414 x 8 km/sec

354. If the earth be one half its present distance from the sun, number of days in the year will be nearly:

a) 129 b) 30 c) 200 d) 60

355. A planet moving along an elliptical orbit is closest to the Sun at a distance r_1 and farthest away at a distance of 'r_2. If υ_1 and υ_2 are the linear velocities at these points respectively, then the ratio υ_1/υ_2 is

a) $(r/r_2)^2$ b) r_2/r_1 c) $(r_1/r_2)^2$ d) r_1/r_2

356. If the radius of the Earth were to shrink by 1% its mass remaining the same, the acceleration due to gravity on the Earth's surface would.

a) Decrease by 2% b) Remain unchanged c) Increase by 2%

d) Increase by 1%

357. In motion of an object under the gravitational influence of another object. Which of the following quantities is not conserved?

a) Angular momentum b) Mass of an object c) Total mechanical energy

d) Linear momentum

358. (A) The plane of the orbit of an artificial satellite must contain the centre of the earth.

(R) For the orbital motion of satellite, the necessary centripetal force is provided by gravitational pull of earth on satellite.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

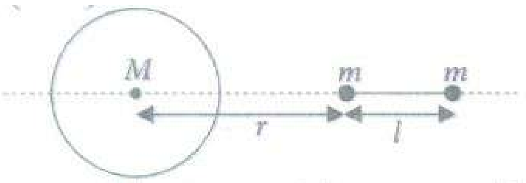
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

359. A large spherical mass M is fixed at one position and two identical point masses m are kept on a line passing through the centre of M (see figure). The point masses are connected by a rigid massless rod of length 1 and this as embly is free to move along the line connecting them. All three masses interact only through their mutual gravitational interaction. When the point mass nearer to M is at a distance r = 3l from M, the tension in the rod is zero for

$m = k\left(\frac{M}{288}\right)$ The value of k is



a) 5 b) 6 c) 7 d) 8

360. A geostationary satellite is orbiting the earth at a height 6 R above the surface 'of earth, where R is the radius of the earth. The time period of another satellite at a height of 2.5 R from the surface of earth in hours is

a) $3\sqrt{2}$h b) $1.5\sqrt{2}$h c) $6\sqrt{2}$h d) $12\sqrt{2}$h

361. The ratio of the K.E. required to be given to the satellite to escape Earth's gravitational field to the K.E.required to be given so that the satellite moves in a circular orbit just above Earth atmosphere is

a) One b) Two c) Half d) Infinity

362. Consider a satellite going round the Earth in an orbit. Which of the following statements is wrong?

a) It is a freely falling body b) It suffers no acceleration

c) It is moving with a constant speed d) Its angular momentum remains constant

363. The escape velocity of a body from the earth depends on

(i) the mass of the body

(ii) the location from where it is projected.

(iii) the direction of projection.

(iv) the height of the location from where the body is launched.

a) (i) and (ii) b) (ii) and (iv) c) (i) and (iii) d) (iii) and (iv)

364. A mass m is placed at point P which lies on the axis of a ring of mass Mand radius R at a distance R from its centre. The gravitational force on mass m is

a) $\frac{GMm}{\sqrt{2R^2}}$ b) $\frac{GMm}{2R^2}$ c) $\frac{GMm}{2\sqrt{2}R^2}$ d) $\frac{GMm}{4R^2}$

365. A man covers 60 metre distance in one minute on the surface of the earth. The distance he will cover on the surface of the moon per minute is: (assuming g_{moon} $\frac{g_{earth}}{6}$)

a) 60 m b) 60 x 6 m c) $\frac{60}{6}m$ d) $\sqrt{60}m$

366. If the ratio of radius of the Mars and the earth around the sun is 1.526 then time period of Mars is:

a) 45 year b) 1.89 year c) 32 year d) 48 year

367. A body of mass m falls from a height R above the surface of the earth, where R is the radius of the earth. What is the velocity attained by the body on reaching the ground? (Acceleration due to gravity on the surface of the earth is g)

a) gR b) $\sqrt{gR}$ c) $\sqrt{g/R}$ d) g/R

368. A missile launched with a velocity less than escape velocity, the sum of its KE and PE is always:

a) + ve b) Zero c) -ve d) none of these

369. A cosmonaut is orbiting the earth in a space-craft at an altitude h = 630 km with a speed of 8 km/s. If the radius of the earth is 6400 km, the acceleration ofthe cosmonaut is:
a) 9.10 m/s^2 b) 9.80 m/s^2 c) 10.0 m/s^2 d) 9.88 m/s^2

370. (A) The escape velocity of a body of mass m is V_e' The escape velocity of another body of mass 2m for same planet is V_e'
(R) The escape velocity of a body for a given planet is independent of mass of the body.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

371. The acceleration due to gravity on the planet A is 9 times the acceleration due to gravity on planet B. A man jumps to a height of 2m on the surface of A. What is the height of jump by the same person on the planet B?
a) $\frac{2}{3}$ m b) $\frac{2}{9}$ m c) 18 m d) 6 m

372. As observed from earth, the sun appears to move in an approximate circular orbit. For the motion of another planet like mercury as observed from earth, this would
a) be similarly true
b)
not be true because the force between earth and mercury is not inverse square law
c) not be true because the major gravitational force on mercury is due to sun
d)
not be true because mercury is influenced by forces other than gravitational forces

373. What is the weight of a body at a distance 2r from the centre of the earth if the gravitational potential energy of the body at a distance r from the centre of the earth is U?
a) $\frac{U}{2r}$ b) $\frac{U}{3r}$ c) $\frac{U}{4r}$ d) Ur

374. The dimension of gravitational field is same as that of:
a) momentum b) velocity c) acceleration d) force

375. A satellite of mass m is in a circular orbit of radius $2R_E$ about the earth. The energy required to transfer it to a circular orbit of radius $4R_E$ is (where M_E and R_E is the mass and radius of the earth respectively)

a) $\frac{GM_E m}{2R_E}$ b) $\frac{GM_E m}{4R_E}$ c) $\frac{GM_E m}{8R_E}$ d) $\frac{GM_E m}{16R_E}$

376. A seconds pendulum is mounted in a rocket. Its period of oscillation decreases when the rocket:
a) comes down with uniform acceleration
b) moves round the earth in a geostationary orbit
c) moves up with a uniform velocity d) moves up with uniform acceleration

377. Assertion: The principle of superposition is not valid for gravitational forces.
Reason: Gravitational forces are non-conservative.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

378. Assertion: A central force is such that the force on the planet is along the vector joining the sun and the planet.
Reason: Conservation of angular momentum is valid for any central force.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false d) If both assertion and reason are false

379. The length of a seconds pendulum on the earth when g is 9.8 m/s^2 is I m. The length of a seconds pendulum on a planet, where g = 4.9 m/s^2 , will be:
a) 1 m b) 2 m c) 0.5 m d) 0.25 m

380. Two spherical bodies of mass M and 5M and radii -R and 2 R released in free space with initial separation between their centres equal to 12 R. If they attract each other due to gravitational force only, then the distance covered by the smaller body better collision is ____________.
a) 4.5 R b) 7.5 R c) 1.5 R d) 2.5 R

381. An astronaut is in a stable orbit around the earth when he weighs a body of mass 5 kg. What is reading of spring balance?
a) Spring will not be extended
b) Spring will be extended according to Hooke's law. c) Less than 5 kg-wt
d) More than 5 kg-wt

382. The distances of two planets from the sun are 10^{13} and 10^{12} m respectively. The ratio of time periods of these two planets is_____

a) $\frac{1}{\sqrt{10}}$ b) 100 c) $10\sqrt{10}$ d) $\sqrt{10}$

383. The mass of the earth is 6 x 10^{24} kg and that of the moon is 7.4 x 10^{22} kg. The potential energy of the system is -7.79 x 10^{28} J. The mean distance between the earth and moon is
($G = 6.67 \times 10^{-11}$ N m^2kg^{-2})

a) 3.8 x 10^8 m b) 3.37 x 10^6 m c) 7.60 x 10^4 m d) 1.9 x 10^2 m

384. If an artificial satellite is moving in a circular orbit around the earth with a speed equal to half the magnitude of the escape velocity from the earth, the height of the satellite above the surface of the earth is:

a) 2R b) $\frac{R}{2}$ c) R d) $\frac{R}{4}$

385. Satellite A of mass m is revolving round the Earth at a height 'r' from the centre. Another satellite B of mass 2 m is revolving at a height 2r. The ratio of their time periods will be:

a) 1 : 2 b) 1 : 16 c) 1 : 32 d) $1:2\sqrt{2}$

386. The change in PE of a body of mass m placed on the earth when it is taken to a height of R (R = radius of the earth) above the earth surface:

a) mgR b) mgR/2 c) 3mgR/4 d) 2/3 mgR

387. A particle of mass 1 kg is placed at a distance of 4 m from the centre and on the axis of a uniform ring of mass 5 kg and radius 3m. Calculate the work required to be done to increase the distance of the particle from 4 m to $3\sqrt{3}$ m.

a) $\frac{5G}{6}J$ b) $\frac{G}{6}J$ c) $\frac{3G}{2}J$ d) $\frac{2G}{3}J$

388. Two satellites A and B go around the earth in circular orbits at heights of R_A and R_B respectively from the surface of the earth. Assuming the earth to be a uniform sphere of radius R_e, the ratio ofthe magnitudes of their orbital velocities is:

a) $\sqrt{\frac{R_B}{R_A}}$ b) $\frac{R_B+R_e}{R_A+R_e}$ c) $\sqrt{\frac{R_B+R_e}{R_A+R_e}}$ d) $(\frac{R_A}{R_B})^2$

389. The satellite of mass m revolving in a circular orbit of radius r around the earth has kinetic energy E. Then, its angular momentum will be:

a) $\sqrt{\frac{E}{mr^2}}$ b) $\frac{E}{2mr^2}$ c) $\sqrt{2Emr^2}$ d) $\sqrt{2Emr}$ e) $\sqrt{\frac{E}{2mr^2}}$

390. The density of core of a planet ρ_1 is and that of the outer shell is Pz. The radii of core and that of the planet are R and 2R respectively. Gravitational acceleration at the surface of planet is same as at a depth. The ratio between $\frac{\rho_1}{\rho_2}$.

a) 2.3 b) 4.5 c) 3.2 d) 5.4

391. Two point masses A and B having masses in the ratio 4 : 3 are separated by a distance of 1 m. When another point mass C of mass M is placed in between A and B, the force between A and C is $\left(\frac{1}{3}\right)^{rd}$ of the force between Band C. Then the distance of C from A is:

a) $\left(\frac{2}{3}\right)m$ b) $\left(\frac{1}{3}\right)m$ c) $\left(\frac{1}{4}\right)m$ d) $\left(\frac{2}{7}\right)m$

392. The force on a 1 kg mass on the earth of radius R is 10 N. Then, the force on a satellite revolving around the earth in the mean orbit of radius 3RI2 will be: (mass of satellite is 100 kg)

a) 4.44×10^2 N b) 6.66×10^2 N c) 500 N d) 3.33×10^2 N

393. A 5000 kg rocket is set for vertical firing. The exhaust speed is 800 m/s. To give an initial upward acceleration of 20 m/s^2, the amount of gas ejected per second to supply the needed thrust will be: (Take g =10 m/s^2)

a) 127.5 kg/s b) 187.5 kg/s c) 185.5 kg/s d) 137.5 kg/s

394. The density of a newly discovered planet is twice that of earth. The acceleration due to gravity at the surface of the planet is equal to that at the surface of the earth. If the radius of the earth is R, the radius of the planet would be_____

a) 1/2 R b) 2R c) 4R d) 1/4 R

395. A planet revolves around the sun in an elliptical orbit. If v_p and v_a are the velocities of the planet at the perigee and apogee respectively, then the eccentricity of elliptical orbit is given by

a) $\frac{v_p}{v_a}$ b) $\frac{v_p}{v_a}$ c) $\frac{v_p+v_a}{v_p-v_a}$ d) $\frac{v_p-v_a}{v_p+v_a}$

396. If a man at the equator would weigh (3/5) th of his weight, the angular speed of the earth is:

a) $\sqrt{\frac{2g}{5R}}$ b) $\sqrt{\frac{g}{R}}$ c) $\sqrt{\frac{R}{g}}$ d) $\sqrt{\frac{2R}{5g}}$

397. Suppose ge b_e the acceleration due to gravity at the equator and g_p be that at the poles. Assuming the earth to be a sphere of radius Re rotating about its own axis with angular speed ω, then (g_p - g_e) is given by:

a) ω^2/R_e b) $R_e\omega^2$ c) $\omega^2 R_e^2$ d) ω^2/R_e^2

398. A ball of mass m is fired vertically upwards from the surface of the earth with velocity nV_e-, where V_e is the escape velocity and n < 1. Neglecting air resistance, to what height will the ball rise? (Take radius of the earth = R)

a) R/n^2 b) $R/(1-n^2)$ c) $Rn^2/(1-n^2)$ d) Rn^2

399. Average distance of the earth from the sun is L_1 If one year of the earth = D days, one year of another planet whose average distance from the sun is L_2 will be

a) $D\left(\frac{L_2}{L_1}\right)^{1/2}$ days b) $D\left(\frac{L_2}{L_1}\right)^{3/2}$ days c) $D\left(\frac{L_2}{L_1}\right)^{2/3}$ days d) $D\left(\frac{L_2}{L_1}\right)$ days

400. If R is the radius of the earth and g is acceleration due to gravity on the earth's surface, the mean density of earth is:

a) $\frac{4\pi G}{3gR}$ b) $\frac{3\pi G}{4gR}$ c) $\frac{3g}{4\pi RG}$ d) $\frac{\pi Rg}{12G}$

Ravi Maths Tuition Centre

Time : 1 Mins GRAVITATION 2 1 Marks : 458

1. Choose the correct statement from the following: The radius of the orbit of a geostationary satellite depends upon:
a) mass of the satellite, its time period and gravitational constant
b) mass of the satellite, mass of the earth and the gravitational constant
c)
mass of the earth, mass of the satellite, time period of the satellite and the gravitational constant
d) mass of the earth, time period of the satellite and the gravitational constant
2. An earth satellite moves from an orbit A to another stable lower orbit B. In this process:
a) gravitational PE decreases b) gravitational PE increases
c) angular speed increases d) none of the above
3. Two satellites are moving in the same circular orbit around the earth. They must have the same:
a) mass b) angular momentum c) kinetic energy d) speed
4. A satellite is in an elliptic orbit around the earth with aphelion of $6R_E$ and perihelion of $2R_E$ where R_E is the radius of the earth. The eccentricity of the orbit is
a) $\frac{1}{2}$ b) $\frac{1}{3}$ c) $\frac{1}{4}$ d) $\frac{1}{6}$
5. The value of 'g' at a particular point is 9.8 m/s^2. Suppose the Earth suddenly shrinks uniformly to, half its present size without losing any mass. The value of 'g' at the same point (assuming that the distance of the point from the centre of Earth does not shrink) will now be :
a) 4.9 m/sec^2 b) 3.1 m/sec^2 c) 9.8 m/sec^2 d) 19.6 m/sec^2
6. If g is the acceleration due to gravity at the Earth's surface and r is the radius of the earth, the escape velocity for the body to escape out of Earth's gravitational field is :
a) gr b) $\sqrt{2gr}$ c) g/r d) r/g

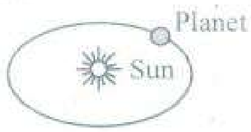
7. The height at which the weight of a body becomes 1/6th, its weight on the surface of earth (radius R), is _____________ .
   a) 5R b) 15R c) 3R d) 4R

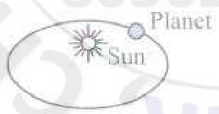
8. If g is acceleration due to gravity on the earth's surface, the gain in the potential energy of an object of mass m raised from the surface of the earth to a height equal to the radius R of the earth is:
   a) $\frac{1}{2}mgR$ b) 2mgR c) mgR d) $\frac{1}{4}mgR$

9. The change in potential energy when a body of mass m is raised to a height nR_E from earth's surface is (R_E = radius of the earth)
   a) $mgR_E\frac{n}{(n-1)}$ b) mgR_E c) $mgR_E\frac{n}{(n+1)}$ d) $\frac{mgR_E}{n}$

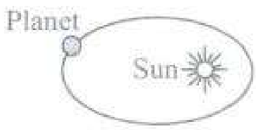
10. In case of a solid sphere, where is its gravitational potential minimum?
   a) At the centre of the sphere b) At the surface of the sphere c) At infinity
   d) At mid-point between the centre and surface of the sphere

11. The mean radius of the earth is R, its angular spped on its own axis is w and the acceleration due to gravity at the earth's surface is g. What will be the radius of the orbit of a geostationary satellite?
   a) $\left(\frac{R^2g}{\omega^2}\right)^{1/3}$ b) $\left(\frac{Rg}{\omega^2}\right)^{1/3}$ c) $\left(\frac{R^2\omega^2}{g}\right)^{1/3}$ d) $\left(\frac{R^2g}{\omega}\right)^{1/3}$

12. Which of the following orbits is a possible orbit for a planet?
   a) 

   b) 

   c) 

   d) 

13. Radius of earth is 6400 km and that of mars is 3200 km. Mass of mars is 0.1 that of earth's mass. Then the acceleration due to gravity on mars is nearly
   a) 1 m/s^2 b) 2.5 m/s^2 c) 4 m/s^2 d) 5 m/s^2

14. If a particle is fired vertically upwards from the surface of the earth and reaches a height of 6400 km, the initial velocity of the particle is: (Assume R =6400 km and g = 10 ms^{-2})
   a) 4 km/sec b) 2 km/sec c) 8 km/sec d) 10 km/sec

15. A planet revolves is an elliptical orbit around the sun. The semi-major and semi-minor axes are a and b, then the time period is given by:
   a) $T^2 \propto b^3$ b) $T^2 \propto (a+b/2)^3$ c) $T^2 \propto a^3$ d) $T^2 \propto (a-b/2)^3$

16. (A) Comets move around the sun in elliptical orbits. The gravitational force on the comet due to sun is not normal to the comet's velocity, but the work done by the gravitational force over every complete orbit of the comet is zero.
(R) Gravitational force is a conservative force and the work done by a conservative force over a closed path is always zero.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false.
d) If both assertion and reason are false.
e) If assertion is false but reason is true.
17. At what height over the earth's pole, the free fall acceleration decreases by one percent? (Assume the radius of earth to be 6400 km) :
a) 32 km b) 64 km c) 80 km d) 1.253 km
18. Two satellites are in the parking orbits around the earth. Mass of one is 10 times that of the other. The ratio of their periods of revolution is:
a) 1 b) $\sqrt{10}$ c) 10 d) 100
19. Assuming the radius of the earth as R, the change in gravitational potential energy of a body of mass m, when it is taken from the earth's surface to a height 3 R above its surface, is ____________ .
a) $3mgR$ b) 3/4mgR c) 1mgR d) 3/2mgR
20. If the Earth stops rotating, the value of 'g' a equator will :
a) Increase b) Remain same c) Decrease d) None of these
21. Assertion: Moon has no atmosphere.
Reason: The escape velocity for moon is less than that for earth.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false
d) If both assertion and reason are false

22. A satellite is orbiting around the earth with a period T. If the earth suddenly shrinks to half its radius without change in mass, the period of revolution of the satellite will be:

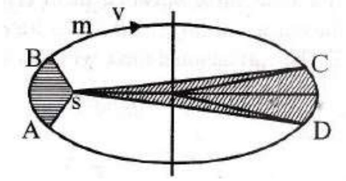
a) $\frac{T}{2}$ b) T c) 2T d) $\frac{T}{\sqrt{2}}$

23. A satellite orbits around the earth in a circular orbit with a speed v and orbital radius r. If it loses some energy, then v and r changes as:

a) v decreases and r increases b) both v and r decreases

c) v increases and r decreases d) both v and r increases

24. The figure shows elliptical orbit of a planet m about the sun S. The shaded area SCD is twice the shaded area SAB. If t_1 is the time for the planet to move from C to D and t_2 is the time to move from A to B then____

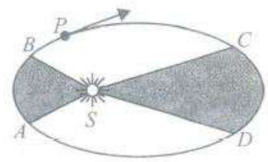


a) $t_1 = 4t_2$ b) $t_1 = 2t_2$ c) $t_1 = t_2$ d) $t_1 > t_2$

25. Two satellites are moving in orbits $R_1 > R_2$; then the velocities associated with them are

a) $v_1 > v_2$ b) $v_1 = v_2$ c) $v_1 = 2v_2$ d) $v_1 < v_2$

26. Figure shows elliptical orbit of a planet P about the sun S.The shaded area SCD is twice the shaded area SAB. If t_1 is the time for the A planet to move from C to D and t_2 is the time to move from A to B, then



a) $t_1 = t_2$ b) $t_1 = 2t_2$ c) $t_1 = 4t_2$ d) $t_1 > t_2$

27. A satellite of the sun is in circular orbit around the sun, midway between the sun and the earth. Then:

a) the period of the satellite is nearly 129 days

b) the speed of the satellite equals the escape velocity of the earth

c) the acceleration of the satellite is four times the acceleration of the earth

d) the period of the satellite is nearly 229 days

28. The period of revolution of the planet A round the sun is 8 times that of B. The distance of A from the Sun is how many times greater than that of B from the sun?

a) 5 b) 4 c) 3 d) 2

29. In the question number 3, the angular speed of s_2 as actually observed by an astronaut in s_1 (in rad/sec)
    a) 3 *10^{-4} b) 3 *10^{-5} c) 3 *10^{-6} d) 3 *10^{-7}
30. A bullet is fired vertically upwards with velocity v from the surface of a spherical planet. When it reaches its maximum height, its acceleration due to the planet's gravity is 1/4th of its value at the surface of the planet. If the escape velocity from the planet is v_{esc} = V $\sqrt{N}$, then the value of Nis (ignore energy loss due to atmosphere)
    a) 2 b) 3 c) 4 d) 5
31. Two planets of radii in the ratio 2: 3 are made from the materials of density in the ratio 3: 2. Then the ratio of acceleration due to gravity g_1/g_2 at the surface of two planets will be:
    a) 1 b) 2.25 c) 4/9 d) 0.12
32. The ratio of the inertial mass to gravitational mass is equal to
    a) 1/2 b) 1 c) 2 d) No fixed number
33. (A) A particle of mass' m dropped into a hole made along the diameter of the earth from one end to the other end possesses simple harmonic motion.
    (R) Gravitational force between any two particles is inversely proportional to the square of the distance between them.
    a)
    If both assertion and reason are true and reason is the correct explanation of assertion.
    b) If assertion is true but reason is false.
    c)
    If both assertion and reason are true but reason is not the correct explanation of assertion
    d) If both assertion and reason are false.
    e) If assertion isfalse but reason is true.
34. The gravitational potential at height h above the earth's surface is -5.12 x 10^7 J/kg and acceleration due to gravity at this point is 6.4 ms^{-2} .If radius of the earth is 6400 km, the value of his:
    a) 1200 Km b) 1600 Km c) 1800 Km d) 2400 Km
35. Average density of the earth:
    a) is directly proportional to g b) is inversely proportional to g
    c) does not depend on g d) a complex function of g

36. If radius of the Earth contracts 2% and its mass remains the same, then weight of the body at the Earth surface

a) Will decrease b) Will increase c) Will remain the same d) None of these

37. The radius of a planet is twice the radius of earth. Both have almost equal average mass-densities. If V_P and V_E are escape velocities of the planet and the carth, respectively, then_____

a) $V_E = 1.5V_p$ b) $V_P = 1.5V_E$ c) $V_P = 2V_E$ d) $V_E = 3V_P$

38. An artificial satellite is moving in a circular orbit around the earth with a speed equal to half the magnitude of escape velocity from the earth. The height of the satellite above the earth's surface will be:

a) 6000 Km b) 5800 Km c) 7500 Km d) 6400 Km

39. The earth's radius is R and acceleration due to gravity at its surface is g. If a body of mass m is sent to a height of R/4 from the earth's surface, the potential energy increases by:

a) $mg = \frac{R}{3}$ b) $mg = \frac{R}{4}$ c) $mg = \frac{R}{5}$ d) $3mg = \frac{R}{16}$

40. A projectile is fired from the surface of the earth with a velocity of 5 ms^{-1} and angle with the horizontal. Another projectile fired from another planet with a velocity of 3 ms^{-1} at the same angle follows a trajectory which is identical with the trajectory of the projectile fired from the earth. The value of the acceleration due to gravity on the planet is (in ms $^{-2}$) given $\left(g = 9.8 \text{ m/s}^2\right)$_____

a) 3.5 b) 5.9 c) 16.3 d) 110.8

41. A satellite moving around the earth in a circular orbit of radius rand speed u suddenly loses some of its energy. Then:

a) r will increase and v will decrease b) both r and v will decrease

c) r will decrease and u will increase d) none of the above

42. A) The time period of revolution of a satellite close to surface of earth is smaller than that revolving away from surface of earth.

(R) The square oftime period of revolution of a satellite is directly proportional to cube of its orbital radius.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

e) If assertion is false but reason is true.

43. A body weighs 250 N on the surface of the earth. How much will it weigh half way down to the centre of the earth?

a) 125 N b) 150 N c) 175 N d) 250 N

44. (A) For a mass M kept at the centre of a cube of side a, the flux of gravitational field passing through its surfaces is 4 ππ GM.

(R) If the direction of a field due to a point source is radial and its dependence on the distance rfrom the source is given as $11r^2$, its flux through a closed surface depends only on the strength of the source enclosed by the surface and not on the size or shape of the surface

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false

d) If both assertion and reason are false.

e) If assertion is false but reason is true.

45. infinite number of masses, each 1 kg are placed along the x-axis at x = ± 1 In, ± 2 In, ± 4 In, ± 8m, ± 16 m . 1 ••• The magnitude of the resultant gravitational potential in terms of gravitational constant Gat the origin (x = 0) is

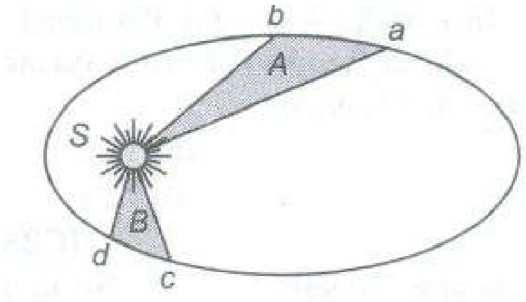
a) G/2 b) G c) 2G d) 4G e) 8G

46. Two bodies with masses M_1 and M_2 are initially at rest and a distance R apart. They then move directly towards one another under the influence of their mutual gravitational. attraction. What is the ratio of the distances travelled by M_1 to the distance travelled by M_2?

a) $\frac{M_1}{M_2}$ b) $\frac{M_2}{M_1}$ c) 1 d) $\frac{1}{2}$

47. The figure shows the motion of a planet around the Sun in an elliptical orbit with Sun at the focus. The shaded areas A and B are also shown in the figure which can be assumed to be equal. If t_l and t_2 represent the time for the planet to move

from a to band d to c respectively, then:



a) $t_1 2$ b) $t_1 > t_2$ c) $t_1 = t_2$ d) $t_1 \leq t_2$

48. The gravitational field intensity at a point 10,000 km from the centre of the earth is 4.8 N kg $^{-1}$, The gravitational potential at that point is :
a) -4.8×10^7 J kg^{-1} b) -2.4×10^7 J kg^{-1} c) -4.8×10^6 J kg^{-1}
d) -3.6×10^6 J kg^{-1}

49. A satellite orbiting around the earth of radius R is shifted to an orbit of radius 2R. How many times the time taken for one revolution increase?
a) 8 times   b) 2 times   c) 2.5 times   d) 2.8 times

50. A projectile is fired vertically upwards from the surface of the earth with a velocity k v_e, where v_e is the escape velocity and k < 1. If R is the radius of the earth, the maximum height to which it will rise measured from the centre of the earth will be: (Neglect air resistance)
a) $\frac{1-K^2}{R}$ b) $\frac{R}{1-K^2}$ c) $R(1-K^2)$ d) $\frac{R}{1+K^2}$

51. The escape velocity on the surface of the earth is 11.2 km/s. If mass and radius of a planet is 4 and 2 times respectively than that of the earth, what is the escape velocity from the planet?
a) 11.2 km/sec   b) 1.112 km/sec   c) 15.8 Km/sec   d) 22.4 Km/sec

52. A satellite is revolving in a circular orbit at a height 'h' from the earth's surface (radius of earth R; h <
a) $\sqrt{2gR}$ b) $\sqrt{gR}$ c) $\sqrt{gR/2}$ d) $\sqrt{gR}(\sqrt{2}-1)$

53. A rod of length 3 m and its mass acting per unit length is directly proportional to distance x from its one end. The centre of gravity of the rod from that end will be at:
a) 1.5 m   b) 2 m   c) 2.5 m   d) 3.0 m

54. If a person with a spring balance and a body hanging from it goes up and up in an aeroplane, then the reading of the weight of the body as indicated by the spring balance will:
a) go on increasing   b) go on decreasing   c) first increase and then decrease
d) remain the same

55. The escape velocity for a rocket from Earth is 11.2 km/sec. Its value on a planet where acceleration due to gravity is double that on the Earth and diameter of the planet is twice that of Earth will be in km/sec:
a) 11.2 b) 5.6 c) 22.4 d) 53.6

56. If the earth stops rotating in its orbit about the sun, there will be variation in the weight of the bodies at:
a) equator b) latitude 60° c) poles d) no where

57. Which of the following statements is correct about satellites?
a)
A satellite cannot move in a stable orbit in a plane passing through the earth's centre
b) Geostationary satellites are launched in the equatorial plane
c)
We can use just one geostationary satellite for global communication around the globe
d) The speed of satellite increases with an increase in the radius of its orbit

58. (A) If an earth satellite moves to a lower orbit there is some dissipation of energy but the satellite speed increases.
(R) The speed of satellite is a constant quantity.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false.
d) If both assertion and reason are false
e) If assertion is false but reason is true.

59. The earth moves around the Sun in an elliptical orbit as shown in figure. The ratio OA/OB = x. The A ratio of the speed of the earth at B to that at A is nearly
a) $\sqrt{x}$ b) x c) $x\sqrt{x}$ d) x^2

60. A body of mass 'm ' is taken from the earth's surface to the height equal to twice the radius (R) of the earth. The change in potential energy of body will be___
a) 2/3 mgR b) 3 mgR c) 1/3 mgR d) mg2R

61. The time-period of a satellite of the earth is 5 hours. If the separation between the earth and the satellite is increased to 4 times the previous value, the new time period will become:

a) 10 hours b) 20 hours c) 40 hours d) 80 hours

62. If v_e is escape velocity and v_0 is orbital velocity of a satellite for orbit close to the earth's surface, then these are related by______

a) $v_0 = \sqrt{2v_e}$ b) $v_0 = v_e$ c) $v_e = \sqrt{2v_0}$ d) $v_e = \sqrt{2}v_0$

63. A rocket is fired vertically from the ground with resultant vertical acceleration of 10 m/sec^2. If the fuel is finished in one minute and it continues to move up, the maximum height reached by it is nearly:

a) 40 km b) 20 km c) 10 km d) 80 km

64. The acceleration due to gravity at a height 1 km above the earth is the same as at a depth d below the surface of earth. Then______

a) $d = \frac{1}{2}$ km b) $d = 1$ km c) $d = \frac{3}{2}$ km d) $d = 2$ km

65. (A) If a body is taken from earth to moon, its gravitational mass becomes one-sixth on moon.

(R) Gravitational mass depends upon acceleration due to gravity.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false.

d) If both assertion and reason are false

e) If assertion is false but reason is true.

66. (A) A person feels weightlessness in an artificial satellite of the earth. However a person on the moon (natural satellite) feels his weight.

(R) Satellite (natural or artificial) of a planet is a freely falling body.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

e) If assertion is false but reason is true.

67. The ratio of the radii of planets A and B is K_1 and ratio of acceleration due to gravity on them is K_2. The ratio of escape velocities from them will be:

a) K_1K_2 b) $\sqrt{K_1K_2}$ c) $\sqrt{\frac{K_1}{K_2}}$ d) $\sqrt{\frac{K_2}{K_1}}$

68. Assertion: The time period of revolution of a satellite close to surface of earth is smaller than that revolving away from surface of earth.

Reason: The square of time period of revolution of a satellite is directly proportional to cube of its orbital radius.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false

d) If both assertion and reason are false

69. A satellite of mass m orbits the earth at a height h above the surface of the earth. How much energy must be expended to rocket the satellite out of earth's gravitational influence?

(where M_E and R_E be mass and radius of the earth respectively)

a) $\frac{GM_Em}{4(R_E+h)}$ b) $\frac{GM_Em}{2(R_E+h)}$ c) $\frac{GM_Em}{(R_E+h)}$ d) $\frac{2GM_Em}{(R_E+h)}$

70. A planet is revolving around the sun in an elliptical orbit. Its closest distance from the sun is r_{min} the farthest distance from the sun is r_{max} If the orbital angular velocity of the planet when it is the nearest to the sun is ωω, then the orbital angular velocity at the point when it is at the farthest distance from the sun is:

a) $\sqrt{\frac{r_{min.}}{r_{max.}}}\omega$ b) $\sqrt{\frac{r_{mix.}}{r_{min.}}}\omega$ c) $\frac{r^2_{max.}}{r^2_{min.}}\omega$ d) $\frac{r^2_{min.}}{r^2_{max.}}\omega$

71. The period of the satellite of the earth orbiting very near to the surface of the earth is T_o. What is the period of the geostationary satellite in terms of T_o?

a) $\frac{T_0}{\sqrt{7}}$ b) $\sqrt{7}T_0$ c) $7T_0$ d) $7\sqrt{7}T_0$

72. A body weighs 200 N on the surface of the earth. How much will it weigh half way down to the centre of the earth?

a) 200 N b) 250 N c) 100 N d) 150 N

73. Six point masses each of mass m ate placed at the vertices of a regular hexagon of side l. The force acting on any of the masses is

a) $\frac{Gm^2}{l^2}\left[\frac{5}{4}+\frac{1}{\sqrt{3}}\right]$ b) $\frac{Gm^2}{l^2}\left[\frac{3}{4}+\frac{1}{\sqrt{3}}\right]$ c) $\frac{Gm^2}{l^2}\left[\frac{5}{4}-\frac{1}{\sqrt{3}}\right]$ d) $\frac{Gm^2}{l^2}\left[\frac{3}{4}-\frac{1}{\sqrt{3}}\right]$

74. The ratio of radii of earth to another planet is 2/3 and the ratio of their mean densities is 4/5. If an astronaut can jump to a maximum height of 1.5 m on the earth, with the same effort, the maximum height he can jump on the planet is
a) 1 m b) 0.8 m c) 0.5 m d) 1.25 m

75. The acceleration due to gravity on the planet A is 9 times the acceleration due to gravity on planet B. A man jumps to a height of 2 m on the surface of A. What is the height of jump by the same person on the planet B?
a) (2/3) m b) (2/9) m c) 18 m d) 6 m

76. The escape velocity from the earth is 11.2k/s. If a body is to be projected in a direction making an angle 45^o to the vertical, then the escape velocity is____
a) 11.2 x 2 km/s b) 11.2 km/s c) $\frac{11.2}{\sqrt{2}}$ km/s d) $11.2\sqrt{2}$ km/s

77. The distance ofthe geostationary satellite from the centre of the earth (radius R) is nearest to:
a) 5R b) 6R c) 7R d) 8R

78. Kepler's second law states that the straight line joining the planet to the sun sweeps out equal areas in equal times. This statement is equivalent to saying that:
a) total acceleration is zero b) tangential acceleration is zero
c) longitudinal acceleration is zero d) radial acceleration is zero

79. A satellite of mass m is orbiting the earth (of radius R) at a height h from its surface. The total energy of the satellite in terms of go, the value of acceleration due to gravity at the earth's surface is:
a) $-\frac{2mg_0R^2}{R+h}$ b) $\frac{mg_0R^2}{2(R+h)}$ c) $-\frac{mg_0R^2}{2(R+h)}$ d) $\frac{2mg_0R^2}{R+h}$

80. A body is projected vertically upwards from the surface of a planet of radius R with a velocity equal to half of the escape velocity for that planet. The maximum height attained by the body is directly proportional to
a) R/3 b) R/2 c) R/4 d) R/5

81. A satellite in force free space sweeps stationary interplanetary dust at a rate dM/dt=o.v where M is the mass and v is the velocity of the satellite and 0. is a constant. What is the deceleration of the satellite?
a) $-\alpha v^2$ b) $-\alpha v^2/2M$ c) $-\alpha v^2/M$ d) $-2\alpha v^2/M$

82. What will be the formula of the mass in terms of g, R and G ?(R - radius of the earth)______

a) $g^2\frac{R}{G}$ b) $G\frac{R^2}{8}$ c) $G\frac{R}{g}$ d) $g\frac{R^2}{G}$

83. If the mass of sun were ten times smaller and gravitational constant G were ten times larger in magnitudes, then which one of the following statements is incorrect?

a) Walking on ground would become more difficult

b) The acceleration due to gravity on earth will not change

c) Raindrops will fall much faster d) Airplanes will have to travel much faster

84. If the distance between the sun and the earth is 400 times the distance between the moon and the earth and gravitational pull of the sun on the earth is 170 times the gravitational pull of the earth on the moon, then the ratio of the mass of the sun to that of the moon is approximately equal to:

a) 2.7×10^7 b) 4.6×10^9 c) 6.8×10^4 d) 7.4×10^4

85. The mass of the moon is (118) of the earth but the gravitational pull is (116) of the earth. It is due to the fact that

a) moon is the satellite of the earth

b) the radius of the earth is (8/6) of the moon

c) the radius of the earth is $\left(\sqrt{8/6}\right)$ of the moon

d) the radius of the moon is (6/8) of the earth

86. Given that mass of the earth is M and its radius is R. A body is dropped from a height equal to the radius of the earth above the surface of the earth. When it reaches the ground its velocity will be:

a) $[\frac{GM}{R}]$ b) $[\frac{GM}{R}]^{1/2}$ c) $[\frac{2GM}{R}]^{1/2}$ d) $[\frac{2GM}{R}]$

87. The distance of saturn and neptune from the sun is nearly 10^{12} and 10^{13} m, respectively. Assuming they move in circular orbits, their time periods will be in the ratio:

a) 1000 : 1 b) 1 : 100 c) 10 : 1 d) $1 : 10\sqrt{10}$

88. The period of the moon's rotation around the earth is nearly 29 days. If the moon's mass were 2-fold, its present value and all other things remained unchanged, the period of the moon's rotation would be nearly:

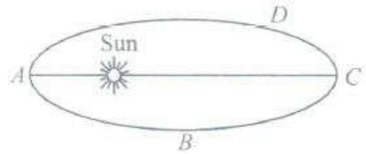
a) $29\sqrt{2}$ days b) $29/\sqrt{2}$ days c) 29 x 2 days d) 29/2 days

89. A space-ship moves from the earth to the moon and back. The greatest energy required for the space-ship is to overcome the difficulty in:

a) entering the earth's gravitational field b) take-off from the earth's field

c) take-off from lunar surface d) entering the moon's lunar surface

90. A planet revolves around the sun in an elliptical orbit. The linear speed of the planet will be maximum at



a) A b) B c) C d) D

91. What will be the escape velocity on some planet which is having radius four times that of the earth and gravitational acceleration equal to the earth?

a) Equal to escape velocity on the earth.

b) One-third of escape velocity on the earth.

c) Half of escape velocity on the earth.

d) Two times of escape velocity on the earth.

92. If v_e and v_p denotes the escape velocity from the Earth and another planet having twice the radius and the same mean density as the Earth, then:

a) $v_e = v_p$ b) ve = vp/2 c) $v_e = 2v_p$ d) ve = vp/4

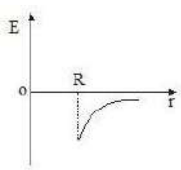
93. If v_e and v_o represent the escape velocity and orbital velocity of a satellite corresponding to a circular orbit of radius R, then:

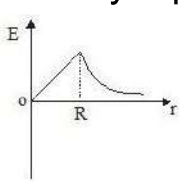
a) $v_e=v_o$ b) $\sqrt{2v_o} = v_o$ c) $v_e = v_o/\sqrt{2}$ d) v_e and v_o are not relate

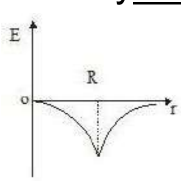
94. The escape velocity corresponding to a planet of mass M and radius R is 50 kmlsec. If the planet's mass and radius were 4M and R respectively, then the corresponding escape velocity would be:

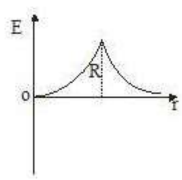
a) 100 km/sec b) 50 km/sec c) 200 km/sec d) 25 km/sec

95. Dependence of intensity of gravitational field (E) of earth with distance (r) from centre of earth is correctly represented by____

a) 

b) 

c) 

d) 

96. In the question number 25, if the mass placed at vertex A is doubled, then the force acting on the mass 2 m placed at the centroid O is :

a) zero b) $\frac{2Gm^2}{l^2}$ c) $\frac{5Gm^2}{l^2}$ d) $\frac{6Gm^2}{l^2}$

97. What should be the angular speed of the earth, so that bodies lying on equator may appear weightless? (R = 6400km,g=10ms^{-2})

a) 1.25×10^{-3} rad/sec b) 2.5×10^{-3} rad/sec c) 2.0×10^{-3} rad/sec

d) 3×10^{-3} rad/sec

98. The time interval between two successive noon when sun passes through zenith point (meridian) is known as

a) sidereal day b) mean solar day c) solar year d) lunar month

99. (A) The principle of superposition IS not valid for gravitational force.

(R) Gravitational force is a non-central force.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false.

d) If both assertion and reason are false

e) If assertion is false but reason is true.

100. In a gravitational field the work done in transporting mass from one point to another:

a) depends on the end positions b) depends on distance between them

c) depends on actual point of motion d) depends on velocity of transport

101. Which of the following is not true for stationary satellite of the earth?

a) Its time-period is 24 hrs

b) Its angular speed is equal to that of the earth about its own axis

c) It is stationary in space d) It revolves from west to east

102. The escape velocity of a body on the surface of the earth is 11.2 km/s. If the Earth's mass increases to twice its present value and the radius of the Earth becomes half, the escape velocity would become:

a) 5.6 km/s b) 11.2 km/s (remain unchanged) c) 22.4 km/s d) 44.8 km/s

103. A planct moving along an elliptical orbit is closest to the sun at a distance r_1 and farthest away at a distance of r_2. If v_1 and v_2 are the linear velocities at these respectively, then the ratio $\frac{v_1}{v_2}$ is_____

a) $(r_1/r_2)^2$ b) $r_2 r_1$ c) $(r_2/r_1)^2$ d) r_1/r_2

104. The acceleration due to gravity at the poles and the equator is g_p and g_e respectively. If the earth is a sphere of radius R_E and rotating about its axis with angular speed ω, then $g_p - g_e$ is given by

a) $\frac{\omega^2}{R_E}$ b) $\frac{\omega^2}{R_E^2}$ c) $\omega^2 R_E^2$ d) $\omega^2 R_E$

105. What is the ratio of gravitational mass and inertial mass?

a) 1 : g b) g : 1 c) 1 : 1 d) g : D

106. Four particles each of mass m are placed at the vertices of a square of side l. The potential energy of the system is

a) $-\frac{\sqrt{2Gm^2}}{l}\left(2-\frac{1}{\sqrt{2}}\right)$ b) $-\frac{2Gm^2}{l}\left(2+\frac{1}{\sqrt{2}}\right)$ c) $-\frac{\sqrt{2Gm^2}}{l}\left(\sqrt{2}-\frac{1}{\sqrt{2}}\right)$

d) $-\frac{2Gm^2}{l}\left(\sqrt{2}-\frac{1}{\sqrt{2}}\right)$

107. The tail of the Comet Halley is directed away from Sun due to the fact that:

a)
as the comet rotates around the Sun the lighter mass of the comet is pushed away due to centrifugal force only

b)
as the comet rotates, the lighter mass of the comet is attracted by some star situated in direction of the tail

c)
the radiation emitted by the Sun exerts a radiant pressure on the comet throwing its tail away from Sun

d) the tail of the comet always exists in the same orientation

108. The largest and the shortest di tances of the earth from the sun are r_1 and r_2. Its distance from the sun when it is at the perpendicular to the major axis of the orbit drawn from the sun, is:

a) $\frac{r_1+r_2}{4}$ b) $\frac{r_1 r_2}{r_1+r_2}$ c) $\frac{2r_1 r_2}{r_1+r_2}$ d) $\frac{r_1+r_2}{3}$

109. If a satellite of mass m is revolving around the earth with distance r from centre, then total energy is:

a) $-\frac{GMm}{r}$ b) $-\frac{2GMm}{r}$ c) $-\frac{GMm}{2r}$ d) $+\frac{GMm}{2r}$

110. At what height h above the earth, the value of g becomes g/2? (R = Radius of the earth)

a) 3 R b) $\sqrt{2}$R c) $(\sqrt{2}-1)$R d) $\frac{1}{\sqrt{2}}$R

111. (A)The acceleration due to gravity near the earth surface differs slightly from the $\frac{GM}{R^2}$ where M = mass of earth and R = radius of earth.

(R) The earth is not a uniform sphere and earth rotates about its axis.

a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false

d) If both assertion and reason are false.

e) If assertion is false but reason is true.

112. The escape speed from the earth is about 11 km/s. The escape speed from a planet, having twice the radius and the same mean density as the earth, is:

a) 22 Km/s b) 11 Km/s c) 5.5 Km/s d) 15.5 Km/s

113. The height of a geostationary satellite is

a) 1000km b) 32000km c) 36000km d) 850km

114. Assuming the radius of the Earth as R, the change in gravitational potential energy of a body of mass m. when it is taken from the Earth's surface to a height 3R above its surface, is :

a) 3mgR b) (3/4)mgR c) mgR d) 3/2mgR

115. The ratio of earth's orbital angular momentum (about the sun) to its mass is 4.4 x 10^{15} m^2/s. The area enclosed by earth's orbit approximately is (in m^2)

a) 6.94 x 10^{22} b) 6.94 x 10^{23} c) 7.94 x 10^{22} d) 7.94 x 10^{23}

116. A particle of mass M is situated at the centre of a spherical shell of same mass and radius a. The gravitational potential at a point situated at $\frac{a}{2}$ distance from the centre, will be_____

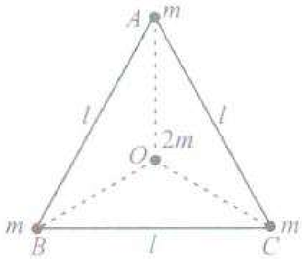
a) $-\frac{3GM}{a}$ b) $-\frac{2GM}{a}$ c) $-\frac{GM}{a}$ d) $-\frac{4GM}{a}$

117. The weight of an astronaut, In an artificial satellite revolving around the earth, is:

a) zero b) equal to that on the earth c) more than that on the earth

d) less than that on the earth

118. Three masses each of mass m are placed at the vertices of an equilateral triangle ABC of side l as shown in figure. The force acting on a mass 2m placed at the centroid O of the triangle is



a) Zero b) $\frac{3Gm^2}{l^2}$ c) $\frac{5Gm^2}{l^2}$ d) $\frac{6Gm^2}{l^2}$

119. A satellite orbiting the earth in a circular orbit of radius R completes one revolution in 3 h. If orbital radius of geostationary satellite is 36,000 km, orbital radius of the earth is:

a) 15000 Km b) 6000 Km c) 9000 Km d) 12000 Km

120. Two planets are at mean distances d_1 and d_2 from the sun and their periods are T_1 and T_2, respectively. Then:

a) $n_1^2 d_2^2 n_2^2 d_2^2$ b) $n_2^2 d_2^3 n_2^1 d_1^3$ c) $n_1 d_1^2 n_2 d_2^2$ d) $n_2^1 d_1 n_2^2 d_2$ e) $n_1 d_1 = n_2 d_2$

121. A body of mass m is taken from Earth surface to the height h equal to radius of Earth, the increase in potential energy will be:

a) mgR b) (1/2)mgR c) 2mgR d) (1/4) mgR

122. The time period (T) of an artificial satellite of the earth depends on the density (d)ofthe earth (assumed constant) as:

a) $T \propto d$ b) $T \propto \sqrt{d}$ c) $T \propto \frac{1}{\sqrt{d}}$ d) $T \propto \frac{1}{d}$

123. If the metal bob of a simple pendulum is replaced by a wooden bob, then its time period will:

a) increase b) decrease c) remain the same d) be first (a) then (b)

124. A body is projected up from the surface of the earth with a velocity equal to $\frac{3}{4}$ th of its escape velocity. If R be the radius of the earth, the height it reaches is:

a) $\frac{3R}{10}$ b) $\frac{9R}{7}$ c) $\frac{8R}{6}$ d) $\frac{9R}{5}$

125. The additional kinetic energy to be provided to a satellite of mass m revolving around a planet of mass M, to transfer it from a circular orbit of radius R_1 to another of radius $R_2 (R_2 > R_1)$ is

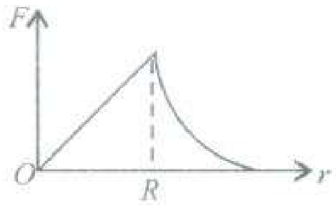
a) $GmM\left(\frac{1}{R_1^2} - \frac{1}{R_2^2}\right)$ b) $GmM\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ c) $2GmM\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ d) $\frac{1}{2}GmM\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

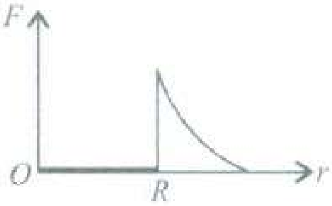
126. Two particles of equal mass go round a circle of radius R under the action of their mutual gravitational attraction. The speed of each particle is:

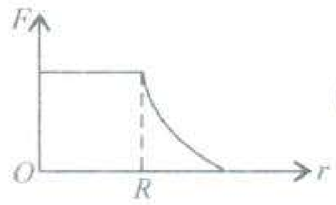
a) $v = \sqrt{GM/R}$ b) $v = \sqrt{GM/R}$ c) $v = \sqrt{GM/4R}$ d) $v = \sqrt{4GM/3R}$

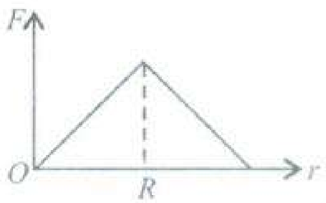
127. If a body describes a circular motion under inverse square field, the time taken to complete one revolution T is related to the radius of the circularm orbit as :
a) $T \propto r$ b) $T \propto r^2$ c) $T^2 \propto y^3$ d) $T \propto r^4$

128. Which one of the following plots represents the variation of gravitational field F on a particle with distance r due to a thin spherical shell of radius R? (r is measured from the centre of the spherical shell)

a) 

b) 

c) 

d) 

Ravi Maths Tuition Centre

Time : 1 Mins **PROPERTIES OF BULK MATTER 1** **Marks : 1423**

1. Water is flowing through two horizontal pipes of different diameters which are connected together. The diameters of the two pipes are 3 cm and 6 cm respectively. If the speed of water in narrower pipe is 4 m/sec and the pressure is 2.0 x 10^4 pascal, then the speed of water in the wider pipe is:
   a) 4 m/sec b) 2 m/sec c) 1 m/sec d) 16 m/sec
2. There is a hole in .the bottom of tank having water. If total pressure at bottom is 3 atm (1 atm = 10^5 N/m^2) then the velocity of water flowing from hole is:
   a) $\sqrt{400}$ m/s b) $\sqrt{600}$ m/s c) $\sqrt{60}$ m/s d) None of these
3. A vessel of water is placed on the floor of an elevator. How does the pressure at the bottom of the vessel change if the elevator moves up with uniform acceleration a?
   a) Increases by hpa b) Decreases by hpa c) No change in pressure
   d) None of these

4. A liquid is flowing through a tube of varying diameter. The rate (R) of flow ofliquid in any portion and the diameter (d) of the tube in that portion are related as:
   a) R ∝ d b) R ∝ $\frac{1}{d}$ c) R ∝ $\frac{1}{d^2}$ d) none of these
5. The adiabatic elasticity of a gas is equal to :
   a) γ X density b) γ X Volume c) γ X Pressure d) γX Specific heat
6. If a spring is extended to length 1, then according to Hook's law:
   a) F = kl b) F = k/l c) F = k2/l d) F = k^2/l
7. (A) The velocity increases, when water flowing in broader pipe enter a narrow pipe.
   (R) According to equation of continuity, product of area and velocity is constant.
   a)
   If both assertion and reason are true and reason is the correct explanation of assertion
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion
   c) If assertion is true but reason is false d) If both assertion and reason are false
   e) If assertion is false but reason is true
8. A tank is filled with water of density 1 g per cm^3 and oil of density 0.9 g per cm^3. The height of water layer is 100 em and of the oil layer is 400 cm. If g =980 cm/sec^2, then the velocity of efflux from an opening in the bottom of the tank is:

a) $\sqrt{900 \times 980}$ cm/sec b) $\sqrt{1000 \times 980}$ cm/sec c) $\sqrt{920 \times 980}$ cm/sec d) $\sqrt{950 \times 980}$ cm/sec

9. If there were no gravity, which of the following will not be there for a fluid?
   a) Viscosity b) Surface tension c) Pressure d) Archimedes' upward thrust

10. A metallic sphere floats in an immiscible mixture of water (pw = 10^3 kg/m^3) and a liquid (p_L = 13.5 x 10^3 kg/m^3 such that its (4/5)th portion is in water and (1/5)th portion in the liquid. The density of metal is:
    a) 1.9 x 10^3 kg/m^3 b) 4.5 x 10^3 kg/m^3 c) 4.0 x 10^3 kg/m^3 d) 3.5 x 10^3 kg/m^3

11. A vertical off shore structure is built to withstand a maximum stress of 10^9 Pa. What is the suitable pressure exerted by water column?
    [Take the depth of the ocean to be roughly 3 km and ignore ocean currents.]
    a) 4 x 10^4 Pa b) 2.94 x 10^7 Pa c) 2.0 x 10^6 Pa d) 3 x 10^5 Pa

12. Copper of fixed volume V is drawn into wire of length 1. When this wire is subjected to a constant force F, the extension produced in the wire is 111. Which of the following graphs is a straight line?
    a) Δl versus 1/l b) Δl versus l^2 c) Δl versus 1/l^2 d) Δl versus l

13. When a large bubble rises from the bottom of a lake to the surface, its radius doubles. The atmospheric pressure is equal to that of a column of water of height H. The depth of the lake is:
    a) H b) 2H c) 7H d) 8H

14. In order that a floating object be in a stable equilibrium, its centre of buoyancy should be:
    a) vertically above its centre of gravity b) vertically below its centre of gravity
    c) horizontally in line with its centre of gravity d) may be anywhere

15. (A) Cars and aeroplanes are streamlined.
    (R) Bernoulli's theorem hold for incompressible, non-viscous fluids.
    a)
    If both assertion and reason are true and reason is the correct explanation of assertion
    b)
    If both assertion and reason are true but reason is not the correct explanation of assertion
    c) If assertion is true but reason is false d) If both assertion and reason are false
    e) If assertion is false but reason is true

16. A bird resting on the floor of an airtight box which is being carried by a boy, starts flying. The boy will feel that the box is now:
    a) heavier b) lighter c) same in weight d) lighter in the beginning and heavier later

17. Two small spheres of radii rand 4r fall through a viscous liquid with the same terminal velocity. The ratio between the viscous forces acting on them is:
    a) 1:2 b) 4:1 c) 1:16 d) 1:4

18. The neck and bottom of a bottle are 3 em and 15 cm in radius respectively. If the cork is pressed with a force 12N in the neck of the bottle, then force exerted on the bottom of the bottle is:
a) 30 N b) 150 N c) 300 N d) 600 N

19. We have three beakers A, B and C containing glycerine, water and kerosene respectively. They are stirred vigorously and placed on a table. The liquid which comes to rest at the earliest is:
a) glycerine b) water c) kerosene d) all of them at the same time

20. A satellite revolves around the earth. Air pressure inside the satellite is maintained at 76 cm of mercury column. The height of the mercury column in the barometer tube of one metre length in the satellite is:
a) 76 cm b) 100 cm c) zero d) none of these

21. The product of the coefficient of viscosity and volume of liquid flowing through a tube of area of cross-section A and length l in time t is x. Then, the pressure difference P between the two ends of the tube is given by:
a) $\frac{8\pi xL}{A^2}$ b) $\frac{8\pi xL}{tA^2}$ c) $\frac{8\pi^2 xL}{tA^2}$ d) $\frac{8xL}{tA^2}$

22. Two helium filled balloons are floating next to each other at the ends of strings tied to a table. The facing surfaces of the balloons are separated by 1 to 2 cm. If you blow through the opening between the balloons, then:
a) they move away from each other b) they move towards each other
c) they are unaffected d) nothing can be said about their separation

23. A body of mass 120 kg and density 600 kg/m^3 floats in water. What additional mass could be added to the body, so that the body will just sink?
a) 20 kg b) 80 kg c) 100 kg d) 120 kg

24. A piece of ice having a stone frozen in it melts in a glass vessel filled with water. How will the level of water in vessel change when the ice melts?
a) The level will rise b) The level will not change c) The level will drop
d) Some water will flow out e) The vessel will break

25. The cylindrical tube of a spray pump has a cross-section of 6 cm^2, one of which has 50 holes each of diameter Imm. If the liquid flow inside the tube is 1.2 m per minute, then the speed of ejection of the liquid through the holes is :
a) 2.1 ms^{-1} b) 0.31 ms^{-1} c) 0.96 ms^{-1} d) 3.4 ms^{-1}

26. Ice pieces are floating in a beaker A containing water and also in a beaker B containing miscible liquid of specific gravity 1.2. When ice melts, the level of:
a) water increases in A b) water decreases in A c) liquid in B decreases
d) liquid in B increases e) water in A and liquid in B remains unaltered

27. A wide vessel with a small hole in the bottom is filled with water and kerosene. Neglecting viscosity, the velocity of water flow v if the thickness of water layer is h_1 and that of kerosene layer is h_2 is (density of water is ρ_1 g/cc and that of kerosene is ρ_2 gm/cc):

a) $\sqrt{2g(h_1+h_2)}$ b) $\sqrt{2g\left(h_1+h_2\frac{\rho_1}{\rho_2}\right)}$ c) $\sqrt{2g(h_1\rho_1+h_2\rho_2)}$ d) $\sqrt{2g\left(h_1\frac{\rho_1}{\rho_2}+h_2\right)}$

28. A square plate of 0.1 meter side moves parallel to a second plate with a velocity of 0.1 m/s, both plates being immersed in water. If the viscous force is 0.002 N and the coefficient of viscosity is 0.01 poise, distance between the plates (in metres) is
a) 0.1 b) 0.05 c) 0.005 d) 0.0005

29. A hemispherical bowl just floats without sinking in a liquid of density 1.2 x 10^3 kg/m^3. If outer diameter and the density of the bowl are 1 m and 2 x 10^4 kg/m^3 respectively, then the inner diameter of the bowl will be:
a) 0.94 m b) 0.97 m c) 0.98 m d) 0.99 m

30. A cube with an edge of 10 cm is immersed in a vessel containing water. A layer of liquid immiscible with water and having a density of 0.8 x 10^3 kg/m^3 is poured above water. The interface between the liquid is at the middle of the cube height. The mass of the cube is:
a) 0.060 kg b) 0.75 kg c) 0.90 kg d) 0.81 kg

31. A cylinder of height 20 m is completely filled with water. The velocity of efflux of water (in ms $^{-1}$) through a hole on the side wall of the cylinder near its bottom is:
a) 10 b) 20 c) 25.5 d) 5

32. Coefficient of linear expansion of brass and steel rods are α_1 and α_2 Lengths of brass and steel rods are l_1 and l_2 respectively. If (l_2- l_1) is maintained same at all temperatures, which one of the following relations holds good?
a) $\alpha_1 l_2$ b) $\alpha_1 l_2 = \alpha_2 l_2$ c) $\alpha_2 l_2 = \alpha_1 l_1$ d) $\alpha_1 l_1 = \alpha_2 l_2$

33. A cylinder is filled with a liquid of density d upto a height h. If the beaker is at rest, then the mean pressure on the wall is:
a) zero b) hdg c) $\frac{h}{2}$dg d) 2hdg

34. A black body at 200 K is found to emit maximum energy at a wavelength 14 urn, When its temperature is raised to 1000 K, then wavelength at which maximum energy emitted is :
a) 14 mm b) 7 μm c) 2.8 μm d) 28 mm

35. (A) The blood pressure in humans is greater at the feet that at the brain.
(R) Pressure of liquid at any point is proportional to height, density of liquid and acceleration due to gravity.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

36. Suppose the gas in the explosion chamber of a rocket ship is kept at density ρ and a pressure P_1 and that it exudes from the chamber into empty space through an opening of area at one end ofthe rocket, fmd the thrust produced on the rocket ship:
a) $2P_1a$ b) P_1a c) $\sqrt{2}P_1a$ d) $\sqrt{2P_1a}$

37. Two capillary tubes of same radius r but of lengths l_1 and l_2 are fitted in parallel to the bottom of a vessel. The pressure head is P. What should be the length of a single tube that can replace the two tubes so that the rate of flow is same as before?
a) l_1+l_2 b) $\frac{1}{l_1}+\frac{1}{l_2}$ c) $\frac{l_1l_2}{l_1+l_2}$ d) $\frac{1}{l_1+l_2}$

38. (A) With increase of temperature, the viscosity of gases increases.
(R) With increase of temperature, the transport of momentum between adjacent layers increases.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

39. A water barrel stands on a table of height h. If a small hole is punched in the side of the barrel at its base, it is found that the resultant stream of water strikes the ground at a horizontal distance R from the table. What is the depth of water in the barrel?
a) $\frac{R^2}{h}$ b) $\frac{R^2}{2h}$ c) $\frac{R^2}{4h}$ d) $\frac{4R^2}{h}$

40. When a steel ball is dropped in oil:
a) the ball attains constant velocity after some time b) the ball stops
c) the speed of ball will keep on increasing d) none of the above

41. Tanks A and B open at the top contain two different liquids upto a certain height in them. A hole is made in the wall of each tank at a depth h from the surface of the liquid. The area of the hole in A is twice that of in B. If the liquid mass flux through each hole is equal, then the ratio of densities of the liquids respectively is:
a) 2/1 b) 3/2 c) 2/3 d) 1/2

42. Suppose the Sun expands so that its radius becomes 100 times its present radius and its surface temperature becomes half of its present value. The total energy emitted by it, then will increase by a factor of:
a) 10^4 b) 625 c) 256 d) 16

43. (A) A gas filled balloon stops rising after it has attained a certain height in the sky.
(R) At the highest point in the sky, the density of air is such that the buoyant force on the balloon just equal its weight.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

44. The mass of a balloon with its contents is 1.5 kg. It is descending with an acceleration equal to half that of acceleration due to gravity. If it is to go up with the same acceleration keeping the volume same, its mass should be decreased by:
a) 1.2 kg b) 1 kg c) 0.75 kg d) 0.5 kg

45. In areas far removed from the tanks, the water does not rise to desired heights. This is because the pressure falls due to:
a) gravity b) density c) surface tension d) viscosity

46. A hole is made at the bottom of a tank filled with water (density = 10^3 kg/m^3). If the total pressure at the bottom of the tank is three atmosphere (1 atmosphere = 10^5 N/m^2), then the velocity of efflux is:
a) $\sqrt{400}$ m/s b) $\sqrt{200}$ m/s c) $\sqrt{600}$ m/s d) $\sqrt{500}$ m/s

47. A cylinder containing water stands on a table of height H. A small hole is punched in the side of cylinder at its base. The stream of water strikes the ground at a horizontal distance R from the table. Then, the depth of water in the cylinder is:
a) H b) R c) $\sqrt{(RH)}$ d) $R^2/4H$

48. Air is blown through a hole on a closed pipe containing liquid. Then, the pressure will:
a) increase on sides b) increase downwards c) increase in all directions
d) never increase

49. A ball floats on the surface of water in a container exposed to the atmosphere. Will the ball remain immersed at its former depth or will it sink or rise if the container is covered and the air is removed?
a) The ball sinks b) The ball rises c) The ball remains immersed at its former depth
d) It oscillates

50. A vessel of area of cross-section A has liquid to a height H. There is a hole at the bottom of vessel having area of cross-section a. The time taken to decrease the level from H_1 to H_2 will be:
a) $\frac{A}{2}\sqrt{\frac{2}{g}}[\sqrt{H_2}-\sqrt{H_2}]$ b) $\sqrt{2gh}$ c) $\sqrt{2gh(H_1-H_2)}$ d) $\frac{A}{a}\sqrt{\frac{2}{g}}[\sqrt{H_1}-\sqrt{H_2}]$

51. The isothermal elasticity of a gas is equal to :
a) Density b) Volume c) Pressure d) Specific heat

52. A wire is stretched by 0.01 m by a certain force F. Another wire of same material whose diameter and length are double to the original wire is stretched by the same force. Then its elongation will be:
a) 0.005 m b) 0.01 m c) 0.02 m d) 0.002 m

53. Of the following thermometers, the one which can be used for measuring a rapidly changing temperature is a
a) Thermocouple thermometer b) Gas thermometer
c) Maximum resistance thermometer d) Vapour pressure thermometer

54. A wind with speed 40 m/s blows parallel to the roof of a house. The area of the roof is 250 m^2. Assuming that the pressure inside the house is atmospheric pressure, the force exerted by the wind on the roof and the direction of the force will be : (ρ_{air} = 1.2kg/m^3)
a) 2.4 x 10^5N, upwards b) 2.4 x 105^N, downwards c) 4.8 x 10^5N, downwards
d) 4.8 x 10^5N, upwards

55. The centre of pressure on a vertical wall of height h immersed in a liquid is at a depth of____________ from the free surface of liquid.
a) $\frac{h}{2}$ b) $\frac{h}{3}$ c) $\frac{2h}{3}$ d) zero

56. An air bubble of radius 10^{-2} m is rising up at a steady rate of 2 x 10^{-3} mls through a liquid of density 1.5 x 10^3 kg/m^3, the coefficient of viscosity neglecting the density of air, will be: (Takeg= 10 m/s^2)
a) 23.2 units b) 83.5 units c) 334 units d) 167 units

57. (A) An ice cube is floating in water in a vessel at 0°c. When ice cube melts, level of water in the vessel remain same.
(R) Volume of melted ice is same as volume of water displaced by ice.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

58. Radius of one arm of hydraulic lift is four times of radius of other arm. What force should be applied on the narrow arm to lift 100 kg?
a) 26.5 N b) 62.5 N c) 6.25 N d) 8.3 N

59. Mercury is poured in a U-tube. Temperature of one side is 50°C and the level of mercury on this side is h_1. Temperature of the other side is 100 °C and the level of mercury on this side is h_2. Then:
a) $h_1 = h_2$ b) $h_1 < h_2$ c) $h_2 > h_1$ d) $h_2 = 2h_1$

60. (A) For a floating body to be in stable equilibrium, its centre of buoyancy must be located above the centre of gravity.

(R) The torque required by the weight of the body and the upthrust will restore body back to its normal position, after the body is disturbed.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

61. Water enters a house through a pipe with 2.0 cm inside diameter at an absolute pressure of 4 x 10^5 Pa. The pipe leading to the second floor bathroom 5m above is 1.0 em in diameter. When the flow velocity at the inlet pipe is 4 ms^{-1}, find the flow velocity and pressure in the bathroom in ms $^{-1}$ and Pa respectively.

a) 16, 2.3 x 10^5 b) 16, 3.2 x 10^5 c) 132, 2.3 x 10^5 d) 32, 3.2 x 10^5

62. (A) Fluids take the shape of container in which they poured.

(R) A fluid cannot sustain a force that is tangential to its surface

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

63. (A) The velocity off all of a man jumping with a parachute first increases and then becomes constant.

(R) The constant velocity off all of a man is called terminal velocity.

a)
If both assertion and reason are true and reason is the correct explanation of assertion

b)
If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

64. If the temperature of the Sun (black body) is doubled, the rate of energy received on earth will be increased by a factor of :

a) 2 b) 4 c) 8 d) 16

65. If x longitudinal strain is produced in a wire of Young's modulus y, then energy stored in the material of the wire per unit volume is :

a) yx^2 b) $2yx^2$ c) $\frac{1}{2}y^2x$ d) $\frac{1}{2}yx^2$

66. An iceberg is floating partly immersed in sea water, density of sea water is 1.03 g/cm^3 and that of ice is 0.92 g/cm^3. The fraction of the total volume of the iceberg above the level of sea water is:

a) 8.1% b) 11% c) 34% d) 0.8%

67. A body floats in water with one-third of its volume above the surface of water. If it is placed in oil, it floats with half of its volume above the surface of the oil. The specific gravity of the oil is:

a) $\frac{5}{3}$ b) $\frac{4}{3}$ c) $\frac{3}{2}$ d) 1 e) $\frac{3}{4}$

68. Three capillaries of length L, L/2 and L/3 are connected in series. Their radii are r, r/2 and r/3 respectively. Then, if stream-line flow is to be maintained and the pressure across the first capillary is P, then:

a) the pressure difference across the ends of second capillary is 8P

b) the pressure difference across the third capillary is 43P

c) the pressure difference across the ends of the second capillary is 16P

d) the pressure difference across the third capillary is 59P

69. A cylindrical, tank is filled with water to a level of 3 m. A hole is opened at a height of 52.5 cm from bottom. The ratio of the area of the hole to that of cross-sectional area of the cylinder is 0.1. Find the square of the velocity with which water is coming out: (g = 10m/sec^2)

a) 50 m^2/sec^2 b) 40 m^2/sec^2 c) 51.5 m^2/sec^2 d) 50.5 m^2/sec^2

70. The fraction of a floating object of volume V_o and density d_o above the surface of a liquid of density d will be:

a) $\frac{d_o}{d}$ b) $\frac{dd_o}{d+d_o}$ c) $\frac{d-d_o}{d}$ d) $\frac{dd_o}{d-d_o}$

71. A body weighs 50 g in air and 40 g in water. How much would it weigh in a liquid of specific gravity 1.5?

a) 30g b) 35g c) 65g d) 45g

72. With rise in temperature, density of a given body changes according to one of the following relations:

a) $p = p_0[1 + \gamma\, d\theta]$ b) $p = p_0[1 - \gamma\, d\theta]$ c) $p = p_0\gamma\, d\theta$ d) $p = p_0/\gamma\, d\theta$

73. A body radiates energy 5W at a temperature of 127°C. If the temperature is increased to 927 °C, then it radiates energy at the rate of:

a) 410 W b) 81 W c) 405 W d) 200 W

74. Water is flowing through a horizontal pipe of varying cross-section. If the pressure of water equals 2 cm of mercury, where the velocity of the flow is 32 cm s^{-1}. what is the pressure at another point, where the velocity of flow is 65 cm s^{-1}?

a) 1.02 cm of Hg b) 1.88 cm of Hg c) 2.42 cm of Hg d) 1.45 cm of Hg

75. (A) The shape of an automobile is so designed that its front resembles the streamline pattern of the fluid through which it moves.
(R) The resistance offered by the fluid is maximum.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

76. Two identical bodies are made of a material for which the heat capacity increases with temperature. One of these is at 100°C, while the other one is at O°C. If the two bodies are brought into contact, then, assuming no heat loss, the final common temperature is:
a) less than 50°C but greater than 0 °C b) O°C c) 50°C d) more than 50°C

77. When a venturimeter is used in an inclined position, it will show:
a) same reading b) more reading c) less reading d) depends on viscosity of liquid

78. A body floats with one third of its volume outside the water and $\frac{1}{4}$th of its volume outside another liquid. The density of the other liquid is :
a) 9.4 g cm^{-3} b) 4 g cm^{-3} c) $\frac{8}{3}$g cm^{-3} d) $\frac{3}{8}$g cm^{-3}

79. When a crown of mass 14.7 kg is submerged in water an accurate scale reads only 13.4 kg. The specific gravity of the material of the crown is :
a) 5.8 b) 8.6 c) 9.8 d) 11.3

80. (A) The buoyant force acts at the centre of buoyancy of the body. i.e., at the centre of mass of the fluid displaced.
(R) The buoyant force on a submerged rigid object can be considered to be acting at the centre of mass of the object.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

81. A body of uniform cross-sectional area floats in a liquid of density thrice its value. The portion of exposed height will be:
a) 2/3 b) 5/6 c) 1/6 d) 1/3

82. A cylindrical vessel is filled with a liquid of density ρ to a height h such that the force exerted by the liquid on the bottom is equal to the force exerted on the walls of the vessel. Then h should be:
a) equal to the radius b) more than the radius c) less than the radius
d) two times the radius

83. If the velocity of the fluid is the same at a given point at all times, then the flow is:
a) turbulent b) rapid c) viscous d) stream-lined

84. A body of volume 100 cc floats immersed completely in water contained in a jar. The mass of water and jar before immersion of the body was 700 g. After immersion mass of water and jar will be:
a) 500 g b) 700 g c) 100 g d) 800 g

85. A solid of relative density D is floating in a liquid of relative density d. If v be the volume of the solid submerged in the liquid and V be the total volume of the solid, then:
a) $vV = dD$ b) $\frac{V}{v} = \frac{D}{d}$ c) $\frac{v}{V} = \frac{D}{d}$ d) $DV = (1 + d)v$

86. Two solid spheres A and B made of the same material have radii r_A and r_B respectively. Both the sphere are cooled from the same temperature under the conditions valid for Newton's law of cooling. The ratio of the rate of change of temperature of A and B is:
a) r_A/r_B b) r_B/r_A c) r_{2A} / r_{2B} d) r_{2B}/r_{2A}

87. Which of the following statements is incorrect?
a) Blood is more viscous than water
b) The blood pressure in humans is greater at the feet than at the brain
c)
The angle of contact of mercury with glass is obtuse while that of water with glass is acute
d) A spinning cricket ball in air follows a parabolic trajectory

88. A tank containing water has an orifice in one vertical side. If the centre of orifice is 4.9 m below the surface level in the tank, the velocity of discharge is:
a) 4.9 metre/second b) 9.8 metre/second c) 2.45 metre/second d) zero

89. What is the velocity v of a metallic ball of radius r falling in a tank of liquid at the instant when its acceleration is one-half that of a freely falling body? (The densities of metal and of liquid are ρ and orespectively and the viscosity of the liquid is η)
a) $\frac{r^2g}{9\eta}(\rho - 2\sigma)$ b) $\frac{r^2g}{9\eta}(2\rho - \sigma)$ c) $\frac{r^2g}{9\eta}(\rho - \sigma)$ d) $\frac{2r^2g}{9\eta}(\rho - \sigma)$

90. A block of volume V and of density ab is placed in liquid of density $\sigma_l(\sigma_l > \sigma_b)$, then block is moved upward due to buoyant force upto a height h. The increase in potential energy is:
a) $\sigma_b = Vgh$ b) $(\sigma_b + \sigma_l)Vgh$ c) $(\sigma_b - \sigma_l)Vgh$ d) none of these

91. A large ship can float but a steel needle sinks because of:
a) viscosity b) surface tension c) density d) none of these

92. A piece of ice is floating in a jar containing water. When the ice melts, then the level of water:
a) rises b) falls c) remains unchanged
d) rises or falls depending upon the mass of ice

93. A solid sphere falls with a terminal velocity of 10 cm/sec in the earth's gravitational field. If it is allowed to fall in a region outside the gravitational field of the earth, the terminal velocity will be:
a) equal to 10 cm/sec b) more than 10 cm/sec c) less than 10 cm/sec d) zero

94. A cylindrical tank has a hole of 1cm^2 in its bottom. If the water is allowed to flow into the tank from a tube above it at the rate of 70 cm^3 /sec then the maximum height upto which water can rise in the tank is:
a) 2.5 cm b) 5 cm c) 10 cm d) 0.25 cm

95. A horizontal pipe line carries water in a stream-line flow. At a point along the pipe where cross-sectional area is 10 cm 2, the velocity of water is 1 m/s and pressure is 2000 Pa. The pressure of water at another point where cross-sectional area is 5 cm^2, is: (Density of water = 1000 kg/m^3)
a) 250 Pa b) 500 Pa c) 1000 Pa d) 2000 Pa

96. If a small sphere is let fall vertically in a large quantity of still liquid of density smaller than that of the material of the sphere:
a) at first its velocity increases, but soon approaches a constant value
b) it falls with a constant velocity all along from the very beginning
c) at first it falls with a constant velocity which after some time goes on decreasing
d) nothing can be said about its motion

97. (A) Roofs of buildings are blown off during a strong storm.
(R) Roofs of buildings becomes lighter during storm.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

98. (A) A dam for water reservoir is built thicker at bottom than at the top.
(R) Pressure of water is very large at the bottom.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

99. The pressure on a swimmer 20 m below the surface of water at sea level is :
(Take atmospheric pressure =1x 10^5 Pa)
a) 1.0 atm b) 2.0 atm c) 2.5 atm d) 3.0 atm

100. Two wires are made of the same material and have the same volume. The first wire has cross-sectional area A and the second wire has cross-sectional area 3A. If the length of the first wire is increased by Δlon applying a force F, how much force is needed to stretch the second wire by the same amount?
a) 9 F b) 6 F c) 4 F d) F

101. The fraction of a floating object of volume Vo and density ρo above the surface of liquid of density ρ will be :
a) $\frac{\rho_o}{\rho-\rho_o}$ b) $\frac{\rho-\rho_o}{\rho}$ c) $\frac{\rho_o}{\rho}$ d) $\frac{\rho_o\rho}{\rho+\rho_o}$

102. Two similar wires under the same load yield elongation of 0.1 nun and 0.05 nun respectively. If the area of cross-section of the first wire is 4 mm^2, then the area of cross-section of the second wire is:
a) 6 mm^2 b) 8 mm^2 c) 10 mm^2 d) 12 mm^2

103. A body of mass 2 kg is floating in water with half its volume submerged. What would be the force required to wholly submerge it into water?
a) 2 N b) 9.8 N c) 19.6 N d) 4.9 N

104. Water from a tap (at the end ofa horizontal pipe) emerges vertically downwards with an initial speed of 1.0 m s^{-1}. The cross-sectional area of the tap is 10^{-4} m^2. Assume that the pressure is constant throughout the stream of water and the flow is steady. The cross-sectional area ofthe stream 0.15 m below the tap is:
a) 5.0 x 10^{-4} m^2 b) 1.0 x 10^{-5} m^2 c) 5.0 x 10^{-5} m^2 d) 2.0 x 10^{-5} m^2

105. Construction of submarines is based on:
a) Archimedes' principle b) Bernoulli's theorem c) Pascal's law d) Newton's laws

106. A motor ship sails from the sea water to a river. To keep the same draught, a 90 tonne load is removed from the ship. Find the mass of the loaded ship before it has been unloaded: (The density of sea water is 1.03 x 10^3 kg/m^3)
a) 3090 tonne b) 4545 tonne c) 2222 tonne d) 1317 tonne

107. (A) Two identical spheres, one solid and the other hollow are immersed completely in water. The solid sphere will experience greater upthurst.
(R) The upthurst is directly proportional to mass of the body.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

108. A force of 6 x 10^6 Nm^{-2} is required for breaking a material. The density p of the material is 3 x 10^3 kg $m^{-3.}$ If the wire is to break under its own weight, the length of the wire made of that material should be (Taking g = 10 ms^{-2})
a) 20 m b) 200 m c) 100 m d) 2000 m

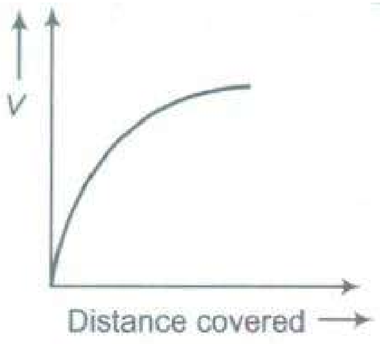
109. When a weight of 10 kg is suspended from a copper wire of length 3 m and diameter 0.4 mm, its length increases by 2.4 em. If the diameter of the wire is
doubled, then the extension in its length will be :
a) 7.6 cm b) 7.6 cm c) 1.2 cm d) 0.6 cm

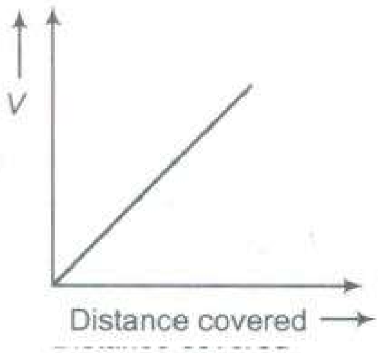
110. (A) Machine parts are jammed in winter.
(R) The viscosity of lubricant used in machine parts increases at low temperature.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

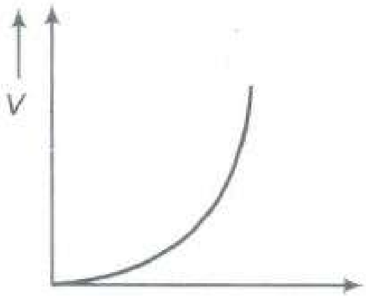
111. The heart of a man pumps 5 litres of blood through the arteries per minute at a pressure of 150 mm of mercury. If the density of mercury be 13.6 x 103 kg/m^3 and g = 10 m/sz then the power of heart in watt is:
a) 1.50 b) 1.70 c) 2.35 d) 3.0

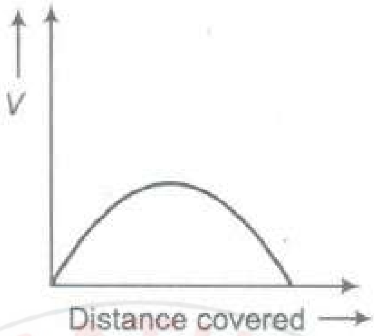
112. The pans of a physical balance are in equilibrium. Air is blown under the right hand pan; then the right hand pan will:
a) move up b) move down c) move erratically d) remain at the same level

113. A lead shot of 1 mm diameter falls through a long column of glycerine. The variation of its velocity v. with distance covered is represented by

a) 

b) 

c) 

d) 

114. (A) Upthurst on a solid block of iron when immersed in a lake will be less on the surface than on the bed of the lake.

(B) On the surface of the lake density of water will be less than that at the bed.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

115. Two solid spheres of same metal but of mass M and 8M fall simultaneously on a viscous liquid and their terminal velocities are v and nv, then value of n is:

a) 16 b) 8 c) 4 d) 2

116. Two equal drops are falling through air with a steady velocity of 5 cm/sec. If the drops coalesce, the new terminal velocity will be:

a) 5 x 2 cm/sec b) 5 x $\sqrt{2}$ cm/sec c) 5 x $(4)^{1/3}$ cm/sec d) $\frac{5}{\sqrt{2}}$ cm/sec

117. A boat carrying a number of large stones is floating in a water tank. What will happen to the water level if the stones are unloaded into water?

a) Rise b) Fall c) Remain unchanged

d) Rise till half the number of stones are unloaded and then begin to fall

118. A tank full of water has a small hole at its bottom. If one-fourth of the tank is emptied in t_1 second and the remaining three-fourth of the tank is emptied in t_2 second. Then, the ratio t_1/t_2 is:

a) $\sqrt{3}$ b) $\sqrt{2}$ c) $1/\sqrt{2}$ d) $1/\sqrt{3}$

119. (A) In the steady flow of an ideal fluid, the velocity at any point is same for different fluid particles.

(R) Steady fluid flow is an unaccelerated fluid flow.

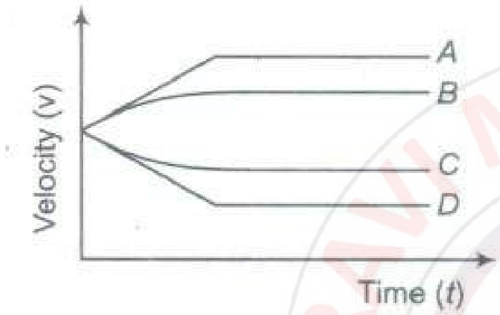
a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

120. A small spherical solid ball is dropped from a great height in a viscous liquid. Its journey in the liquid is best described in the diagram given below by the:



a) Curve A b) Curve B c) Curve C d) Curve

121. A steel ball is floating in a trough of mercury. If we fill the empty part of the trough with water, what will happen to the steel ball?

a) It will continue in its position b) It will move up c) It will move down

d) It will execute vertical oscillations

122. A solid body floating on water has one-fifth of its volume above the surface. It is allowed to float in a liquid of specific gravity 1.25; the fraction of the volume that will project will be:

a) $\frac{16}{25}$ b) $\frac{9}{25}$ c) $\frac{4}{5}$ d) $\frac{5}{4}$

123. The volume of the hollow portion of a sphere is $\frac{3}{4}$ of the external volume of the sphere. If it floats in a liquid of relative density $\frac{3}{2}$,half of its external volume immersed, the relative density of the material of the solid is:

a) 2 b) 3 c) 2.4 d) 1.8

124. The rate of steady volume of water through a capillary tube of length l and radius runder a pressure difference of P is V. This tube is connected with another tube of same length but half the radius in series. Then, the rate of steady volume flow through them is: (pressure difference across the combination is P)

a) V/16 b) V/17 c) 16V/17 d) 17V/16

125. A flat plate of area 10 cm^2 is separated from a large plate by a layer of glycerine I mm thick. If the coefficient of viscosity of glycerine is 20 poise, the force required to keep the plate moving with a velocity of I cm/sec is

a) 80 dyne b) 200 dyne c) 800 dyne d) 2000 dyne

126. (A) Specific gravity of a fluid is a dimensionless quantity.

(R) It is the ratio of density of fluid to the density of water.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

127. A thin square steel plate with each side equal to 10 cm is heated by a blacksmith. The rate radiated energy by the heated plate is 1134 W. The temperature of the hot steel plate is (Stefan's constant (σ = 5.67 x 10-8 W/m^2K^4, emissivity of the plate = 1)

a) 1000K b) 1189K c) 20000K d) 2378K

128. Stream-line flow is more likely for liquids with:

a) low density and low viscosity b) high viscosity and high density

c) high viscosity and low density d) low viscosity and high density

129. Air is streaming past a horizontal airplane wing such that its speed is 120 metre per sec over the upper surface and 90 metre per sec at the lower surface. If the density of air is 1.3 kg per $metre^3$ and the wing is 10 metre long and has an average width of 2 metre, then the difference ofthe pressure on the two sides of the wing is:

a) 4095.0 pascal b) 409.50 pascal c) 40.950 pascal d) 4.0950 pascal

130. The radiant energy from the sun incident normally at the surface of earth is 20 kcal/me min. What would have been the radiant energy incident normally on the earth, if the Sun had a temperature twice of the present one:

a) 160 $kcal/m^2$ min b) 40 $kcal/m^2$ min c) 320 $kcel/m^2$min d) 80 $kcal/m^2$min

131. A rectangular block of mass m and area of cross-section a, floats in a liquid of density σ. If it is given a small vertical displacement from equilibrium, it starts oscillating with frequency f, then:

a) $f \propto \frac{1}{\sigma}$ b) $f \propto \sigma$ c) $f \propto m$ d) $f \propto \sqrt{a}$

132. (A) Sudden fall of pressure at a place indicates storm.

(R) Air flows from higher pressure to lower pressure.

a)
If both assertion and reason are true and reason is the correct explanation of assertion

b)
If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

133. At what speed, the velocity head of water is equal to pressure head of 40 cm of Hg?
a) 10.3 m/s b) 2.8 m/s c) 5.6 m/s d) 8.4 m/s

134. A cubical box of wood of side 30 cm weighing 21.6 kg floats on water with two faces horizontal. The depth of immersion of box is:
a) 30 cm b) 12 cm c) 6 cm d) 24 cm

135. Blood is flowing at the rate of 200 cm^3 /sec in a capillary of cross-sectional area 0.5 m^2. The velocity of flow, (in mm/sec) is:
a) 0.1 b) 0.5 c) 0.3 d) 0.4 e) 0.5

136. A solid ball of volume v experiences a viscous force F when falling with a speed v in a liquid. If another ball of volume 8V with the same velocity v is allowed to fall in the same liquid it experiences a force:
a) F b) 16F c) 4F d) 8F e) 2F

137. Two spheres of volume 250 cc each but of relative densities 0.8 and 1.2 are connected by a string and the combination is immersed in a liquid. The tension in the string is: (g = 10 m/s^2)
a) 5.0 N b) 0.5 N c) 1.0 N d) 2.0 N

138. Eight drops of a liquid of density p and each of radius a are falling through air with a constant velocity 3.75 cms^{-1}. When the eight drops coalesce to form a single drop, the terminal velocity of the new drop will be:
a) 1.5×10^{-2} ms^{-1} b) 2.4×10^{-2} ms^{-1} c) 0.75×10^{-2} ms^{-1} d) 25×10^{-2} ms^{-1}

e) 15×10^{-2} ms^{-1}

139. An incompressible fluid flows steadily through a cylindrical pipe which has radius 2R at point A and radius R at point B further along the flow direction. If the velocity at point A is v, its velocity at point B will be:
a) 2v b) v c) v/2 d) 4v

140. Bernoulli's principle is not involved in the working or explanation of:
a) movement of spinning ball b) carburetor of automobile

c) blades of a kitchen mixer d) dynamic lift of an aeroplane

141. A spherical ball of radius R is falling in a viscous fluid of viscosity η with a velocity v. The retarding viscous force acting on the spherical ball is:

a) directly proportional to R but inversely proportional to v

b) directly proportional to both radius R and velocity v

c) inversely proportional to both radius R and velocity v

d) inversely proportional to R but directly proportional to velocity v

142. The density P of water of bulk modulus B at a depth y in the ocean is related to the density at surface P_0 by the relation:

a) $p = p_o[1 - \frac{p_0 gy}{B}]$ b) $p = p_o[1 + \frac{p_0 gy}{B}]$ c) $p = p_o[1 + \frac{B}{p_0 gy}]$ d) $p = p_o[1 - \frac{B}{p_0 gy}]$

143. Viscosity of gases is:

a) about hundred times less than those of liquids

b) about twenty times less than those of liquids

c) about five hundred times less than those of liquids

d) about ten hundred times less than those of liquids

144. Two metal spheres are falling through a liquid of density 2×10^3 kg/m^3 with the same uniform speed. The material density of sphere 1 and sphere 2 are 8×10^3 kg/m^3 and 11×10^3 kg/m^3 respectively. The ratio of their radii is:

a) $\frac{11}{8}$ b) $\sqrt{\frac{11}{8}}$ c) $\frac{3}{2}$ d) $\sqrt{\frac{3}{2}}$

145. (A) The rate of flow of a liquid through a capillary becomes non-linear when the pressure across capillary is increased.

(R) With increase of pressure, the bore of capillary increases.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

146. Once a submarine starts sinking, it will always sink to the bottom of the ocean if no other changes arc made. This is because during the descent of the submarine:

a) the buoyant force acting on it decreases

b) the hydrostatic pressure acting on it increases

c) the gravitational force acting on it increases d) the density remains constant

147. Aboat having a length of 5 m and breadth 1m is floating on a lake. If a man gets on to the boat, the boat sinks by 1 cm. The weight of the man is (Take g = 10m s^{-2}):

a) 50 kg b) 9 kg c) 35 kg d) 75 kg

148. Velocity of water in a river is :

a) Same everywhere b) More in the middle and less near its banks
c) Less in the middle and more near its banks
d) Increase from one bank to other bank

149. A hollow sphere of inner and outer diameter of 12 cm and 16 cm respectively floats half submerged in water. The specific gravity of the material of the sphere is :
a) 8.65 b) 6.85 c) 0.865 d) 0.685

150. A piece of ice is floating in a beaker containing water. When ice melts, the temperature falls from 20°C to 4°C and the level of water:
a) remains unchanged b) falls c) rises d) changes erratically

151. The height of a mercury barometer is 75 cm at sea level and 50 cm at the top of a hill. Ratio of density of mercury to that of air is 10^4. The height of the hill is:
a) 250 m b) 2.5 km c) 2.5 km d) 750 m

152. The gate of a canal is 8 m wide. The level of water on one side is 30 m and on the other side is 15 m. The resultant force on the gate is :
a) 270×10^5 N b) 270×10^6 N c) 540×10^5 N d) 540×10^6 N

153. A large open tank has two holes in its wall. One is a square hole of side a at a depth of x from the top and the other is a circular hole of radius r at depth 4x from the top. When the tank is completely filled with water, the quantities of water flowing out per second from both holes are the same. Then r is equal to:
a) aπa b) a c) $\frac{a}{2\pi}$ d) $\frac{a}{\pi}$ e) $\frac{a}{\sqrt{2\pi}}$

154. The average depth of Indian ocean is about 3000 m. The fractional compression, $\frac{\Delta V}{V}$ of water at the bottom of the ocean (given that the bulk modulus of the water $=2.2\times 10^9$ N m^{-2} and $g=10ms^{-2}$)is:
a) 0.82% b) 0.91% c) 1.36% d) 1.24% e) 1.52%

155. A liquid is allowed to flow into a tube of truncated cone shape. Identify the correct statement from the following:
a) the speed is high at the wider end and low at the narrow end
b) the speed is low at the wider end and high at the narrow end
c) the speed is same at both ends in a stream line flow
d) the liquid flows with uniform velocity in the tube

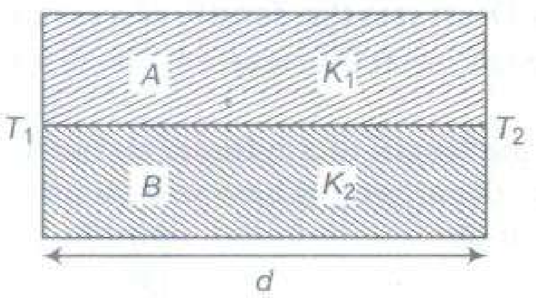
156. A manometer connected to a closed tap reads 4.5×10^5 Pa. When the tap is opened the reading of the manometer falls to 4×10^5 Pa. Then, the velocity of flow of water is:
a) 7 ms^{-1} b) 8 ms^{-1} c) 9 ms^{-1} d) 10 ms^{-1}

157. When a bimetallic strip is heated, it
a) Does not bend at all b) Gets twisted in the form of an helix
c) Bend in the form of an arc with the more expandable metal outside
d) Bends in the form of an arc with the more expandable metal inside

158. A U-tube containing a liquid is accelerated horizontally with a constant acceleration a. If the separation between the two vertical limbs is l, then the difference in the heights of the liquid in the two arms is:

a) zero b) l c) $\frac{la}{g}$ d) $\frac{lg}{a}$

159. Two rods A and B of different materials are welded together as shown in figure. Their thermal conductivities are Kl and K2• The thermal conductivity of the composite rod will be :



a) $3(K_1 + K_2)/2$ b) $K_l + K_2$ c) $2(K_l + K_2)$ d) $(K_1 + K_2)/2$

160. With increase in temperature the viscosity of:

a) both gases and liquids increases b) both gases and liquids decreases

c) gases increases and liquids decreases d) gases decreases and liquids increases

161. Two friends A and B are waiting for another friend for tea. A took the tea in a cup and mixed the cold milk and then waits. B took the tea in the cup and then mixed the cold milk when the friend comes. Then the tea will be hotter in the cup of :

a) A b) B c) tea will be equally hot in both cups d) friend's cup

162. A body of density D_1 and mass M is moving downward in glycerine of density D_2. What is the viscous force acting on it?

a) $Mg\left(1-\frac{D_2}{D_1}\right)$ b) $Mg\left(1-\frac{D_1}{D_2}\right)$ c) $Mg\left(1-\frac{D_1}{D_2}\right)$ d) $Mg\left(1-\frac{D_1}{D_2}\right)$

163. Two solid pieces, one of gold and the other of silver when immersed completely in water have equal weights. When weighed in air:

a) the gold piece will weigh more b) the silver piece will weigh more

c) they will have the same weight

d) both of them weigh less than they weighed in water

164. A sphere of mass M and radius R is dropped in a liquid, then terminal velocity of sphere is proportional to:

a) R b) 1/R c) R^2 d) $1/R^2$

165. (A) Two identical beakers contains water to the same level. A wooden block is floating in one of the beakers. The total weight of both-beakers is same.

(R) Volume of the displaced water is equal to the volume of block.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

166. A cube made of material having a density of 0.9 x 10^3 kg/m^3 floats between water and a liquid of density 0.7 x 10^3 kg/m^3, which is immiscible with water. What part of the cube is immersed in water?
a) $\frac{1}{3}$ b) $\frac{2}{3}$ c) $\frac{3}{4}$ d) $\frac{3}{7}$

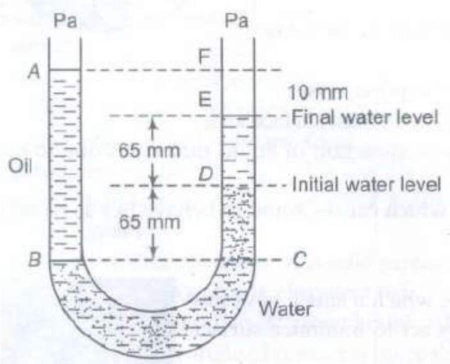
167. (A) Water flows faster than honey.
(R) The coefficient of viscosity of water is less than honey.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

168. Two solids A and B float in water. It is observed that A floats with half its volume immersed and B floats with 2/3 of its volume immersed. Compare the densities of A and B:
a) 4 : 3 b) 2 : 3 c) 3 : 4 d) 1 : 3

169. In rising from the bottom of a lake to the top, the temperature of an air bubble remains unchanged but its diameter gets doubled. If h is the barometric height (expressed in metres of mercury of relative density p) at the surface of the lake, the depth of the lake is:
a) 8phm b) 4phm c) 7phm d) 2phm

170. Consider the following equation of Bemoulli's theorem;
$p+\frac{1}{2}\rho v^2+\rho gh=K$ (constant)
The dimensions of K/p are same as that of which of the following?
a) Thrust b) Pressure c) Angle d) Viscosity

171. The viscosity of liquids is due to:
a) adhesive force b) cohesive force c) gravitational force d) diffusion

172. 

A U tube with both ends open to the atmosphere, is partially filled with water and oil, which is immiscible with water, is poured into one side until it stands at a distance of 10 mm above the water level on the other side. Meanwhile the water rises by 65 mm from its original level (see diagram). The density of the oil is

a) 650kgm-^{3} b) 425kg^{-3} c) 800kgm^{-3} d) 928kgm^{-3}

173. Which one of the following would a hydrogen balloon find easiest to lift?

a) 1 kg of steel b) 1 kg of water c) 1 kg of lightly packed feathers

d) All of the above are same

174. Planet having average surface temperature To at an average distance d from the sun. Assuming that the planet receives radiant energy from th sun only and it loses radiant energy only from the surface and neglecting all other atmospheric effects we conclude:

a) $T_o \propto d^2$ b) $T_o \propto a^2$ c) $T_o \propto d^{1/2}$ d) $T_o \propto d^{-1/2}$

175. The light machine oil used for lubrication is about:

a) one hundred times more viscous than water b) ten times more viscous than water

c) one thousand times more viscous than water d) ten times less viscous than water

176. A metal ball immersed in alcohol weighs W_1 at 0°C and W_2 at 50^0 C. The coefficient of cubical expansion of the metal is less than that of alcohol. Assuming that the density of the metal is large compared to that of alcohol, it can be shown that:

a) $w_1 = w_2$ b) $w_1 > w_2$ c) $w_1 < w_2$ d) none of these

177. If the length of a cylinder on heating increases by 2%, the area of its base will increase by:

a) 0.5% b) 2% c) 1% d) 4%

178. A silver ingot weighing 2.1 kg is held by a string so as to be completely immersed in a liquid of relative density 0.8. The relative density of silver is 10.5. The tension in the string (in kg-wt) is:

a) 1.6 b) 1.94 c) 3.1 d) 5.25

179. The working of venturimeter is based on:

a) Torricelli's law b) Pascal's law c) Bernoulli's theorem d) Archimedes' principle

e) Stokes' law

180. The bulk modulus of a spherical object is 'B'. If it is subjected to uniform pressure 'p', the fractional decrease in radius is :

a) B/3p b) 3p/B c) p/3B d) p/B

181. (A) A hydrogen filled balloon stops rising after it has attained a certain height in the sky.
(R) The atmosphere pressure decreases with height and becomes zero when maximum height is attained by hydrogen balloon.
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

182. There is a hole of area A at the bottom of cylindrical vessel.Water is filled upto a height h and water flows out in t second. If water is filled to a height 4h, it will flow out in time equal to:
a) t b) 4t c) 2t d) t/4

183. A wooden sphere is taken deep inside a long column of water and released. It will move up with a:
a) uniform acceleration b) uniform retardation c) uniform velocity finally
d) non-uniform velocity finally

184. On which of the following, the terminal velocity of a solid ball in a viscous liquid is independent?
a) Area of cross-section b) Height of liquid c) Density of the ball
d) Density of the liquid

185. A body floats with one-third of its volume outside water and 3/4th of its volume outside another liquid. The density of another liquid is:
a) $\frac{9}{4}g/cc$ b) $\frac{4}{9}g/cc$ c) $\frac{8}{3}g/cc$ d) $\frac{3}{8}g/cc$

186. The value of coefficient of viscosity, in comparison to coefficient of friction, is:
a) very large b) very small c) nearly same d) eight to ten times more

187. The profile of advancing liquid in a tube is a:
a) straight line b) circle c) parabola d) hyperbola

188. A steadily flowing liquid enters a wide tube and continues to flow steadily. What will be nature of flow in the widened part of the tube?
a) Crowded b) Widened c) Will remain same as before
d) May be crowded or widened

189. Two substances of densities P_1 and P_2 are mixed in equal volume and the relative density of mixture is 4. When they are mixed in equal masses, the relative density of the mixture is 3. The values of P_1 and P_2 are:
a) $P_1 = 6$ and $P_2 = 2$ b) $P_1 = 3$ and $P_2 = 5$ c) $P_1 = 12$ and $P_2 = 4$ d) none of these

190. A body is raised through a height h in water. If the density of body is p and that of water is σσ and p > σ, the volume of the body is V; then the change in potential energy of the body is given as:
a) the potential energy remains unchanged b) the potential energy increases by hVpg
c) the potential energy increases by hV(p + σ)g
d) the potential energy increases by hV(p - σ)g

191. A gale blows over a house. The force due to the gale on the roof is:
a) in the downward direction b) in the upward direction c) in the horizontal direction
d) zero

192. A concrete sphere of radius R has a cavity of radius r which is packed with sawdust. The specific gravities of concrete and sawdust are respectively 2.4 and 0.3 for this sphere to flow with its entire volume submerged under water. Ratio of mass of concrete to mass of sawdust will be:
a) 8 b) 4 c) 3 d) zero

193. (A) A man is sitting in a boat which is floating on a pond. If the man drink some water from the pond, the level of the water in the pond decreases.
(R) According to Archimedes' principle, the weight of liquid displaced by body is equal to weight of the body
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

194. (A) Falling raindrops acquire a terminal velocity.
(R) A constant force in the direction of motion and a velocity dependent force opposite to the direction of motion, always result in the acquisition of terminal velocity.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

195. The terminal velocity u of a small steel ball of radius r falling under gravity through a column of viscous liquid of coefficient of viscosity II depends on mass of the ball m, acceleration due to gravity g, coefficient of viscosity IIand radius r. Which of the following relations is dimensionally correct?

a) $v \propto \frac{mgr}{\eta}$ b) $v \propto mg\eta r$ c) $v \propto \frac{mg}{r\eta}$ d) $v \propto \frac{\eta mg}{r}$

196. Water flows steadily through a horizontal pipe of variable cross-section. If the pressure of water is P at a point where flow speed is v, the pressure at another point where the flow speed is 2v, is: (Take density of water as ρ)

a) $P-\frac{3\rho v^2}{2}$ b) $P-\frac{\rho v^2}{2}$ c) $P-\frac{3\rho v^2}{4}$ d) $P-\rho v^2$

197. The force acting on a window of area 50 cm x 50 cm of a submarine at a depth of 2000 m in an ocean, the interior of which is maintained at sea level atmospheric pressure, is : [Density of sea water = 10^3 kg m^{-3}, g = 10m s^{-2}]

a) 5×10^5 N b) 25×10^5 N c) 5×10^6 N d) 25×10^6 N

198. We have two narrow capillary tubes T_1 and T_2. Their lengths are l_1, l_2 and radii of cross-sections are r_1, r_2 respectively. The rate of flow of water through T_1 is 8 cm^3 s^{-1} when the pressure difference across its ends is P. What will be the rate of flow of water through T_2, under the same pressure difference, given that $l_1 = l_2$ and $r_1 = 2r_2$?

a) 8 cm^3s^{-1} b) 4 cm^3s^{-1} c) 2 cm^3s^{-1} d) 0.5 cm^3s^{-1}

199. The viscosity of an ideal liquid is:

a) 1 b) 0.5 c) zero d) infinite

200. (A) A piece of ice floats in water. The level of water remains unchanged when the ice melts completely.

(R) According to Archimedes' principle, the loss in weight of the body in the liquid is equal to the weight of the liquid displaced by the immersed part of the body.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

201. The energy emitted per second by a black body at 27°C is 10 J. If the temperature of the black body is increased to 327°C, the energy emitted per second will be:

a) 20 J b) 40 J c) 80 J d) 160 J

202. A U-tube is partially filled with water. Oil which does not mix with water is next poured into one side, until water rises by 25 cm on the other side. If the density of oil is 0.8, the oil level will stand higher than the water level by:

a) 6.25 cm b) 12.50 cm c) 31.75 cm d) 62.50 cm

203. (A) Aeroplanes are made to run on the runway before take off, so that they acquire the necessary lift.

(R) This is as per Bernoulli's theorem, as velocity increases, pressure decreases and vice-versa.

a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

204. The cylinder is placed in a lift which is moving upwards with an acceleration a, then the pressure on the bottom is:
a) hdg b) $\frac{1}{2}$ hdg c) hd(g + a) d) hd(g -a)

205. A wooden cube just floats inside water, when a 200 g mass is placed on it. When the mass is removed the cube is 2 cm above the water level. The size of the cube is:
a) 5 cm b) 10 cm c) 15 cm d) 20 cm

206. A solid sphere falls with a terminal velocity of 10 cm/sec in air. If it is allowed to fall in vacuum, the terminal velocity will:
a) be equal to 10 cm/sec b) be less than 10 cm/sec c) be more than 10 cm/sec
d) never be attained

207. A solid sphere of volume V and density P floats at the interface of two immiscible liquids of densities ρ_1 and ρ_2 respectively. If $\rho_1 < \rho < \rho_2$, then the ratio of volume of the parts of the sphere in upper and lower liquid is:
a) $\frac{\rho-\rho_1}{\rho_2-\rho}$ b) $\frac{\rho_2-\rho}{\rho-\rho_1}$ c) $\frac{\rho+\rho_1}{\rho+\rho_2}$ d) $\frac{\rho+\rho_2}{\rho+\rho_1}$ e) $\frac{\sqrt{\rho_1\rho_2}}{\rho}$

208. When water flows at a rate Q through a tube of radius r placed horizontally, a pressure difference pdevelops across the ends ofthe tube. If the radius of the tube is doubled and the rate offlow halved, the pressure difference will be:
a) 8p b) p c) p/8 d) p/32

209. Water contained in a tank flows through an orifice of diameter 2 cm, under a constant pressure difference of 10 cm of water column. The rate of flow of water through the orifice is:
a) 44 cc/sec b) 4.4 cc/sec c) 440 cc/sec d) 4400 cc/sec

210. Two tubes A and B are in series. Radius of A is R and that of B is 2R. If water flows through A with velocity v then velocity of water through B is:
a) v/2 b) v c) v/4 d) v/8

211. The Young's modulus of brass and steel are respectively 1.0 x 10^{11} Nm^{-2} and 2.0 x 1011 Nm^{-2}. A brass wire and a steel wire of the same length are extended by 1 mm each under the same force. If radii of brass and steel wires are RB and Rs respectively, then:
a) $R_S = \sqrt{2R_B}$ b) $R_S = R_B/\sqrt{2}$ c) Rs = $4R_B$ d) Rs = $R_B/2$

212. A small sphere of radius r falls from rest in a viscous liquid. As a result, heat is produced due to viscous force. The rate of production of heat when the sphere attains its terminal velocity, is proportional to

a) r^5 b) r^2 c) r^3 d) r^4

213. A rectangular vessel when full of water takes 10 minutes to be emptied through an orifice in its bottom. How much time will it take to be emptied when half filled with water?

a) 9 minute b) 7 minute c) 5 minute d) 3 minute

214. The speeds of air-flow on the upper and lower surfaces of a wing of an aeroplane are v_1 and v_2 respectively. If A is the cross-sectional area of the wing and 'ρ' is the density of air, then the upward lift is:

a) $\frac{1}{2}\rho A(v_1-v_2)$ b) $\frac{1}{2}\rho A(v_1+v_2)$ c) $\frac{1}{2}\rho A\left(v_1^2-v_2^2\right)$ d) $\frac{1}{2}\rho A\left(v_1^2+v_2^2\right)$

215. The aerofils are so designed that the speed of air:

a) on top side is more than on lower side b) on top side is less than on lower side

c) is same on both sides d) is turbulent

216. A stream-lined body falls through air from a height h on the surface of a liquid. Let d and D denote the densities of the materials of the body and the liquid respectively. If D > d, then the time after which the body will be instantaneously at rest, is:

a) $\sqrt{\frac{2h}{g}}$ b) $\sqrt{\frac{2h}{g}\frac{D}{d}}$ c) $\sqrt{\frac{2h}{g}\frac{d}{D}}$ d) $\sqrt{\frac{2h}{g}}(\frac{d}{D-d})$

217. A dam for water reservoir is built thicker at the bottom than at the top because:

a) pressure of water is very large at the bottom due to its large depth

b) water is likely to have more density at the bottom due to its large depth

c) quantity of water at the bottom is large d) none of the above

218. Terminal velocity depends on radius of drop rand viscosity η according to:

a) $v_T \propto r\eta$ b) $vT \propto r^2\eta$ c) $v_T \propto \frac{\eta}{r^2}$ d) $v_T \propto \frac{r^2}{\eta}$

219. Find the lifting force of a 4 kg cork lifebelt in sea water, if the densities of cork and sea water are 0.2×10^3 kg/m^3 and 1.03×10^3 kg/m^3 respectively:

a) 163 N b) 273 N c) 119 N d) 289 N

220. The time period of a simple pendulum is T. The relative density of the bob is σ. The bob is put in water and allowed to oscillate. Assuming there is no friction due to viscosity, etc., what will be the time period of the pendulum?

a) $T(\sigma-1)$ b) $T(\sigma-1)^{1/2}$ c) $T/(\sigma-1)$ d) $T/(\sigma-1)^{1/2}$

221. A wooden block is taken to the bottom of a deep, calm lake of water and then released. It rises up with a:

a) constant acceleration b) decreasing acceleration c) constant velocity

d) decreasing velocity

222. A wooden block is floating in a liquid. 50% of its volume is inside the liquid when the vessel is stationary. Percentage of volume immersed when the vessel moves upwards with an acceleration a = g/2 is:
a) 75% b) 25% c) 50% d) 33.33%

223. The viscosity of gases is due to:
a) adhesive force b) cohesive force c) gravitational force d) diffusion

224. Two capillaries of length L and 2L and of radii R and 2R are connected in series. The net rate of flow of fluid through them will be: (given rate of the flow through single capillary $X=\pi PR^4/8\eta L$)
a) 8/9 X b) 9/8 X c) 5/7 X d) 7/5 X

225. Pressure is a scalar quantity because:
a) it is the ratio of force to area and both force and area are vectors
b) it is the ratio of the magnitudes of the force to area
c) it is the ratio of the component of the force normal to the area and area itself
d) it depends on the size of the area chosen

226. A metallic sphere with an internal cavity weighs 40 g-wt in air and 20 g-wt in water. If the density of the material with cavity be 8 g per cm^3, then the volume of cavity is:
a) zero b) 15 cm^3 c) 5 cm^3 d) 20 cm^3

227. Water rises to height 'h' in capillary tube. If the length of capillary tube above the surface of water is made less than' h', then:
a) water does not rise at all.
b) water rises upto the tip of capillary tube and then starts overflowing like a fountation
c) water rises upto the top of capillary tube and stays there without overflowing
d) water rises upto a point a little below the top and stays there

228. In a laminar flow the velocity of the liquid in contact with the walls of the tube is:
a) zero b) maximum c) in between zero and maximum d) equal to critical velocity

229. A block of aluminum of mass 1kg and volume 3.6×10^{-4} m^3 is suspended from a string and then completely immersed in a container of water. The decrease in tension in the string after immersion is:
a) 9.8 N b) 6.2 N c) 3.6 N d) 1.0 N

230. When a certain weight is suspended from a long uniform wire, its length increases by one em. If the same weight is suspended from another wire of the same material and length but having a diameter half of the first one then the increase in length will be :
a) 0.5 cm b) 2 cm c) 4 cm d) 8 cm

231. We have two different liquids A and B whose relative densities are 0.75 and 1.0 respectively. If we dip solid objects P and Q having relative densities 0.6 and 0.9 in these liquids, then:
a) P floats in A and Q sinks in B b) P sinks in A and Q floats in B
c) P floats in B and Q sinks in A d) P sinks in B and Q floats in A

232. Mercury thermometers can be used to measure temperatures upto

a) 100°C b) 212°C c) 360°C d) 500°C

233. If there were a smaller gravitational effect, which of the following forces do you think would alter in some respect?

a) Viscous forces b) Archimedes' uplift c) Electrostatic forces d) Nuclear forces

234. Three liquids of densities Pl' Pz and P3 (with Pl>PZ>P3)' having the same value of surface tension Trise to the same height in three identical capillaries. The angles of contact 91, 92 and 93 obey:

a) $\pi/2 > \theta_1 > \theta_2 > \theta_3 \geq 0$ b) $0 < \theta_1 < \theta_2 < \theta_3 < \pi/2$ c) $\pi/2 < \theta_1 < \theta_2 < \theta_3 < \pi/2$

d) $\pi > \theta_1 > \theta_2 > \theta_3 < \pi/2$

235. A layer of glycerine of thickness 1mm is present between a large surface area and a surface area of $0.1 m^2$. With what force the small surface is to be pulled, so that it can move with a velocity of 1 m/s? (Given that coefficient of viscosity =0.07 kg-$m^{-1}s^{-1}$)

a) 70 N b) 7 N c) 700 N d) 0.70 N

236. In a beaker, there is a hole at the bottom and a hole of same area is at the top and water starts flowing through it with velocity v, then:

a) water level will oscillate about a height of $v^2/2g$

b) water level will rise till a height of $v^2/2g$ is reached and remains constant

c) no water will remain in the beaker d) none of the above

237. (A) The velocity of flow of a liquid is smaller when pressure is larger and vice-versa.

(R) According to Bernoulli's theorem, for the stream- line flow of an ideal fluid, the total energy per unit mass remains constant.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

238. The terminal velocity of a sphere moving through a viscous medium is:

a) directly proportional to the radius of the sphere

b) inversely proportional to the radius of the sphere

c) directly proportional to the square of the radius of sphere

d) inversely proportional to the square of the radius of sphere

239. A block of wood weighs 4N in air and 3N when immersed in a liquid. The buoyant force (in newton) is:

a) zero b) 1 c) 3/4 d) 4/3

240. (A) Weight of a empty balloon measured in air is W_1. If air at atmospheric pressure is filled inside balloon and again weight of the balloon is measured. Weight of balloon in second case is equal to W_1.
(R) Upthurst is equal to weight of the fluid displaced by the body.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

241. Two bodies are in equilibrium when suspended in water from the arms of a balance. The mass of one body is 36 g and its density is 9 g/cc. If the mass of the other is 48 g, its density (in g/cc) is:
a) $\frac{4}{3}$ b) $\frac{3}{2}$ c) 3 d) 5

242. (A) The shape of an automobile is so designed that its front resembles the stream line pattern of the fluid through which it moves.
(R) The shape of the automobile is made stream lined in order to reduce resistance offered by the fluid.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

243. The amount of radiation emitted by a perfectly black body is proportional to
a) Temperature on ideal gas scale b) Fourth root of temperature on ideal gas scale
c) Fourth power of temperature on ideal gas scale
d) Source of temperature on ideal gas scale

244. A balloon of volume 1500 m^3 and weighing 1650 kg with all its equipment is filled with helium (density 0.2 kg/m^3). If the density of air is 1.3 kg/m^3, the pull on the rope tied to the balloon will be:
a) zero b) 300 kg c) 16.5 kg d) 1950 kg

245. (A) A parachute descends slowly whereas a stone dropped from same height falls rapidly.
(R) The viscous force of air on parachute is larger than that of on a falling stone.

a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

246. A common hydrometer reads specific gravity of liquids. Compared to the 1.6 mark of the stem the mark 1.5 will be:
a) upwards b) downwards c) in the same place
d) may be upward or downward depending upon the hydrometer

247. A large tank filled with water to a height of h is said to be emptied through a small hole at the bottom. The ratio of time taken for the level of water to fall down from h to h/2 and from h/2 to zero is:
a) $\sqrt{2}$ b) $1/\sqrt{2}$ c) $\sqrt{2}$-1 d) $\frac{1}{\sqrt{2}-1}$

248. An open vessel containing water is given a constant acceleration a in the horizontal direction. Then, the free surface of water gets sloped with the horizontal at an angle θ given by:
a) $\theta = tan^{-1}(\frac{a}{g})$ b) $\theta = tan^{-1}(\frac{g}{a})$ c) $\theta = sin^{-1}(\frac{a}{g})$ d) $\theta = cos^{-1}(\frac{g}{a})$

249. An areoplane of mass 3 x 10^4 kg and total wing area of 120 m^2 is in a level flight at some height. The difference in pressure between the upper and lower surface of its wings, (in kilo pascals) is:
a) 2.5 b) 5.0 c) 10.0 d) 12.5

250. The velocity of a small ball of mass M and density d_1 when dropped in a container filled with glycerine becomes constant after some time. If the density of glycerine is d_2, the viscous force acting on the ball is:

a) $Mg\left(1-\frac{d_2}{d_1}\right)$ b) $Mg\frac{d_1}{d_2}$ c) $Mg(d_1-d_2)$ d) Mgd_1d_2

251. A sample of metal weighs 210 g in air, 180 g in water and 120 g in an unknown liquid. Then:
a) the density of metal is 3 g/cm^3 b) the density of the metal is 7 g/cm^3
c) the density of metal is 4 times the density of unknown liquid
d) the metal will float on water

252. In making an alloy, a substance of specific gravity S_1 and mass m_1 is mixed with another substance of specific gravity S_2 and mass m_2 ;then the specific gravity of the alloy is:
a) $(\frac{m_1+m_2}{s_1+s_2})$ b) $(\frac{s_1s_2}{m_1+m_2})$ c) $[\frac{m_1+m_2}{(m_1s_1+m_2/s_2)}]$ d) $[\frac{(m_1s_1+m_2/s_2)}{m_1+m_2}]$

253. A spherical body falling through a viscous liquid of infinite extent ultimately attains a constant value, when:

a) upthrust + weight = viscous drag b) weight + viscous drag = upthrust

c) viscous drag + upthrust = weight d) viscous drag + upthrust > weight

254. The largest average velocity of blood flow in an artery of radius 2 x 10^{-3} m (if the flow must remain laminar) is (Take viscosity of blood to be 2.084 x 10^{-3} Pa-s and ρ_{blood} = 1.06 x 10^3 kgm^{-3}). What is the corresponding flow rate?

a) 2.12 ms^{-1}, 1.23 x 105 m^{3}s^{-1} b) 0.98 ms^{-1}, 1.23 x 10^5 m^{3}s^{-1}

c) 1.72 ms^{-1}, 0.23 x 10^5 m^{3}s^{-1} d) 0.62 ms^{-1}, 0.23 x 10^5 m^{3}s^{-1}

255. The Young's modulus of steel is twice that of brass. Two wires of the same length and same area of cross section, one of steel and another of brass, are suspended from the same roof. If we want the lower ends of the wires to be at the same level, then the weights added to the steel and brass wires must be in the ratio of:

a) 4:1 b) 1:1 c) 1 :2 d) 2:1

256. A piece of paraffin wax of density 0.9 g/cc floats on water. A layer of turpentine of density 0.87 g/cc is added on top of water until the wax is entirely submerged. The ratio of the volume of wax immersed in water to that in turpentine is:

a) 3 : 13 b) 87 : 90 c) 90:87 d) 3:10

257. In a turbulent flow, the velocity of the liquid molecules in contact with the walls of the tube is:

a) zero b) maximum c) equal to critical velocity d) may have any value

258. A spherical body is dropped in a viscous liquid of infinite extent. What happens to the net force acting on it?

a) It goes on increasing b) It goes on decreasing, till it becomes zero

c) First increases then decreases d) None of the above

259. Expansion during heating:

a) Occurs only in solids b) Increases the weight of a material

c) Decreases the density of a material

d) Occurs at the same rate for all liquids and solids

260. (A) 1 kg of cotton fibre will weight equals in air when made more fluffy.

(R) Weight of air in cotton will cancel out with the force of extra buoyancy acting on it.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

261. A tiny sphere of mass m and density x is dropped in a jar of glycerine of density y. When the sphere acquires terminal velocity, the magnitude of the viscous force acting on it is:
a) $\frac{mgx}{y}$ b) $\frac{mgy}{x}$ c) $mg(1-\frac{y}{x})$ d) $mg(1+\frac{y}{x})$

262. A metal block having an internal cavity weighs 110 g in air and 80 g in water. If the density of metal is 5.5 g/cc, then the volume of cavity is:
a) 30 cc b) 20 cc c) 10 cc d) 5 cc

263. Two non-mixing liquids of densities P and np (n > 1) are put in a container. The height of each liquid is h. A solid cylinder of length L and density d is put in this container. The cylinder floats with its axis vertical and length pL (p < 1) in the denser liquid. The density d is equal to :
a) {1 + (n + I)p}ρ b) {2 + (n + I)p}ρ c) {2 + (n -1)p}ρ d) {I + (n -1)p}ρ

264. The power radiated by a black body is P and it radiates maximum energy at wavelength λ_0. If the temperature of the black body is now changed so that it radiates maximum energy at wave length $3/4\,{}'_0{}'$..0, the power radiated by it becomes nP. The value of n is :
a) 3/4 b) 4/3 c) 256/81 d) 81/256

265. (A) To float, a body must displace liquid whose weight is greater than the actual weight of the body.
(R) The body will experience no net downward force, in the case of floating.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

266. An empty balloon weighs W_1. If air equal in weight to W is pumped into the balloon, the weight of the balloon becomes W_2. Suppose that the density of air inside and outside the balloon is same; then:
a) $W_2 = W_1 + W$ b) $W_2 = \sqrt{W_1 W}$ c) $W_2 = W_1$ d) $W_2 = W_1 - W$

267. A wooden block of mass m and density ρ is tied to a string. The other end of the string is fixed to the bottom of a tank. The tank is filled with a liquid of density σ with $\sigma > \rho$. What is the tension in the string?
a) $(\frac{\sigma-\rho}{\sigma})mg$ b) $(\frac{\sigma-\rho}{\rho})mg$ c) $\frac{\rho mg}{\sigma}$ d) $\frac{\sigma mg}{\rho}$

268. (A) A block floats in water with some part outside water. When whole system is given a constant upward acceleration then volume of block inside water remains unchanged in equilibrium.
(R) Net force on the block in both cases is zero.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

269. The height of mercury column in a simple barometer is h. As the tube is inclined to the vertical at an angle α, the length of mercury column along the length of the tube is l; then:
a) $l = \frac{h}{\cos\alpha}$ b) 1= h cos α c) l=h d) 1= (h) cos α

270. 16 cm^3 of water flows per second through a capillary tube of radius a cm and of length l em when connected to a pressure head of h ern of water. If a tube of the same length and radius (a/2)cm is connected to the same pressure head the quantity of water flowing through the tube per second will be:
a) 4 cm^3 b) 1 cm^3 c) 8 cm^3 d) 16 cm^3

271. A body cools from a temperature 3T to 2T in 10 minutes. The room temperature is T. Assume that Newton's law of cooling is applicable. The temperature of the body at the end of next 10 minutes will be :
a) T b) 7/4 T c) 3/2 T d) 4/3 T

272. Which of the following has the greatest viscosity?
a) Hydrogen b) Air c) Water d) Ammonia

273. In Bernoulli's theorem which of the following is conserved?
a) Mass b) Energy c) Linear momentum d) Angular momentum

274. An engine pumps water through a hose pipe. Water passes through the pipe and leaves it with a velocity of 2 m/s. The mass per unit length of water in the pipe is 100 kg/m. What is the power of the engine?
a) 400 W b) 200 W c) 100 W d) 800 W

275. A parrot sitting on the floor of a wire cage which is being carried by a boy, starts flying. The boy will feel that the box is now:
a) heavier b) lighter c) same in weight d) lighter in the beginning and heavier later

276. The wet-ability of a surface by a liquid depends primarily on :
a) density b) angle of contact between surface and liquid c) viscosity
d) surface tension

277. The ratio of inertial force to viscous force represents:
a) Magnus effect b) Reynold's number c) Torricells's law d) Relative density

278. A volume V of a viscous liquid flows per unit time due to a pressure head ΔP along a pipe of diameter d and length l. Instead of this pipe, a set of four pipes each of diameter d/2 and length 2l is connected to the same pressure head ΔP. Now the volume of liquid

flowing per unit time is:

a) V/16 b) V/8 c) V/4 d) V

279. The potential energy of particle in a force field is $U=A/r^2$ - B/r, where A and B are positive constants and r is the distance of particle from the centre of the field. For stable equilibrium, the distance of the particle is :

a) B/2A b) 2A/B c) A/B d) B/A

280. If two liquids of same volume but different densities p_1 and p_2 are mixed, then density of mixture is given by:

a) $p=\frac{p_1p_2}{2}$ b) $p=\frac{p_1+p_2}{2p_1p_2}$ c) $p=\frac{2p_1p_2}{p_1+p_2}$ d) $p=\frac{p_1p_2}{p_1+p_2}$

281. Two bodies of equal mass with volumes V and 2V are equalized on a balance. The larger body is then immersed in oil of density p = 0.9 g/cc. What must be the density of the liquid in which the smaller body is simultaneously immersed, so as not to disturb the equilibrium of the balance?

a) 0.9 g/cc b) 1.8 g/cc c) 0.45 g/cc d) 1.35 g/cc

282. A glass flask having mass 390 g and an interior volume of 500 cm^3 floats on water, when it is lessthan half filled with water. The density of the material of the flask is:

a) 0.8 g/cc b) 2.8 g/cc c) 1.8 g/cc d) 0.28 g/cc

283. Select the correct alternative.

a)

A hollow cylinder of mass m , made heavy at its bottom, is floating vertically in water. It is tilted from its vertical position through an angle e to the left. The restoring force acting on it is mg(sec θ -1).

b)

A block of ice with lead shot embedded in it is floating on water, contained in a vessel. The temperature of the system is maintained at 0°C as the ice melts. When the ice melts completely, the level of the water in the vessel rises.

c)

A man is sitting in a boat which is floating in a pond. If the man drinks some water from the pond, the level of the water in the pond decreases.

d) None of the above.

284. Two syringes of different cross-sections (without needles) filled with water are connected with a tightly filted rubber tube filled with water. Diameters of the smaller piston and larger piston are 1.0 cm and 3.0 cm respectively. Find the force exerted on the larger piston when a force of 10 N is applied to the smaller piston.

a) 90 N b) 40 N c) 50 N d) 80 N

285. The units of Young's modulus of elasticity are:

a) N/m b) N-m c) N/m^2 d) $N–m^2$

286. A cork ball is floating on the surface of water in a beaker. The beaker is covered with a bell jar and the air is evacuated. What will happen to the ball?

a) Sink a little b) Rise a little c) Remain unchanged d) Sink completely

287. Mercury boils at 367"C. However, mercury thermometers are made such that they can measure temperature up to 500°C.This is done by

a) maintaining vacuum above mercury column in the stem of the thermometer

b) filling nitrogen gas at high pressure above the mercury column

c) filling oxygen gas at high pressure above the mercury column

d) filling nitrogen gas at low pressure above the mercury column

288. (A) The apparent weight of a block of wood floating in water is equal to zero.

(R) The value of acceleration due to gravity (g) in water becomes zero.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

e) If assertion is false but reason is true.

289. Two capillary tubes of the same length but different radii r_1 and r_2 are fitted in parallel to the bottom of a vessel. The pressure head is P. What should be the radius of a single tube that can replace the two tubes so that the rate of flow is same as before?

a) $r_1^4+r_2^4$ b) None of these c) r_1+r_2 d) $r_1^2+r_2^2$

290. Two rain drops reach the earth with different terminal velocities having ratio 9 : 4. Then, the ratio of their volumes is:

a) 3:2 b) 4:9 c) 9:4 d) 27:8

291. A piece of wood is floating in water. When the temperature of water rises, the apparent weight of the wood will:

a) increase b) decrease c) may increase or decrease d) remain the same

292. One poise is:

a) 1 dyne sec/cm^2 b) 1/98.1 kg-f-sec/m^2 c) 10^{-1} kg/m-sec d) any of these

293. As a bubble comes from the bottom of a lake to the top, its radius:

a) increases b) decreases c) does not change d) becomes zero

294. A good lubricant should have:

a) high viscosity b) low viscosity c) moderate viscosity d) high density

295. A sphere of solid material of relative density 9 has a concentric spherical cavity and sinks in water. If the radius of the sphere be R, then the radius of the cavity (r) will be related to R as:

a) $r^3 = \frac{8}{9}R^3$ b) $r^3 = \frac{2}{3}R^3$ c) $r^3 = \frac{\sqrt{8}}{3}R^3$ d) $r^3 = \sqrt{\frac{2}{3}R^3}$

296. In case of a hollow body, if ρ_B and ρ_s represent the densities of body and substance respectively, then:

a) $\rho_B = \rho_s$ b) $\rho_B < \rho_s$ c) $\rho_B > \rho_s$ d) none of these

297. The following four wires are made of same material. Which of these will have the largest extension when the same tension is applied?

a) Length = 50 em, diameter = 0.5 mm b) Length= 100 em, diameter= 1mm
c) Length = 200 em, diameter = 2 mm d) Length= 300 em, diameter= 3 mm

298. More viscous oil is used in summer than in winter in motors due to:

a) rise in temperature in summer; the viscosity of oil decreases

b) rise in temperature in summer the viscosity of oil increases c) S.T. of oil decreases

d) S.T. of oil increases

299. A river of salty water is flowing with a velocity 2 m/s. If the density of the water is 1.2 g/cc, then the kinetic energy of each cubic metre of water is:

a) 2.4 J b) 24 J c) 2.4 kJ d) 4.8 kJ

300. A wire of length l meteres, made of a material of specific gravity 8 is floating horizontally on the surface of water. If it is not wet by water, the maximum diameter of the wire (in millimeters) up to which it can continue to float is: (surface tension of water is $T = 70 \times 10^{-3} N\text{-}m^{-1}$)

a) 1.1 b) 0.75 c) 0.55 d) 1.5

301. The working of an atomizer depends upon:

a) Bernoulli's theorem b) Boyle's law c) Archimedes' principle

d) Newton's law of motion

302. A cylinder is filled with non-viscous liquid of density d to a height ho and a hole is made at a height h_1 from the bottom of the cylinder. The velocity of liquid issuing out of the hole is:

a) $\sqrt{2gh_0}$ b) $\sqrt{2g(h_0 - h_1)}$ c) $\sqrt{dgh_1}$ d) $\sqrt{dgh_0}$

303. A spherical small ball of density ρ is gently placed in a liquid of density σ($\rho > \sigma$) The initial acceleration of the free fall of the ball will be:

a) $(\frac{\rho+\sigma}{\rho})g$ b) $(\frac{\rho-\sigma}{\sigma})g$ c) $(\frac{\rho-\sigma}{\rho})g$ d) g

304. A piece of wax weighs x g in air. A piece of metal is found to weigh y g in water. It is tied to the wax and both together weigh z g in water. Then, the specific gravity of wax is: (z > y)

a) $\frac{x}{y}$ b) $\frac{y}{x}$ c) $\frac{x}{x(z-y)}$ d) $\frac{x}{x-z}$

305. Some liquid is filled in a cylindrical vessel of radius R. Let F_1 be the force applied by the liquid on the bottom of the cylinder. Now, the same liquid is poured into a vessel of uniform square cross-section of side R. Let F_2 be the force applied by the liquid on the bottom of this new vessel, then:

a) $F_1 = \pi F_2$ b) $F_1 = F_2 \backslash \pi$ c) $F_1 = \sqrt{\pi} F_2$ d) $F_1 = F_2$

306. A barometer reads 0.76 m. Its torricellian space is 0.09 m long. The volume of air measured at atmospheric pressure to be introduced into space to cause the mercury to drop to 0.57 m is: (the cross-section of the barometer tube is 10^{-4}sq. m)
a) 1.7x 10^{-6} m^3 b) 0.7x 10^{-6} m^3 c) 7x 10^{-6} m^3 d) 7 m^3

307. There is a 1 mm thick layer of water between a plate of area 100 cm^2 and another very big plate. The coefficient of viscosity of water is 0.01 poise. Then, the force required to move the smaller plate with a velocity of 10 cm/sec with respect to the larger plate is:
a) 10 dyne b) 100 dyne c) 1000 dyne d) 10,000 dyne

308. (A) The stream of water flowing at high speed from a garden hose pipe tends to spread like a fountain when held vertically up, but tends to narrow down when held vertically down.
(R) In any steady flow of an incompressible fluid, the volume flow rate of the fluid remains constant.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

309. A body weighs m_1 in a fluid of density d_1 and m_2 in a fluid of density d_2. What would be the weight in a fluid of density d_3?
a) $\frac{m_1(d_3-d_1)-m_2(d_2-d_3)}{(d_2-d_1)}$ b) $\frac{m_1(d_2-d_3)-m_1(d_1-d_3)}{(d_2-d_1)}$ c) $\frac{m_2(d_3-d_1)-m_1(d_3-d_2)}{(d_2-d_1)}$
d) $\frac{m_1(d_2-d_3)-m_2(d_3-d_1)}{(d_2+d_1)}$

310. (A) The stream of water emerging from a water tap "necks down" as it falls.
(R) The volume flow rate at different levels is same.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

311. (A) A man sitting in a boat which is floating on a pond. If the man drinks some water from the pond, the level of water in the pond decreases.
(R) In floating, the weight displaced by body is less than the weight of the body.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

312. (A) The blood pressure in humans is greater at the feet than at the brain.
(R) Pressure of liquid column is proportional to height, density of liquid and acceleration due to gravity.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

313. The approximate depth of an ocean is 2700 m. The compressibility of water is 45.4×10^{-11} P and density of water is 103 kg/m^3. What fractional compression of water will be obtained at the bottom of the ocean?
a) 0.8×10^{-2} b) 1.0×10^{-2} c) 1.2×10^{-2} d) 1.4×10^{-2}

314. Two identical cylindrical vessels with their bases at same level, each contains a liquid of density d. The height of the liquid in one vessel is h_1 and that in the other vessel is h_2. The area of either base is A. The work done by gravity in equalizing the levels when the two vessels are connected is:
a) $(h_1 - h_2)gd$ b) $(h_1 - h_2)gAd$ c) $\frac{1}{2}(h_1 - h_2)^2 gAd$ d) $\frac{1}{4}(h_1 - h_2)^2 gAd$

315. A 50 kg girl wearing high heel shoes balances on a single heel. The heel is circular with the diameter 1.0 cm, What is the pressure exerted on the horizontal floor?
a) 3×10^6 Pa b) 2×10^4 Pa c) 6.24×10^6 Pa d) 9×10^3 Pa

316. An aircraft has a mass 4×10^5 kg with total wing area 500 m^2 flying at a speed of 720 km h^{-1}. The density of air at its height is 1.2 kg m^{-3}. The fractional increase in the speed of the air on the upper surface of the wings relative to the lower surface is: (Take g = 10s^{-2})
a) 0.04 b) 0.08 c) 0.17 d) 0.32

317. The flow of liquid is laminar or stream-line is determined by:
a) rate of flow of liquid b) density of fluid c) radius of the tube
d) coefficient of viscosity of liquid

318. A gas flows with a velocity u along a pipe of cross-sectional area S and bent an angle of 90° at a point A. What force does the gas exert on the pipe at A if its density is ρ?

a) $\frac{\sqrt{2}Sv}{\rho}$ b) $\sqrt{2}Sv^2\rho$ c) $\frac{\sqrt{3}Sv^2\rho}{2}$ d) $\sqrt{3}Sv^2\rho$

319. A boy is carrying a bucket of water in one hand and a piece of plastic in the other. After transferring the plastic piece to the bucket (in which it floats) the boy will carry:
a) same load as before b) more load as before c) less load as before
d) either less or more load, depending on the density of plastic

320. A metal plate of area 10^3 cm^2 rests on a layer of oil 6 mm thick. A tangential force of 10^{-2} N is applied on it to move it with a constant velocity of 6 cms^{-1}. The coefficient of viscosity of the liquid is:
a) 0.1 poise b) 0.5 poise c) 0.7 poise d) 0.9 poise

321. Find the density of a block of wood that floats in water with 0.1 of its volume above water:
a) 0.9 g/cc b) 0.9 c) 0.1 g/cc d) 0.1

322. If A denotes the area of free surface of a liquid and h the depth of an orifice of area of cross-section a, below the liquid surface, then the velocity v of flow through the orifice is given by:
a) v=$\sqrt{(2gh)}$ b) v=$\sqrt{(2gh)}\sqrt{\left(\frac{A^2}{A^2-a^2}\right)}$ c) v=$\sqrt{(2gh)}\sqrt{\left(\frac{A}{A-a}\right)}$ d) v=$\sqrt{(2gh)}\sqrt{\left(\frac{A^2-a^2}{A^2}\right)}$

323. The rate of flow of water in a capillary tube of length l and radius r is V. The rate of flow in another capillary tube of length 2l and radius 2r for same pressure difference would be:
a) 16 V b) 9 V c) 8 V d) 2 V

324. (A) When an ice cube, floating in a glass of water melts, the water remains unchanged.
(R) The volume of ice on melting increases.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

325. (A) To empty an oil tank, two holes are made.
(R) Oil will come out of two holes so it will be emptied faster.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

326. A certain number of spherical drops of a liquid of radius 'T' coalesce to form a single drop of radius 'R' and volume 'V'. If 'T is the surface tension of the liquid, then:
a) energy = 4VT (l/r -l/R) is released b) energy = 3VT (l/r + l/R) is absorbed
c) energy = 3VT (l/r - l/R) is released d) energy is neither released nor absorbed

327. A closed vessel is half-filled with water. There is a hole near the top of the vessel and air is pumped out from this hole:
a) the water level will rise up in the vessel
b) the pressure at the surface of water will decrease
c) the force exerted due to the water on the bottom of the vessel will decrease
d) the density of the liquid will decrease

328. A balloon with mass 'm' is descending down with an acceleration' a' where a < g. How much mass should be removed from it so that it starts moving up with an acceleration' a'?
a) 2ma/(g + a) b) 2ma/(g-a) c) ma/(g + a) d) ma/(g - a)

329. A raft of wood (density 600 kg/m^3) of mass 120 kg floats in water. How much weight can be put on the raft to make it just sink?
a) 120 kg b) 200 kg c) 40 kg d) 80 kg

330. The value of g at a place decreases by 2%. The barometric height of mercury:
a) increases by 2% b) decreases by 2% c) remains unchanged
d) sometimes increases and sometimes decreases

331. A body is just floating in a liquid (their densities are equal). If the body is slightly pressed down and released it will:
a) start oscillating b) sink to the bottom
c) come back to the same position immediately
d) come back to the same position slowly

332. A copper ball of radius rtravels with a uniform speed v in a viscous fluid. If the ball is changed with another ball of radius 2r, the new uniform speed will be:
a) v b) 2v c) 4v d) 8v

333. A container of large uniform cross-sectional area A resting on a horizontal surface holds two immiscible, non-viscous and incompressible liquids of densities d and 2d, each of height (H/2) The lower density liquid is open to the atmosphere having pressure P_0. A tiny hole of area s (s<< A)is punched on the vertical side of the container at a height h $\left(h << \frac{H}{2}\right)$. The initial speed of efflux of the liquid at the hole is:
a) (3H-4h)g b) $\frac{(3H-4H)g}{2}$ c) $\sqrt{(3H-4h)g}$ d) $\sqrt{\frac{(3H-4h)g}{2}}$

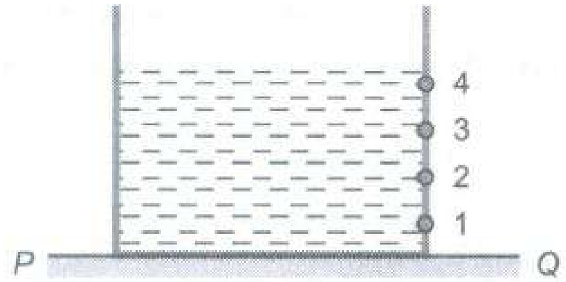
334. Paint-gun or scent sprayer depends upon:
a) Bernoulli's principle b) Boyle's law c) Faraday's law d) Archimedes' principle
e) Newton's law of motion

335. (A) The size of the needle of a syringe controls flow rate better than the thumb pressure exerted by a doctor while administering an injection.
(R) Flow rate is independent of pressure exerted by the thumb of the doctor.
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

336. (A) Railway tracks are laid on small sized wooden sleepers.
(R) Small sized wooden' sleepers are used so that train exert more pressure on the railway track. Due to which train does not leave the track.
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

337. Sixty four spherical rain drops of equal size are falling vertically through air with a terminal velocity 1.5 ms^{-1}. If these drops coalesce to form a big spherical drop, then terminal velocity of big drop is:
a) 8 ms^{-1} b) 16 ms^{-1} c) 24 ms^{-1} d) 32 ms^{-1}

338. A cylindrical vessel of 90 cm height is kept filled upto the brim. It has four holes 1, 2, 3, 4 which are respectively at heights of 20 cm, 30 cm, 45 cm and 50 cm from the horizontal floor PQ. The water falling at the maximum horizontal distance from the vessel comes from;



a) Hole number 4 b) Hole number 3 c) Hole number 2 d) Hole number 1

339. A Centigrade and a Fahrenheit thermometers are dipped in boiling water. The water temperature is lowered until the Fahrenheit thermometer registers a temperature of 140°C.The fall of temperature as registered by the centigrade thermometer is:
a) 80°C b) 40°C c) 50°C d) 90°C

340. A trough full of water is placed on a spring balance. If we put our hand in water touching the trough, how will the reading of balance change?
a) It will remain unchanged b) It will decrease c) It will rise
d) It is not possible to predict

341. (A) Viscosity of liquid is the property of liquid by virtue of which it opposes the relative motion amongst its different layers.
(R) Viscosity of liquid increases rapidly with the rise of temperature.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

342. Two thermometers are constructed in the same way excepted that one has a spherical bulb and the other a cylindrical bulb, which one will respond quickly to temperature changes
a) spherical bulb thermometer b) Cylindrical bulb thermometer c) both equally
d) None of the above

343. The onset of turbulance in a liquid is determined by:
a) Pascal's law b) Reynold's number c) Toricelli's law d) Bernoulli's principle

344. An inverted bell lying at the bottom of a lake 47.6 m deep has 50 cm^3 of air trapped in it. The bell is brought to the surface of the lake. The volume of the trapped air will be: (atmospheric pressure 70 cm of Hg and density of Hg = 13.6 g/cc.)
a) 350 cm^3 b) 300 cm^3 c) 25.0 cm^3 d) 22 cm^3

345. (A) A piece of cork embedded inside an ice block, floats in water. If ice melts completely, the water level remains unchanged.
(R) Ice and water have same density.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
e) If assertion is false but reason is true.

346. A bird of mass 1.23 kg is able to hover by imparting a downward velocity 10 m/s uniformly to air of density p kg/m^3 over an effective area 0.1 m^2. If the acceleration due to gravity is 10 m/s^2, then the magnitude of p (in $kg.m^3$) is:
a) 0.0123 b) 0.123 c) 1.23 d) 1.32

347. (A) Aeroplanes are made to run on the runway before take off, so that they acquire the necessary lift.

(R) According to Bernoulli's theorem, as velocity increases pressure decreases and vice-versa.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

348. The flow rate of water from a tap of diameter 1.25 cm is 3 L per min. The coefficient of viscosity of water is 10^{-3} Pa-s. The nature of flow is:

a) unsteady b) turbulent c) laminar d) none of these

349. The water flows from a tap of diameter 1.25 cm with a rate of 5 x 10^{-5} m^3 s^{-1}. The density and coefficient of viscosity of water are 10^3kg m^{-3} and 10^{-3} Pa, respectively. The flow of water is:

a) steady with Reynold's number 5100 b) turbulent with Reynold's number 5100

c) steady with Reynold's number 3900 d) turbulent with Reynold's number 3900

350. In a plant, a sucrose solution of coefficient of viscosity 0.0015 N-s/m^2 is driven at a velocity of 10^{-3} m/s through xylem vessels of radius 2 μm and length 5 μm. The hydrostatic pressure difference across the length of xylem vessels (in N/m^2) is:

a) 5 b) 8 c) 10 d) 15

351. (A) The viscosity of liquid increases rapidly with rise of temperature.

(R) Viscosity of a liquid is the property of the liquid by virtue of which it opposes the relative motion amongst its different layers.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

352. The rate of outflow of liquid through an orifice does not depend upon:

a) radius of the orifice b) height ofliquid column c) acceleration due to gravity

d) density of the liquid

353. A metal ball B_1 (density 3.2 g cm^{-3}) is dropped in water while another metal ball B_2 (density 6.0 g cm $^{-3}$) is dropped in a liquid of density 1.6 g em -3. If both the balls have the same diameter and attain the same terminal velocity, the ratio of viscosity of water to

that of the liquid is :

a) 2.0 b) 0.5 c) 4.0 d) indeterminate due to insufficient data

354. A cylindrical vessel of 92 cm height is kept filled upto the brim. It has four holes 1, 2, 3 and 4 which are respectively at heights of 20 cm, 30 cm, 46 cm and 80 cm from the horizontal floor. The water falling at the maximum horizontal distance from the vessel comes from:

a) hole no. 4 b) hole no. 3 c) hole no. 2 d) hole no. 1

355. Water is moving with a speed of 5.0 m/s through a pipe with cross-sectional area of 4.0 cm^2. The water gradually descends 10 m as the pipe increase in area to 8.0 cm^2. If the pressure at the upper level is 1.5 x 10^5 Pa, the pressure at lower level will be :

a) 2.8 x 10^5 Pa b) 2.6 x 10^5 Pa c) 2.4 x 10^5 Pa d) 2.1 x 10^5 Pa

356. A wooden block is floating in a water tank. The block is pressed to its bottom. During the process, work done is equal to:

a) work done against upthrust exerted by the water

b) work done against upthrust plus loss of gravitational potential energy of the block

c) work done against upthrust minus loss of gravitational potential energy of the block

d) none of the above

357. Viscosity of liquids:

a) increases with increase in temperature b) is independent of temperature

c) decreases with decrease in temperature d) decreases with increase in temperature

358. A piece of solid weighs 120 g in air, 80 g in water and 60 g in a liquid. The relative density of the solid and that of the liquid are respectively:

a) 3,2 b) 2,3/4 c) 3/2,2 d) 3,3/2

359. A rectangular film of liquid is extended from (4 cm x 2 cm) to (5 cm x 4 cm). If the work done is 3 x 10^{-4} J, the value of the surface tension of the liquid is:

a) 8.0Nm^{-1} b) 0.250Nm^{-1} c) 0.125Nm^{-1} d) 0.2Nm^{-1}

360. An empty balloon weighs 1g. The balloon is filled with water to the neck and tied with a massless thread. The weight of balloon along with water is 101 g. The balloon filled with water is weighed when fully immersed. Then, its weight in water is:

a) 1 g b) 101 g c) 201 g d) 51 g

361. A piece of ice is floating in ajar containing water. When the ice melts, the temperature of water falls from 4^o C to 1^oC. Then, the level of water?

a) rises b) falls c) unchanged d) none of these

362. A black body radiates energy at the rate of E W/m^2 at a high temperature T K. When the temperature is reduced to T/2K, the radiant energy will be

a) E/16 b) E/4 c) 4E d) 16E

363. A rectangular block is 5 cm x 5 cm x 10 cm in size. The block is floating in water with 5 cm side vertical. If it floats with 10 cm side vertical, what change will occur in the level of water?

a) No change b) It will rise c) It will fall

d) It may rise or fall depending on the density of the block

364. Why the dam of water reservoir is thick at the bottom?

a) Quantity of water increases with depth b) Density of water increases with depth

c) Pressure of water increases with depth

d) Temperature of water increases with depth

365. On a new scale of temperature (which is linear), a called the W scale, the freezing and boiling point of water are 39°W and 239°W respectively. What will be the temperature of 39° C celsius scale?

a) 78°W b) 117°C c) 200°C d) 139°W

366. A small sphere of mass m is dropped from a great height. After it has fallen 100 metres, it has attained its terminal velocity and continues to fall at that speed. The work done by air friction against the sphere during the first 100 metres offall is:

a) greater than the work done by air friction in the second 100 metres

b) less than the work done by air friction in the second 100 metres c) equal to 100 mg

d) greater than 100 mg

367. The cylindrical tube of a spray pump has a cross-section of 8 cm^2, one end of which has 40 fine holes each of area 10^{-8} m^2. If the liquid flows inside the tube with a speed of 0.15 m min^{-1}, the speed with which the liquid is ejected through the holes is:

a) 50 ms^{-1} b) 5 ms^{-1} c) 0.05 ms^{-1} d) 0.5 ms^{-1}

368. The total area of cross-section is 0.25 m^2. If the blood is flowing at the rate of 100 cm^3/sec, then the average velocity of flow of blood through the capillaries is:

a) 0.4 mm/sec b) 4 mm/sec c) 25 mm/sec d) 400 mm/sec

369. A large block of ice 5 m thick has a vertical hole drilled through it and is floating in the middle of a lake. The minimum length of the rope required to scoop up a bucket of water through the hole is: (density of ice = 0.9 g/cc)

a) 5.5 m b) 5 m c) 4.5 m d) 0.5 m

370. Which of the following relations is true :

a) 3Y = K (1-σ) b) $K = 9\eta Y / Y + \eta$ c) $\sigma = (6K + \eta)Y$ d) $\sigma = (0.5Y - \eta)/n$

371. A water barrel having water upto a depth d is placed on a table of height h. A small hole is made on the wall of the barrel at its bottom. If the stream of water coming out of the hole falls on the ground at a horizontal distance R from the barrel, then the value of d is:

a) $\frac{4h}{R^2}$ b) $4hR^2$ c) $\frac{R^2}{4h}$ d) $\frac{h}{4R^2}$

372. A rubber cord catapult has cross-sectional area 25 nun 2 and initial length of rubber cord is 10 cm. It is stretched to 5 cm and then released to project a missile of mass 5 gm. Taking Y_{rubber} = 5 x 108 N/m^2 velocity of projected missile is :

a) 20 m/s b) 100 m/s c) 250 m/s d) 200 m/s

373. (A) For Reynolds number $R_e > 2000$, the flow of fluid is turbulent.
(R) Inertial forces are dominant compared to the viscous forces at such high Reynolds number.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

374. Pressure at the bottom of a tank of water is 3P, where P is atmospheric pressure. If the water is drawn out till the level of water is lowered by one fifth, then the pressure at the bottom of the tank is:
a) 2P b) 13P/5 c) 8P/5 d) 4P/5

375. A body is just floating on the surface of a liquid. The density of the body is same as that of the liquid. The body is slightly pushed down. What will happen to the body?
a) It will come back slowly to its earlier position
b) It will remain submerged where it is left c) It will sink d) It will come out violently

376. An air bubble of 1cm radius is rising at a steady rate of 2.00 mm/sec through a liquid of density 1.5 gm per cm^3. Neglect density of air. If g is 1000 cm/sec^2, then the coefficient of viscosity of the liquid is:
a) 0.166×10^3 poise b) 166×10^3 poise c) 1.66×10^3 poise d) 16.6×10^3 poise

377. A ball whose density is 0.4×10^3 kg/m^3 falls into water from a height of 9 cm. To what depth does the ball sink?
a) 9 cm b) 6 cm c) 4.5 cm d) 2.25 cm

378. An inverted vessel (diving bell) lying at the bottom of a lake, 47.6 m deep, has 50 cm^3 of air trapped in it. The bell is brought to the surface of lake. The volume of the trapped air will now be: (atmospheric pressure is 70 cm of mercury, density of mercury = 13.6 $g/cm^3$and g = 980 cm/sec^2)
a) 350 cm^3 b) 300 cm^3 c) 250 cm^3 d) 200 cm^3

379. An aeroplane gets its upward lift due to a phenomenon described by the:
a) Archimedes' principle b) Bernoulli's principle c) Buoyancy principle
d) Pascal's law

380. A ball of mass m and radius r is released in viscous liquid. The value of its terminal velocity is proportional to:
a) I/r only b) m/r c) $(m/r)^{1/2}$ d) m only

381. A beam of metal supported at the two ends is loaded at the centre. The depression at the centre is proportional to :
a) Y^2 b) Y c) 1/Y d) $1/Y^2$

382. The top surface of an incompressible liquid is open to the atmosphere. The pressure at a depth h below the surface is P_1. How does the pressure P_2 at depth $h_2 = 2h_1$ compare with P_1?

a) $P_2 > 2P_1$ b) $P_2 = 2P_1$ c) $P_2 < 2P_1$ d) $P_2 = P_1$

383. A manometer connected to a closed tap reads 3.5×10^5 newton/metre^2. When the valve is opened, the reading of manometer falls to 3.0×10^5 newton per metre 2, then velocity of flow of water is:

a) 100 m/s b) 10 m/s c) 1 m/s d) $10\sqrt{10}$ m/s

384. A hot body at temperature T loses heat to the surrounding temperature T_s by radiation. If the difference in temperature is small then the rate of loss of heat by the hot body is proportional to :

a) $T - T_s$ b) $(T - T_S)^2$ c) $(T - T_S)^{1/2}$ d) $(T - T_S)^4$

385. A wooden ball of density D is immersed in water of density d to a depth h below the surface of water and then released. Upto what height will the ball jump out of water?

a) $\frac{d}{D}h$ b) $(\frac{d}{D} - 1)h$ c) h d) zero

386. A body of density d_1 is counterpoised by Mg of weights of density d_2 in air of density d. Then, the true mass of the body is:

a) M b) $M(1 - \frac{d}{d_2})$ c) $M(1 - \frac{d}{d_1})$ d) $M(\frac{1 - d/d_2}{1 - d/d_1})$

387. A small drop of water falls from rest through a large height h in air; the final velocity is:

a) proportional to $\sqrt{h}$ b) proportional to h c) inversely proportional to h

d) almost independent of h

388. If two liquids of same masses but different densities p_1 and p_2 respectively are mixed, then density of mixture is given by:

a) $p = \frac{p_1 + p_2}{2}$ b) $p = \frac{p_1 + p_2}{2p_1p_2}$ c) $p = \frac{2p_1p_2}{p_1 + p_2}$ d) $p = \frac{p_1p_2}{p_1 + p_2}$

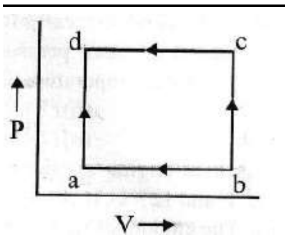
Ravi Maths Tuition Centre

Time : 1 Mins **THERMODYNAMICS 1** **Marks : 1623**

1. (A) If two bodies are in thermal equilibrium in one frame, they will be in thermal equilibrium in all frames.
   (R) The transfer of energy from a hot body to a cold body is a non mechanical process, i.e., the energy is transferred from one body to the other, without any mechanical work.
   a)
   If both assertion and reason are true and reason is the correct explanation of assertion
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion
   c) If assertion is true but reason is false d) If both assertion and reason are false
   e) If assertion is false but reason is true

2. A gas is heated at constant pressure. The fraction of heat supplied used for external work is:
   a) $\frac{1}{\gamma}$ b) $\left(1-\frac{1}{\gamma}\right)$ c) $\gamma-1$ d) $\left(1-\frac{1}{\gamma^2}\right)$

3. A system is taken from state a to state c by two paths adc and abc as shown in the figure. The internal energy at a is $U_a = 10$ J Along the path adc the amount of heat absorbed $dQ_1 = 50$ J and the work done $dW_1 = 20$ J whereas along the path abc the heat absorbed $dQ_2 = 36$ J. The amount of work done along the path abc is
   _______________ .



   a) 6 J b) 10 J c) 12 J d) 36 J

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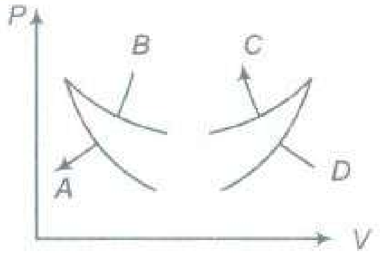
4. In a thermodynamic process, pressure of a fixed mass of a gas is changed in such a manner that the gas releases 20 J of heat and 8 J of work is done on the gas. If initial internal energy of the gas was 30 J, what will be the final internal energy?
   a) 42 J b) 12 J c) 10 J d) 18 J

5. Four curves A, B, C and D are drawn in the adjoining figure for a given amount of gas. The curves which represent adiabatic and isothermal changes are:



   a) C and D respectively b) D and C respectively c) A and B respectively
   d) B and A respectively

6. Two moles of oxygen is mixed with eight moles of helium. The effective specific heat of the mixture at constant volume is
   a) I.3R b) 1.4R c) 1.7R d) 1.9R

7. (A) First law of thermodynamics does not forbid flow of heat from lower temperature to higher temperature.
   (R) Heat supplied to a system always equal to the increase in its internal energy.
   a)
   If both assertion and reason are true and reason is the correct explanation of assertion
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion
   c) If assertion is true but reason is false d) If both assertion and reason are false
   e) If assertion is false but reason is true

8. 1 mole of gas expands isothermally at 37° C. The amount of heat is absorbed by it until its volume doubled is ($R = 8.31\ J\ mol^{-1}\ K^{-1}$)
   a) 411.25 cal b) 418.50 cal c) 420.25 cal d) 425.40 cal

9. **Assertion:** A heat engine is the reverse of a refrigerator.
   Reason: A refrigerator cannot work without some external work done on the system.
   a)
   If both assertion and reason are true and reason is the correct explanation of assertion.
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

10. Consider a Carnot cycle operating between source temperature 750 K and sink temperature 350 K producing 1.25 kJ of mechanical work per cycle, the heat transferred to the engine by the reservoirs
a) 1.34 kJ b) 2.34 kJ c) 3.34 kJ d) 4.34 kJ

11. Three copper blocks of masses M1, M2 and M3 kg respectively are brought into thermal contact till they reach equilibrium. Before contact, they were at T_1, T_2, T_3 ($T_1 > T_2 > T_3$). Assuming there is no heat loss to the surroundings, the equilibrium temperature Tis (s is specific heat of copper)
a) $T=\frac{T_1+T_2+T_3}{3}$ b) $T=\frac{M_1T_1+M_2T_2+M_3T_3}{M_1+M_2+M_3}$ c) $T=\frac{M_1T_1+M_2T_2+M_3T_3}{3(M_1+M_2+M_3)}$ d) $T=\frac{M_1T_1s+M_2T_2s+M_3T_3s}{M_1+M_2+M_3}$

12. A container having 1 mole of a gas at a temperature 27°C has a movable piston which maintains at constant pressure in container of 1 atm. The gas is compressed until temperature becomes 127°C. The work done is: (C_p for gas is 7.03 cal/mol-K)
a) 703 J b) 814 J c) 121 J d) 2035 J

13. If the ratio of specific heats of a gas at constant pressure to that at constant volume is γ, the change in internal energy of the given mass of gas, when the volume changes from V to 2V at constant pressure P is:
a) $R/(\gamma-1)$ b) PV c) $PV/(\gamma-1)$ d) $\gamma PV/(\gamma-1)$

14. An ideal gas after going through a series of four thermodynamic states in order, reaches the initial state again (cyclic process). The amounts of heat (Q) and work (W) involved in the states are,
Q_1=6000 J; Q_2=-5500 J; Q_3=-3000 J; Q_4=3500 J
W_1=2500 J; W_2=-1000 J; W_3=-1200 J; W_4= xJ
The ratio of network done by the gas to the total heat absorbed by the gas in η. The value of x and η are nearly
a) 500 J; 7.5% b) 700 J; 10.5% c) 1000 J; 21% d) 1500 J; 15%

15. The efficiency of Carnot's heat engine is 0.5 when the temperature of the source is T_1 and that of sink is T_2. The efficiency of another Carnot's heat engine is also 0.5. The temperature of source and sink of the second engine are respectively
a) $2T_1$, $2T_2$ b) $2T_1, \frac{T_2}{T_1}$ c) T_1+5, T_2-5 d) T_1+10, T_2-10

16. The relation between the slope of isothermal curve and slope of adiabatic curve
a) slope of adiabatic curve = γ times slope of isothermal curve
b) slope of isothermal curve = γ times slope of adiabatic curve
c) slope of adiabatic curve = γ^2 times slope of isothermal curve
d) slope of isothermal curve = γ^2 times slope of adiabatic curve

17. For diatomic gas, which of the following statements is correct?
a) $C_v=\frac{3R}{2}$ b) $C_p=\frac{7R}{2}$ c) $C_p=\frac{5R}{2}$ d) $C_p-C_v=2R$

18. A monatomic gas is compressed adiabatically to 1/4 th of its original volume, the final pressure of gas in terms of initial pressure P is:
a) 7.08 P b) 8.08 P c) 9.08 P d) 10.08 P
19. (A) In isothermal process whole of the heat energy supplied to a system is converted into work.
(R) According to first law of thermodynamics Q=W+ΔU
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true
20. A box (thermally insulated) has two chambers separated by a membrane. One of volume V contains an ideal gas at temperature T. The other of volume $\left(\frac{1}{2}V\right)$ is evacuated. If the membrane breaks down, the gas temperature will be:
a) $\frac{3}{2}$T b) $\frac{2T}{3}$ c) T d) none of these
21. The coefficient of performance of refrigerator, whose efficiency is 25% is:
a) 1 b) 3 c) 5 d) 7
22. A gas is heated at constant pressure. The fraction of heat energy used to increase the internal energy of the gas molecules is:
a) γ b) 1/γ c) C_p-C_v d) C_p+C_v
23. 1 kg of water is heated from 40°C to 70 °C, If its volume remains constant, then the change in internal energy is (specific heat of water 4148 J $kg^{-1}K^{-1}$)
a) 2.44 x 10^5 J b) 1.62 x 10^5 J c) 1.24 x 10^5 J d) 2.62 x 10^5 J
24. In a reversible isochoric process:
a) ΔW=0 b) ΔQ=0 c) ΔT=0 d) ΔU=0
25. (A) In adiabatic compression, the temperature of system get decreased.
(R) Adiabatic compression is a slow process.

Processing math: 100%

a)
If both assertion and reason are true and reason is the correct explanation of assertion

b)
If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false   d) If both assertion and reason are false

e) If assertion is false but reason is true

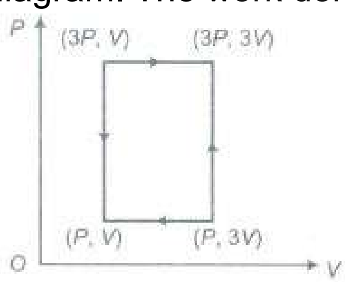
26. The possibility of increase in the temperature of a gas without adding heat to it happens in
a) adiabatic expansion   b) isothermal expansion   c) adiabatic compression
d) isothermal compression

27. A gas is found to obey the law P^2V = constant. The initial temperature and volume are T^0 and V^0. If the gas expands to a volume $2V^0$, its final temperature becomes:
a) $\sqrt{2}T_0$ b) $2T_0$ c) $T_0/2$ d) $T_0/\sqrt{2}$

28. The temperature of n moles of an ideal gas is increased from T to 4T through a process for which pressure $P = aT^{-1}$ where a is a constant. Then, the work done by the gas is
a) nRT   b) 4nRT   c) 2nRT   d) 6nRT

29. If R is gas constant for 1 gm mole, C_p and C_v are specific heats for a solid, then:
a) C_p-C_v=R   b) C_p-C_v < R   c) C_p-C_v=0   d) C_p-C_v > R

30. An ideal monoatomic gas is taken round the cycle ABCDA as shown in following P-V diagram. The work done during the cycle is :



a) PV   b) 2 PV   c) 4 PV   d) Zero

31. An ideal gas (γ = 1.5) is expanded adiabatically. How many times has the gas to be expanded to reduce the root mean square velocity of molecules 2.0 times?
a) 4 times   b) 16 times   c) 8 times   d) 2 times

32. The adiabatic elasticity of hydrogen gas γ = 1.4 at NTP is:
a) 1×10^5 N/m^2 b) 1×10^{-5} N/m^2 c) 1.4 N/m^2 d) 1.4×10^5 N/m^2

33. The thermodynamic process in which no work is done on or by the gas is:

a) isothermal process b) adiabatic process c) cyclic process

d) isobaric process e) isochoric process

34. In a heat engine, the temperature of the source and sink are 500 K and 375 K. If the engine consumes 25 x 10^5 J per cycle, the work done per cycle is:
a) 6.25 x 10^5 J b) 3 x 10^5 J c) 2.19 x 10^5 J d) 4 x 10^4 J

35. In a Carnot cycle, order of process is:
a) isothermal expansion, adiabatic expansion and adiabatic compression

b) isothermal expansion, adiabatic compression and adiabatic expansion

c) adiabatic expansion, isothermal expansion and adiabatic compression

d) none of the above

36. The efficiency of a Carnot heat engine:
a) is independent of the temperature of the source and the sink

b) is independent of the working substance c) can be 100%

d) is not affected by the thermal capacity of the source or the sink

37. The temperature of the system decreases in the process of:
a) free expansion b) adiabatic expansion c) isothermal expansion

d) isothermal compression

38. An ideal gas heat engine operates in Carnot cycle between 227^0C and 127^0c. It absorbs 6 x 10^4 cals of heat at higher temperature. Amount of heat converted to work is:
a) 2.4 x 10^4 cal b) 6 x 10^4 cal c) 1.2 x 10^4 cal d) 4.8 x 10^4 cal

39. The cycle in the figure followed by an engine made of an ideal gas in a cylinder with a piston, the heat exchanged by the engine with the surroundings for adiabatic section AB of the

cycle is $\left[C_V = \frac{3}{2}R\right]$

a) $\frac{3}{2}(P_B - P_A)V_A$ b) $\frac{5}{2}P_A(V_A - V_B)$ c) $\frac{1}{2}(P_A - P_B)(V_A - V_B)$ d) zero

40. For free expansion of a gas which of the following is true?
a) Q=W=0 and $\Delta E_{int}=0$ b) Q=0, W>0 and $\Delta E_{int}=-W$ c) W=0, Q>0 and $\Delta E_{int}=Q$

d) W=0, Q<0 and $\Delta E_{int}=0$

41. In changing the state of a gas adiabatically from an equilibrium state A to another equilibrium state B an amount of work equal to 22.3 J is done on the system. If the gas is taken from state A to B via a process in which the net heat absorbed by the system is 9.35 cal then the net work done by the system in latter case is (Take 1 cal = 4.2 J)

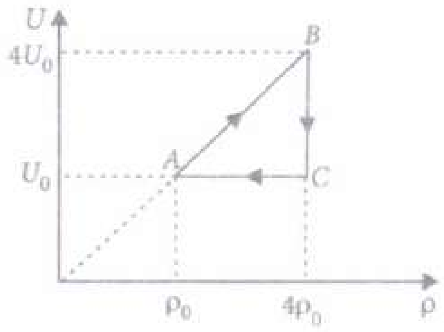
Processing math: 100%

a) 15J b) 16J c) 17J d) 18J

42. The coefficient of performance of a refrigerator, if it is to maintain eatables kept inside at 7°C and the room temperature is 38°C, is:

a) 15.5 b) 16.3 c) 20.19 d) 9.03

43. A monatomic ideal gas is following the cyclic process ABCA. Then choose the incorrect option.



a) Molar heat capacity for the process AB is R/2.

b) `Heat is rejected by the system in path BC.

c) Molar heat capacity for the process BC is 2/3R.

d) Work done by the system in the process CA is $2U_0/3\ln 4$.

44. When the state of a gas adiabatically changed from an equilibrium state A to another equilibrium state B, an amount of work done on the system is 35 J. If the gas is taken from state A to B via process in which the net heat absorbed by the system is 12 cal, then the net work done by the system is (1 cal = 4.19 J)

a) 13.2 J b) 15.4 J c) 12.6 J d) 16.8 J

45. In an adiabatic process, where in pressure is increased by $\frac{2}{3}$% if $\frac{C_p}{C_v} = \frac{3}{2}$, then the volume decreases by about:

a) $\frac{4}{9}$% b) $\frac{2}{3}$% c) 4% d) $\frac{9}{4}$%

46. An insulated container of gas has two chambers separated by an insulating partition. One of the chambers has volume V_1 and contains ideal gas at pressure P_1 and temperature T_1. The other chamber has volume V_2 and contains ideal gas at pressure P_2 and temperature T_2. If the partition is removed without doing any work on the gas, the final equilibrium temperature of the gas in the container will be:

a) $\frac{T_1T_2(P_1V_1+P_2V_2)}{P_1V_1T_2+P_2V_2T_1}$ b) $\frac{P_1V_1T_1+P_2V_2T_2}{P_1V_1+P_2V_2}$ c) $\frac{P_1V_1T_2+P_2V_2T_1}{P_1V_1+P_2V_2}$ d) $\frac{T_1T_2(P_1V_1+P_2V_2)}{P_1V_1T_1+P_2V_2T_2}$

47. Mean kinetic energy per gram molecule for diatomic gas is:

a) $\frac{3}{2}$RT b) $\frac{4}{2}$RT c) $\frac{5}{2}$RT d) $\frac{6}{2}$RT

48. (A) In an isolated system, the entropy increases

(R) The processes in an isolated system are adiabatic.

Processing math: 100%

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

49. A monoatomic gas is suddenly compressed to (l/8)th of its initial volume adiabatically. The ratio of its final pressure to the initial pressure is: (given the ratio of the specific heats of the given gas to be 5/3)
a) 32 b) 40/3 c) 24/5 d) 8

50. If the coefficient of performance of a refrigerator is 5 and operates at the room temperature 27°C, the temperature inside the refrigerator is
a) 240 K b) 250 K c) 230 K d) 260 K

51. In a Carnot engine, the temperature of reservoir is 927°C and that of sink is 27°C. If the work done by the engine when it transfers heat from reservoir to sink is 12.6 x 106 J, the quantity of heat absorbed by the engine from the reservoir is:
a) 16.8×10^6 J b) 4×10^6 J c) 7.6×10^6 J d) 4.2×10^6 J e) 20.8×10^6 J

52. A given mass of a gas is compressed isothermally until its pressure is doubled. It is then allowed to expand adiabatically until its original volume is restored and its pressure i~ then found to be 0.75 of its initial pressure. The ratio of the specific heats of the gas is approximately:
a) 1.20 b) 1.41 c) 1.67 d) 1.83

53. Two identical bodies are made of a material for which the heat capacity increases with temperature. One of these is at 100°C, while the other one is at 0°C. If the two bodies are brought into contact, then assuming no heat loss, the final common temperature is:
a) 50°C b) more than 50°C c) less than 50°C but greater than 0°C d) 0°C

54. An electric heater supplies heat to a system at a rate of 120 W If system performs work at a rate of 80 J s^{-1}, the rate of increase in internal energy is
a) 30 J s^{-1} b) 40 J s^{-1} c) 50 J s^{-1} d) 60 J s^{-1}

55. An ideal gas is compressed isothermally until its pressure is doubled and then allowed to expand adiabatically to regain its original volume (γ = 1.4 and $2^{-1.4}$= 0.38). The ratio of the final to initial pressure is:
a) 0.76:1 b) 1:1 c) 0.66:1 d) 0.86:1

Processing math: 100%

56. Three samples of the same gas A, Band C (γ = 3/2) have equal volume initially. Now, the volume of each sample is doubled. For A, the process is adiabatic; for B, it is isobaric and for C, the process is isothermal. If the final pressure are equal for all the three samples, the ratio of their initial pressures is:
a) 2:1:$\sqrt{2}$ b) $\sqrt{2}$:1:2 c) $\sqrt{2}$:1:2 d) $\sqrt{2}$:2:1

57. (A) The ratio of specific heat of a gas at constant pressure and specific heat at constant volume for a diatomic gas is more than that for a monoatomic gas.
(R) The molecules of a monoatomic gas have more degree of freedom than those of a diatomic gas.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b) If assertion is true but reason is false
c)
If both assertion and reason are true but reason is not the correct explanation of assertion
d) If both assertion and reason are false e) If assertion is false but reason is true

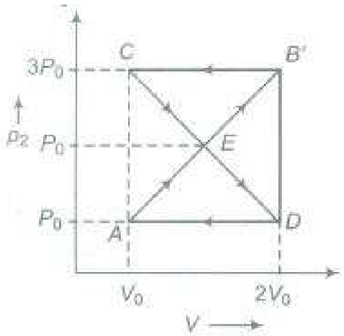
58. Which of the following is not a state function?
a) Work done at constant pressure b) Enthalpy
c) Work done by conservative force d) Work done by non-conservative force

59. (A) Adiabatic process is isoentropic.
(R) For adiabatic process ΔQ= 0 and change in entropy = $\frac{\Delta Q}{T}$.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

60. A motor-car tyre has a pressure of 2 atmosphere at 27°C. It suddenly bursts. If (C_p/C_v)= 1.4 for air, find the resulting temperature:
a) 27 K b) 27°C c) -27°C d) 246°C

Processing math: 100%

61. Athermodynamic system undergoes cyclic process ABCDA as shown in figure. The work done by the system in the cycle is :



a) P_0V_0 b) $2P_0V_0$ c) $P_0V_0/2$ d) Zero

62. A black body is at temperature of 500 K. It emits energy at rate which is proportional to:

a) $(500)^4$ b) $(500)^3$ c) $(500)^2$ d) 500

63. The work done in adiabatic process is given by:

a) $\frac{nR(T_1-T_2)}{\gamma}$ b) $\frac{nR(T_1-T_2)}{\gamma-1}$ c) $n\gamma(T_1-T_2)R$ d) $\frac{\gamma(T_1-T_2)R}{n}$

64. One mole of an ideal monoatomic gas undergoes a process described by the equation PV^3 = constant. The heat capacity of the gas during the process is:

a) R b) $\frac{3}{2}$R c) $\frac{5}{2}$R d) 2R

65. A diatomic gas initially at 18^oC is compressed adiabatically to one-eight of its original volume. The temperature after compression will be:

a) 18^oC b) 668.4 K c) 395.4^oC d) 144^oC

66. If one mole of a monoatomic gas γ =5/3 is mixed with one mole ofa diatomic gas γ =7/5, what is the value ofγ for the mixture?

a) 1.5 b) 1.53 c) 1.60 d) 1.52

67. An ideal gas at 21^oC is compressed adiabatically to $\frac{8}{27}$ of its original volume. The rise in temperature is $\left(\gamma = \frac{5}{3}\right)$

a) 475^oC b) 402^oC c) 275^oC d) 375^oC

68. A piece of ice falls from a height h so that it melts completely. Only one-quarter of the heat produced is absorbed by the ice and all energy of ice gets converted into heat during its fall. The value of h is [Latent heat of ice is 3.4×10^5 J/kg and g = 10 N/kg]

a) 136 km b) 68 km c) 4 km d) 544 km

69. A perfect gas is found to obey the relation $PV^{3/2}$ =constant during an adiabatic process. If such a gas initially at a temperature T, is compressed to half of its initial volume, then its final temperature will be:

a) 4T b) $(2)^{1/2}$T c) $2(2)^{1/2}$T d) 2T

70. An ideal gas system undergoes an isothermal process, then the work done during the process is

a) nRT In=$\frac{V_2}{V_1}$ b) nRT In=$\frac{V_1}{V_2}$ c) 2nRT In=$\frac{V_2}{V_1}$ d) 2nRT In=$(\frac{V_1}{V_2})$

71. According to kinetic theory of gases, at absolute zero temperature,

a) Water freezes b) Liquid helium freezes c) Molecular motion stops

d) Liquid hydrogen freezes

72. The work done in an isothermal expansion of a gas depends upon:

a) temperature only b) expansion ratio only

c) both temperature and expansion ratio

d) neither temperature nor expansion ratio

73. (A) It is impossible for a ship to use the internal energy of sea water to operate its engine.

(R) A refrigerator is a heat engine working in the reverse direction.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

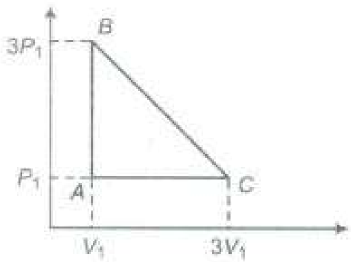
c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

74. A system performs work ΔW when an amount of heat ΔQ is added to the system. The corresponding change in the internal energy is ΔU. A unique function of initial and final states irrespective of the mode of change is:

a) ΔW b) ΔQ c) ΔW and ΔQ d) ΔU

75. An ideal gas is taken around the cycle ABCA as shown in the P-V diagram. The net work done by the gas during the cycle is equal to :



a) $12P_1V_1$ b) $6P_1V_1$ c) $3P_1V_1$ d) $2P_1V_1$

76. **Assertion:** A constant volume gas thermometer, reads temperature in terms of pressure.

Reason: In this case a plot of pressure Versus temperature gives a straight line.

Processing math: 100%

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

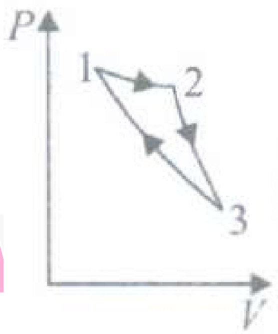
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

77. The molar specific heat at constant pressure of an ideal gas is (7/2)R. The ratio of specific heat at constant pressure to that at constant volume is:
a) 9/7 b) 7/5 c) 8/7 d) 5/7

78. A heat engine has an efficiency η. Temperatures of source and sink are each decreased by 100 K The efficiency of the engine
a) increases b) decreases c) remains constant d) becomes 1

79. Consider a cycle followed by an engine as shown in figure 1 to 2 is isothermal 2 to 3 is adiabatic 3 to 1 is adiabatic Such a process does not exist because



a)
heat is completely converted to mechanical energy in such a process, which is not possible.
b)
mechanical energy is completely converted to heat in this process, which is not possible.
c) curves representing two adiabatic processes can intersect.
d)
curves representing an adiabatic process and an isothermal process don't intersect.

80. Air is expanded from 50 litres to 150 litres at 2 atmospheric pressure. The external work done is (Given, 1 atm = 10^5 N m^{-2})
a) 2 x 10^{-8}J b) 2 x 10^4J c) 200 J d) 2000 J

81. The temperature of sink of Carnot engine is 27°C. Efficiency of engine is 25%. Then temperature of source is:
a) 227°C b) 327°C c) 127°C d) 27°C

Processing math: 100%

82. (A) All processes in which P and V are proportional, take place at constant temperature.
(R) Work done in a thermodynamical process is path independent.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

83. A refrigerator is to maintain eatables kept inside at 7°C. The coefficient of performance of refrigerator if room temperature is 38°C is
a) 15.5 b) 16.3 c) 20.1 d) 9.03

84. In isothermal process, which of the following is not true?
a) Internal energy does not change b) No heat enters or leaves the system
c) None of the above d) Temperature remains constant

85. Which of the following engines have 100% efficiency?
a) Auto engine b) Internal combustion engine c) Petrol engine
d) Carnot engine

86. In the adiabatic compression, the decrease in volume is associated with:
a) increase in temperature and decrease in pressure
b) decrease in temperature and increase in pressure
c) decrease in temperature and decrease in pressure
d) increase in temperature and increase in pressure

87. Internal energy of an ideal gas depends upon
a) temperature only b) volume only c) both volume and temperature
d) neither volume nor temperature

88. (A) Work cannot change the temperature of system.
(R) Only heat can change the temperature of a system
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion

Processing math: 100%

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

89. For a certain gas the ratio of specific heats is given to be g = 1.5, for this gas:

a) $C_v = \frac{3R}{J}$ b) $C_p = \frac{3R}{J}$ c) $C_p = \frac{5R}{J}$ d) $C_v = \frac{5R}{J}$

90. **Assertion:** The efficiency of a heat engine can never be unity.

Reason: Efficiency of heat engine is fundamental limitation given by first law of thermodynamics.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

91. An ideal gas A and a real gas B have their volumes increased from V to 2V under isothermal conditions. The increase in internal energy:

a) of A will be more than that of B b) of B will be more than that of A

c) will be same in both A and B d) will be zero in both the cases

92. When you make ice cubes, the entropy of water:

a) does not change b) increases c) decreases

d) may either increase or decreases depending on the process used

93. (A) Work done by a gas in isothermal expansion is more than the work done by the gas in the same expansion adiabatically.

(R) Temperature remains constant in isothermal expansion not in adiabatic expansion.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

94. The temperature inside a refrigerator is t_2 °C and the room temperature is t_1 °C. The amount of heat delivered to the room for each joule of electrical energy consumed ideally will be:

a) $\frac{t_1}{t_1-t_2}$ b) $\frac{t_1+273}{t_1-t_2}$ c) $\frac{t_2+273}{t_1-t_2}$ d) $\frac{t_2+273}{t_2-t_2}$

95. The efficiency of a Carnot engine working between 127°C and 77°C is
a) 10.5% b) 11.5% c) 12.5% d) 13.5%

96. If in an isothermal process, the volume of an ideal gas is halved, then we can say that:
a) internal energy of the system decreases
b) internal energy of the system increases c) work done by the gas is negative
d) work done by the gas is positive

97. The coefficients of linear expansions of brass and steel are a_1 and a_2 respectively. When we take a brass rod of length l_1 and a steel rod of length l_2 at $0\,^\circ\mathrm{C}$, then the difference in their lengths $\left(l_2-l_1\right)$ will remain the same at all temperatures, if:
a) $a_1 l_1 = a_2 l_2$ b) $a_1 l_2 = a_2 l_1$ c) $\alpha_1^2 l_2 = \alpha_2^2 l_1$ d) $\alpha_1 l_2^2 = \alpha_2 l_1^2$

98. (A) On removing the valve, the air escaping from a cycle tube becomes cool.
(R) On removing the valve, the gas expands suddenly and does work at the expense of its internal energy
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If assertion is true but reason is false
e) If assertion is false but reason is true

99. A thermally insulated vessel contains an ideal gas of molecular mass M and ratio of specific heats . It is moving with speed v and is suddenly brought to rest. Assuming no heat is lost to the surroundings, its temperature increases by:
a) $\frac{(\gamma-1)}{2(\gamma+1)R}$Mv^{2}K b) Mv^{2}K c) $\frac{\gamma MV^2}{2R}$K d) $\frac{(\gamma-1)}{2R}$Mv^{2}K

100. Which of the following is not a path function
a) $\triangle$Q b) $\triangle$Q+$\triangle$W c) $\triangle$W d) $\triangle$Q-$\triangle$W

101. Mayer's formula for the relation between two principal specific heats C_p and C_v of a gas is given by
a) $C_v - C_p = R$ b) $\frac{C_P}{C_v} = R$ c) $C_p - C_v = R$ d) $\frac{C_V}{C_P} = R$

102. In a cyclic process, which of the following statement is correct?

Processing math: 100%

a) Change in internal energy is not zero.

b) The system returns to its initial state and it is is reversible.

c) The total heat absorbed by the system is not equal to work done by the system.

d) Change in internal energy is zero.

103. A Camot's reversible engine conver $\frac{1}{6}$ of heat input into work. When the temperature of the sink is reduced by 62 K, the efficiency of Carnot's cycle becomes (1/3). The temperature of the source and the sink (in degree kelvin) are respectively:
a) 372, 310 b) 472, 410 c) 310, 372 d) 744, 682

104. Two containers A and B are partly filled with water and closed. The volume of A is twice that of B and it contains half the amount of water in B. If both are at the same temperature, the water vapour in the containers will have pressure in the ratio of ______________ .
a) 1: 2 b) 1: 1 c) 2: 1 d) 4: 1

105. (A) The specific heat of a gas in an adiabatic process is zero but it is infinite in an isothermal process.
(R) Specific heat of a gas is directly proportional to heat exchanged with the system and inversely proportional to change in temperature.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

106. Find the amount of work done to increase the temperature of one mole of ideal gas by 30°C, if it is expanding under the condition $V \propto T^{2/3}$: (R = 8.31 J/mol-K)
a) 16.62 J b) 166.2 J c) 1662 J d) 1.662 J

107. A Carnot engine with sink's temperature at 17°C has 50% efficiency. By how much should its source temperature be changed to increase its efficiency to 60%?
a) 225 K b) 128^0C c) 580 K d) 145 K e) 145^0C

108. Which of the following is not a thermodynamic coordinate?
a) Gas constant (R) b) Volume (V) c) Pressure (P) d) Temperature (T)

109. A sample of gas expands from volume V_1 to V_2. The amount of work done by the gas is greatest when the expansion is:
a) Adiabatic b) Isobaric c) Isothermal d) Equal in all above cases

110. If a gas is compressed adiabatically by doing work of 150 J, the change in internal energy of the gas is

a) 100 J   b) 150 J   c) 200 J   d) 250 J

111. Relation between pressure (p) and energy (E) of a gas is:

a) $p = \frac{2}{3}E$ b) $P = \frac{1}{3}E$ c) $p = \frac{3}{2}E$ d) p =3 E

112. Which is an intensive property?

a) Volume   b) Mass   c) Refractive index   d) Weight

113. Which of the following processes described below is irreversible?

a) The increase in temperature of an iron rod by hammering it.

b)

A gas in a small container at a temperature T_1 is brought in contact with a big reservoir at a higher temperature T_2 which increases the temperature of the gas.

c)

An ideal gas is enclosed in a piston cylinder arrangement with adiabatic walls. A weight W is added to the piston resulting in compression of gas.

d) All of above

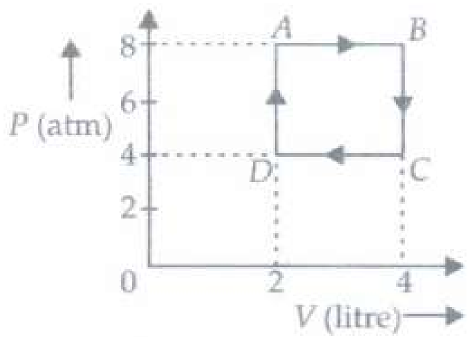
114. Which of the following parameters does not characterise the thermodynamic state of matter?

a) Temperature   b) Pressure   c) Work   d) Volume

115. A mass of diatomic gas (g = 1.4) at a pressure of 2 atmospheres is compressed adiabatically so that its temperature rises from 27°C to 927°C. The pressure of the gas in final state is _____________ .

a) 28 atm   b) 68.7 atm   c) 256 atm   d) 8 atm

116. One mole of an ideal gas undergoes a cyclic process ABCDA as shown in the P- V diagram, The net work done in the process is (1 atm = 10^6 dyne cm^{-3})



a) 500 J   b) 700 J   c) 800 J   d) 900 J

117. (A) If heat is supplied to an ideal gas in an isothermal process, the internal energy of the gas increases.

(R) When an ideal gas expands adiabatically, it does positive work and its internal energy increases.

a)
If both assertion and reason are true and reason is the correct explanation of assertion

b)
If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false   d) If both assertion and reason are false

e) If assertion is false but reason is true

118. If the amount of heat given to a system is 35 J and the amount of work done on the system is 15 J, then the change in internal energy of the system is:
a) -50 J   b) 20 J   c) 30 J   d) 50 J   e) -20 J

119. 50 g of oxygen at NTP is compressed adiabatically to a pressure of 5 atmosphere. The work done on the gas, ify = 1.4 and R = 8.31 J mol^{-1} K^{-1} is
a) - 5173 J   b) 1131 J   c) - 1364 J   d) 5673

120. When two bodies A and B are in thermal equilibrium:
a) the KE of all the molecules of A and B will be equal

b) the PE of all the molecules of A and B will be equal

c) the internal energies of the two bodies will be equal

d) the average kinetic energy of the molecules of the two bodies will be equal

121. If the energy input to a Carnot engine is thrice the work it performs then, the fraction of energy rejected to the sink is:
a) $\frac{1}{3}$ b) $\frac{1}{4}$ c) $\frac{2}{5}$ d) $\frac{2}{3}$ e) $\frac{3}{4}$

122. When the door of a refrigerator is kept open then the room temperature starts
a) cool down   b) hot up   c) first cool down then hot up

d) neither cool down nor hot up

123. An engine has an efficiency of 1/6. When the temperature of sink is reduced by 62^oC, its efficiency is doubled. Temperature of the source is ____________ .
a) 37^oC b) 62^oC c) 99^oC d) 124^oC

124. At 27°C, a gas is suddenly compressed such that its pressure becomes 1/8th of original pressure. Temperature of the gas will be: (γ=5/3)
a) 420 K   b) 327^0C c) 300 K   d) -142^0C

125. Two rigid boxes containing different ideal gases are placed on a table. Box A contains one mole of nitrogen at temperature T_0, while box B contains one mole of helium at temperature (7/3)T_0. The boxes are then put into thermal contact with

Processing math: 100%

each other and heat flows between them until the gases reach a common final temperature (Ignore the heat capacity of.boxes). Then, the final temperature of the gases T_f in terms of T_0 is:

a) $T_f=\frac{5}{2}T_0$ b) $T_f=\frac{3}{7}T_0$ c) $T_f=\frac{7}{3}T_0$ d) $T_f=\frac{3}{2}T_0$

126. A gas is suddenly expanded such that its final volume becomes 3 times its initial volume. If the specific heat at constant volume of the gas is 2R, then the ratio of initial to final pressure is nearly equal to:

a) 5 b) 6.5 c) 7 d) 3.5

127. (A) The value of ΔQ is always zero in adiabatic process.

(R) Adiabatic process is always a cyclic process.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

128. γ of a gas is 7/5. Then, the gas may be:

a) He b) H_2 c) Ar d) Ne

129. Pressure P, volume V and temperature T for a A certain gas are related by P = $\frac{AT-BT^2}{V}$, where A V and B are constants. The work done by the gas as its temperature change from T_1 to T_2 while pressure remaining constant is

a) A-$\frac{B}{2}$(T_2 -T_1) b) A(T_2-T_1)-B($T_2^3-T_1^3$) c) $\frac{A}{2}(T_2^2-T_1^2)-\frac{B}{3}(T_2^3-T_1^3)$

d) $A(T_2-T_1)^2-\frac{B}{3}(T_2-T_1)^3$

130. In which of the following thermodynamic process of the gas, the work done is maximum?

a) Isothermal b) Isobaric c) Adiabatic d) Isochoric

131. Universal constant is:

a) C_p/C_v b) C_p-C_v c) C_p+C_v d) C_p/C_v

132. First law of thermodynamics concerns conservation of:

a) heat b) work c) momentum d) energy

133. An ideal heat engine working between temperatures T_H and T_L has efficiency η. If both the temperatures are raised by 100 K each, the new efficiency (η) of the heat engine will be:

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a) equal to η b) greater than η c) less than η

d) greater or less than η depending upon the nature of the working substance

134. (A) First law of thermodynamics allows many processes which actually don't happen.

(R) First law of thermodynamics must not be violated for any process to happen.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

135. The pressure of a gas is raised from 27°C to 927°C. The root mean square speed

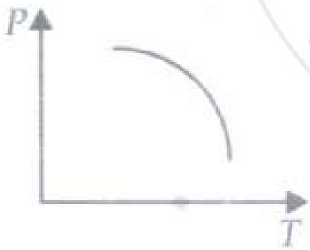
a) Is $\sqrt{\left(\frac{927}{27}\right)}$ times the earlier value b) Remains the same c) Gets halved

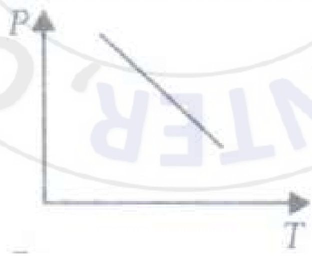
d) Gets doubled

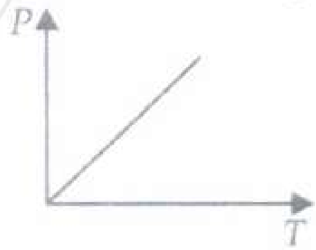
136. The molar specific heats of an ideal gas at constant pressure and volume are denoted by C_p and C_v, respectively. If $\gamma = C_p/C_v$ and R is the universal gas constant, then C_v is equal to:

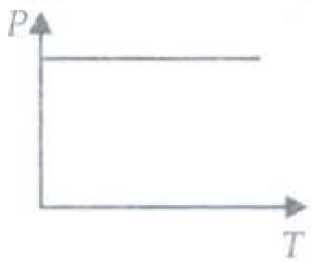
a) γR b) $1+\gamma/1-\gamma$ c) $R/\gamma-1$ d) $\gamma-1/R$

137. Which of the following P- Y diagram represent the graph of isometric process?

a) 

b) 

c) 

d) 

138. When 1 kg of ice at 0°C melts to water at 0°C, the resulting change in its entropy, taking latent heat of ice to be 80 cal/^{0}C is :

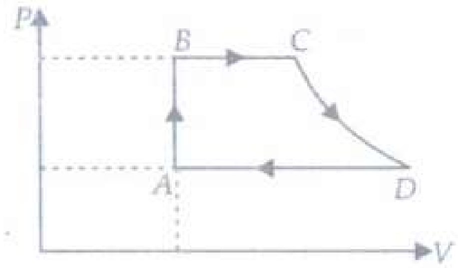
a) 293 cal/K b) 273 cal/K c) 8 x 10^4 cal/K d) 80 cal/K

139. The efficiency of the reversible heat engine is η_r and that of irreversible heat engine is η_I. Which of the following relations is/are correct?

a) $\eta_r > \eta_I$ b) $\eta_r < \eta_I$ c) $\eta_r = \eta_I$ d) $\eta_r > 1$ and $\eta_I < 1$

140. If an engine delivers 9.5 x 10^6 J of work per hour and absorbs 6.2 x 10^7 J of heat per hour, then the amount of heat wasted per hour is:
a) 6.95 x 10^7 J b) 5.25 x 10^7 J c) 8.55 x 10^7 J d) 9.55 x 10^7 J

141. A cycle followed by an engine (made of one mole of an ideal gas in a cylinder with a piston) is shown in figure. The heat exchanged by the engine with the surroundings at constant volume is (Take C_v = 3/2R)



a) $(P_B - P_A)V_A$ b) $\frac{1}{2}(P_B - P_A)V_A$ c) $\frac{3}{2}(P_B - P_A)V_A$ d) $\frac{5}{2}(P_B - P_A)V_A$

142. (A) For a heat engine, the thermodynamics P-V cyclic curve is always clockwise.
(R) A clockwise cyclic P- V curve does positive work.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

143. A heat insulating cylinder with a movable piston contains 5 moles of hydrogen at standard temperature and pressure if the gas is compressed to quarter of its original volume then the pressure of the gas is increased by (γ = 1.4)
a) $(2)^{1.4}$ b) $(3)^{1.4}$ c) $(4)^{1.4}$ d) $(5)^{1.4}$

144. When heat is added to a system which of the following is not possible?
a) Internal energy of the system increases b) Work is done by the system
c) Neither internal energy increases nor work is done by the system
d) Internal energy increases and also work is done by the system

145. A given quantity of an ideal gas is at pressure P and absolute temperature T. The isothermal bulk modulus of the gas is:
a) $\frac{2}{3}$P b) P c) $\frac{3}{2}$P d) 2P

146. An ideal gas has molar specific heat 5R/2 at constant pressure. If 300 J of heat is given to two moles of gas at constant pressure, the change in temperature is:
a) 7.22^{0}C b) 8.94^{0}C c) zero d) 5^{0}C

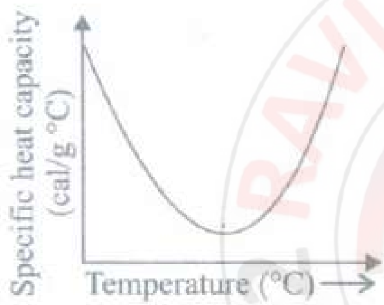
147. During adiabatic process pressure P versus density ρ equation is:
a) $P\rho^{\gamma}$=constant b) $P\rho^{-\gamma}$=constant c) $P^{\gamma}\rho^{1+\gamma}$ =constant d) $P^{1/\gamma}\rho^{\gamma}$=constant

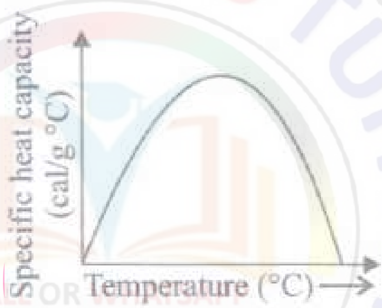
148. The quantities of heat required to raise the temperature of two solid copper spheres of radii r_1 and $r_2\left(r_1 = 1.5r^2\right)$ through 1K are in the ratio:
a) $\frac{5}{3}$ b) $\frac{27}{8}$ c) $\frac{9}{4}$ d) $\frac{3}{2}$

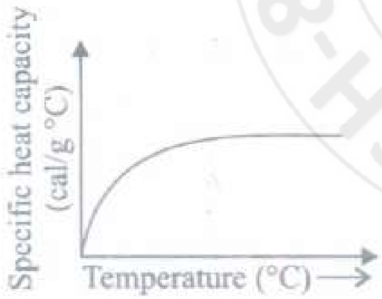
149. To complete one cycle of operation of an ideal Carnot engine, the time taken is:
a) finite b) infinite c) very small d) zero

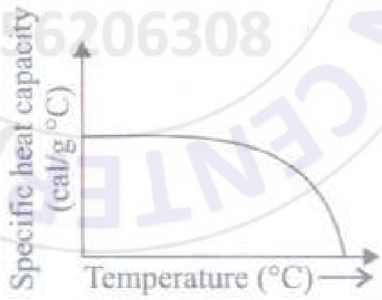
150. The temperature of source and sink of a heat engine are 127°C and 27°C respectively. An inventor claims its efficiency to be 26% then:
a) It is impossible b) It is possible with high probability
c) It is possibie with low probability d) Data are insufficient

151. Which one of the following graphs represents variation of specific heat capacity of water with temperature?

a) 

b) 

c) 

d) 

152. A frictionless heat engine can be 100% efficient only if its exhaust temperature is:
a) 0^0C b) 0 K c) equal to its input temperature d) half of its input temperature

153. **Assertion:** The zeroth law said that, when two systems A and B, are in thermal equilibrium, there must be a physical quantity that has the same value for both.
Reason: The physical quantity which is same for both systems is temperature.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

154. A person of mass 70 kg wants to loss 5 kg by going up and down a 10m high stairs. He bums twice as much fat while going up than coming down. If 1 kg is burnt on expanding 7000 kilocalories, the number of times he must go up and down to reduce his weight by 4 kg is :

a) 1000 b) 5600 c) 22400 d) 11200

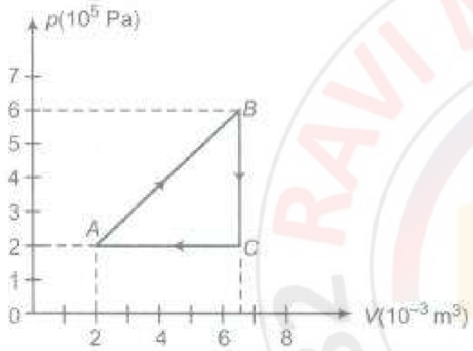
155. In irreversible processes, the entropy of the universe:

a) decreases b) increases c) remains unchanged d) fluctuates

156. A body cools from 50°C to 49.9°C in 5s. How long will it take to cool from 40°C to 39 .9°C? (Assume the temperature of surroundings to be 30.0°C and Newton's law of cooling to be valid)

a) 2.5s b) 10s c) 20s d) 5s

157. A gas is taken through the cycle A-B-C-A, as shown, what is the net work done by the gas?



a) -2000 J b) 2000 J c) 1000 J d) 0 J

158. "Two systems in thermal equilibrium with a third system separately are in thermal equilibrium with each other":

The above statement is

a) First law of thermodynamics b) Second law of thermodynamics

c) Third law of thermodynamic d) Zeroth law of thermodynamics

159. If a steam engine delivers 6.0 x 10^8 J of work per minute and absorbs 5.4 x 10^9 J of heat per minute from its boiler then the efficiency of the engine is:

a) 11% b) 12% c) 13% d) 14%

160. The ratio of the molar heat capacities of a diatomic gas at constant pressure to that at constant volume is:

a) $\frac{7}{2}$ b) $\frac{3}{2}$ c) $\frac{3}{5}$ d) $\frac{7}{5}$ e) $\frac{5}{2}$

161. In adiabatic expansion of a gas:

a) its pressure increases b) its temperature falls c) its density increases

d) its thermal energy increases

162. Which of the following is not thermodynamical function:

a) Enthalpy b) Work done c) Gibb's energy d) Internal energy

163. A beaker full of hot water is kept in a room. If it cools from $80\,^\circ\mathrm{C}$ to $75\,^\circ\mathrm{C}$ in t_1 minutes from $75\,^\circ\mathrm{C}$ to $70\,^\circ\mathrm{C}$ in t_2 minutes and from $70\,^\circ\mathrm{C}$ to $65\,^\circ\mathrm{C}$ to in t_3 minutes, then

a) $t_1 = t_2 = t_3$ b) $t_1 < t_2 = t_3$ c) $t_1 < t_2 < t_3$ d) $t_1 > t_2 > t_3$

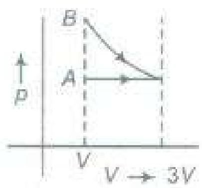
164. Two moles of an ideal gas at 300 K were cooled at constant volume, so that the pressure is reduced to half the initial value. Then, as a result of heating at constant pressure the gas has expanded till it attains the original temperature. Find the total heat absorbed by gas, if R is the gas constant.

a) 150R joules b) 300R joules c) 75R joules d) 100R joules

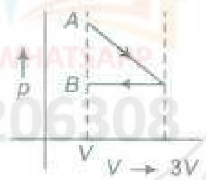
165. An ideal gas with pressure P, volume V and temperature T is expanded isothermally to a volume 2V and a final pressure P_I. The same gas is expanded adiabatically to a volume 2V, the final pressure is PA . In terms of the ratio of the two specific heats for the gas γ. the ratio P_I/P_A is:

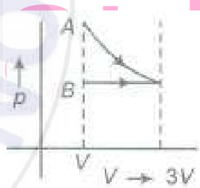
a) $2^{\gamma-1}$ b) 1/γ c) 2γ d) 2γ

166. One mole of an ideal gas goes from an initial state A to final state B via two processes. It first undergoes isothermal expansion from volume V to 3V and then its volume is reduced from 3V to V at constant pressure. The correct P-V diagram representing the two processes is

a) 

b) 

c) 

d) 

167. **Assertion:** The temperature of a gas does not change, when it undergoes on adiabatic process.

Reason: During adiabatic process, heat energy is exchanged between a system and surroundings.

a)
If both assertion and reason are true and reason is the correct explanation of assertion

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

168. A Carnot engine takes heat from a reservoir at 627°C and rejects heat to the sink at 27°C. Its efficiency will be:

a) 3/5 b) 1/3 c) 2/3 d) 200/209

169. Refrigerator with coefficient of performance $\frac{1}{3}$ releases 200 J of heat to a hot reservoir. Then the work done on the working substance is:
a) $\frac{100}{3}$ J b) 100 J c) $\frac{200}{3}$ J d) 150 J

170. The pressure and density of a diatomic gas (γ = 7/5) change adiabatically from (P.p)to (P'.ρ) If (P'/ P) = 32, (ρ'/ ρ') should be equal to:
a) (1/128) b) 32 c) 128 d) none of these

171. A closed gas cylinder is divided into two parts by a piston held tight. The pressure and volume of gas in two parts respectively are (P, 5V) and (10P, V). If now the piston is left free and the system undergoes isothermal process, then the volume of the gas in two parts respectively are:
a) 2V, 4V b) 3V, 3V c) 5V, V d) 4V, 2V e) 2.5V, 3.5V

172. If γ be the ratio of specific heats of a perfect gas to the number of degrees of freedom of a molecule of the gas is:
a) $\frac{25}{2}(\gamma-1)$ b) $\frac{3\gamma-1}{2\gamma-1}$ c) $\frac{2}{\gamma-1}$ d) $\frac{9}{2}(\gamma-1)$

173. Two identical cylinders A and B with frictionless pistons contain the same ideal gas at the same temperature and the same volume V. The mass of gas A is m_A and that of B is m_B. The gas in each cylinder is now allowed to expand isothermally to the same final volume 2 V. The change in the pressure in A and B are found to be 1P and 1.5M respectively. Then :
a) $4m_A = 9m_B$ b) $3m_A = 3m_B$ c) $3m_A = 2m_B$ d) $9m_A = 4m_B$

174. Temperature of argon kept in a vessel is raised by 1°C at constant volume. Heat supplied to the gas may be taken partly as: (i) translational and partly (ii) rotational kinetic energies. Their respective shares are:
a) 60%, 40% b) 50%, 50% c) 100%, zero d) 40%, 60%

175. A refrigerator works between 4°C and 30°C. It is required to remove 600 calories of heat every second in order to keep the temperature of the refrigerated space constant. The power required is [Take 1 cal = 4.2 joules)
a) 236.5 W b) 2365 W c) 2.365 W d) 23.65 W

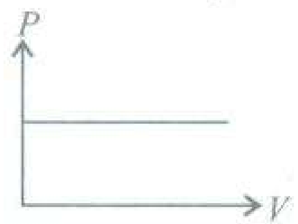
176. Ratio of C_p and C_v depends upon temperature according to the following relation:
a) $\gamma \propto T$ b) $\gamma \propto (1/T)$ c) $\gamma \propto \sqrt{T}$ d) $\gamma \propto T^0$

177. Quantity of a substance in a closed system is made to undergo a reversible process from an initial volume of 3 m^3 and initial pressure 105 N/m^2 to a final volume of 5 m^3. If the pressure is proportional to the square of the volume (i.e., $P = AV^2$), the work done by the substance will be:
a) 3.6×10^2 J b) 7.4×10^3 J c) 2.2×10^4 J d) 3.6×10^5 J

Processing math: 100%

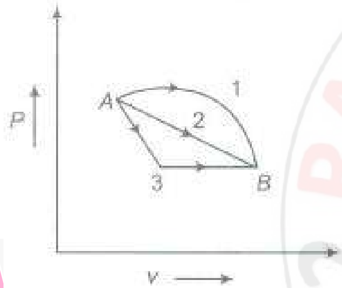
178. We consider a thermodynamic system. If DU represents the increase in its internal energy and tt the work done by the system, which of the following statements is true?
a) $\Delta U = -W$ in an adiabatic process b) $\Delta U = W$ in an isothermal process
c) $\Delta U = -W$ in an isothermal process d) $\Delta U = W$ in an adiabatic process

179. Which of the following process is correct for the given P - V diagram.



a) Adiabatic process b) Isothermal process c) Isobaric process
d) Isochoric process

180. An ideal gas goes from state A to state B via three different processes as indicated in the P-V diagram. If Q_1, Q_2, Q_3 indicate the heat absorbed by the gas along the three processes and Δu_1, Δu_2, Δu_3 indicate the change in internal energy along the three processes respectively, then:



a) $Q_3 > Q_2 > Q_1$ and $\Delta u_1 > \Delta u_2 > \Delta u_3$ b) $Q_1 > Q_2 > Q_3$ and $\Delta u_1 = \Delta u_2 = \Delta u_3$
c) $Q_3 > Q_2 > Q_1$ and $\Delta u_1 = \Delta u_2 = \Delta u_3$ d) $Q_1 = Q_2 = Q_3$ and $\Delta u_1 > \Delta u_2 > \Delta u_3$

181. A diatomic ideal gas is used in a car engine as the working substance. If during the adiabatic expansion part of the cycle, volume of the gas increases from V to 32 V, the efficiency of the engine is:
a) 0.5 b) 0.75 c) 0.99 d) 0.25

182. Thermal capacity of 40g of aluminium $(s = 0.2 ca/g - K)$ is:
a) $168\ J/{}^\circ C$ b) $672\ J/{}^\circ C$ c) $840\ J/{}^\circ C$ d) $33.6\ J/{}^\circ C$

183. The efficiency of Carnot engine is 0.6. It rejects 20 J of heat to the sink. The work done by the engine is:
a) 20 J b) 30 J c) 33.5 J d) 50 J

184. If 2 moles of an ideal monatomic gas at temperature T_0 is mixed with 4 moles of another idea! monoatomic gas at temperature $2T_0$, then the temperature of the mixture is:
a) $\frac{5}{3}T_0$ b) $\frac{3}{2}T_0$ c) $\frac{4}{3}T_0$ d) $\frac{5}{4}T_0$

Processing math: 100%

185. When two moles of oxygen is heated from 0°C to 10°C at constant volume, its internal energy changes by 420 J. What is the molar specific heat of oxygen at constant volume?
a) 5.75 JK^{-1} mol^{-1} b) 10.5 JK^{-1} mol^{-1} c) 21 JK^{-1} mol^{-1} d) 42 JK^{-1} mol^{-1}

186. Mercury thermometer can be used to measure temperature up to:
a) 260°C b) 100°C c) 360°C d) 500°C

187. An ideal monoatomic gas at 27^0C is compressed adiabatically to 8/27 times of its present volume. The increase in temperature of the gas is:
a) 402^0C b) 375^0C c) 475^0C d) 175^0C

188. 70 calories of heat are required to raise the temperature of 2 moles of an ideal gas at constant pressure from 30°C to 35°C. The amount of heat required to raise the temperature of the same gas through same range (30°C to 35°C) at constant volume is:
a) 30 cal b) 50 cal c) 70 cal d) 90 cal

189. The work done in an adiabatic change in a particular gas depends upon only:
a) change in volume b) change in pressure c) change in temperature
d) none of these

190. The radiant energy from the sun, incident normally at the surface of earth is $20 \mathrm{kcal/m^2\,min}$. What would have been the radiant energy, incident normally on the earth, if the sun had a temperature, twice of the present one?
a) $160 \mathrm{kcal/m^2\,min}$ b) $40 \mathrm{kcal/m^2\,min}$ c) $320 \mathrm{kcal/m^2\,min}$ d) $80 \mathrm{kcal/m^2\,min}$

191. An ideal gas is compressed to half its initial volume by means of several processes. Which of the process results in the maximum work done on the gas?
a) Isothermal b) Adiabatic c) Isobaric d) Isochoric

192. The theory of refrigerator is based on:
a) Joule-Thomson effect b) Newton's particle theory c) Joules's effect
d) none of the above

193. The amount of heat supplied to 4 x 10^{-2} kg of nitrogen at room temperature to rise its temperature by 50°C at constant pressure is (Molecular mass of nitrogen is 28 and R = 8.3 J mol^{-1} k^{-1})
a) 2.08 kJ b) 3.08 kJ c) 4.08 kJ d) 5.08 kJ

194. **Assertion:** First law of thermodynamics does not forbid flow of heat from lower temperature to higher temperature.
Reason: Heat supplied to a system is always equal to the increase in its internal energy.

Processing math: 100%

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

195. The internal energy change in a system that has absorbed 2 kcals of heat and done 500 J of work is :

a) 6400 J b) 5400 J c) 7900 J d) 8900 J

196. Which relation is correct for isometric process?

a) ΔQ=ΔU b) ΔW=ΔU c) ΔQ=ΔW d) None of these

197. A carnot engine has the same efficiency between 800K to 500K and x K to 600K. The value of x is :

a) 1000 K b) 960 K c) 846 K d) 754 K

198. A one mole of an ideal gas expands adiabatically at constant pressure such that its temperature $T \propto \frac{1}{\sqrt{V}}$.The value of the adiabatic constant of gas is

a) 1.3 b) 1.5 c) 1.67 d) 2.0

199. (A) The efficiency of a carnot cycle depends on the nature of the gas used.

(R) Adiabatic is a part of carnot cycle and work done in adiabatic process does not depend on nature of gas.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

200. Compressed air in the tube of a wheel of a cycle at normal temperature suddenly starts coming out from a puncture. The air inside:

a) Starts becoming hotter b) Remains at the same temperature

c) Starts becoming cooler

d)

May become hotter or cooler depending upon the amount of water vapour present.

Processing math: 100%

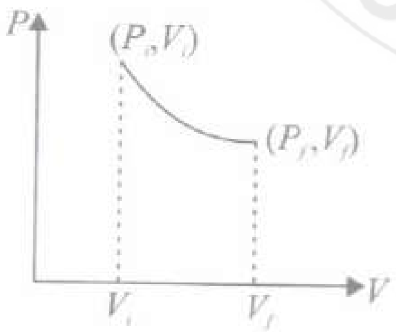
201. A Carnot engine works first between 200°C and 0°C and then between 0°C and -200°C. The ratio of its efficiency in these two cases is:
a) 1.0 b) 0.721 c) 0.577 d) 0.34

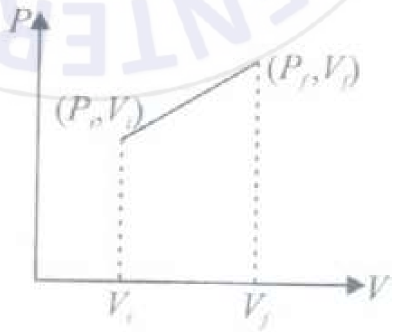
202. In an adiabatic process, there is no:
a) change in temperature b) exchange of heat c) change in internal energy
d) work done

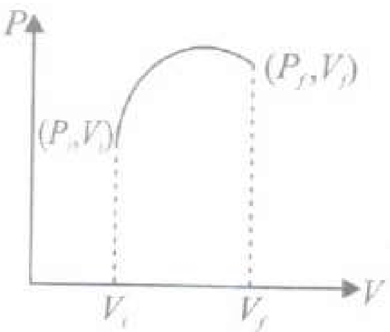
203. A monoatomic gas of n-moles is heated from temperature T_1 to T_2 under two different conditions (i) at constant volume and (ii) at constant pressure. The change in internal energy of the gas is :
a) More for (i) b) More for (ii) c) Same in both cases
d) Independent of number of moles

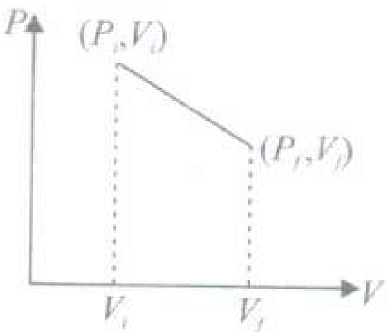
204. **Assertion:** The isothermal curves intersect each other at a certain point.
Reason: The isothermal changes take place rapidly, so the isothermal curves have very little slope.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

205. The initial state of certain gas is (P_i V_i T_i). It undergoes expansion till its volume becomes V_f at constant temperature T. The correct plot of P- V diagram for it is:

a) 

b) 

c) 

d) 

206. 10g of ice cubes at $0^\circ C$ are released in a tumbler (water equivalent $55\ g$) at $40^\circ C$. Assuming that negligible heat is taken from the surroundings, the temperature of water in the tumbler becomes nearly $(L = 80 cal/g)$,

a) $31^\circ C$ b) $22^\circ C$ c) $19^\circ C$ d) $15^\circ C$

207. The efficiency of a Carnot engine operating between temperatures of 100^oC and 23^oC will be:

a) $\frac{100-23}{273}$ b) $\frac{100+23}{373}$ c) $\frac{100+23}{100}$ d) $\frac{100-23}{100}$

208. For a gas, if $\gamma = 1.4$, then atomicity, C_p and C_v of the gas are respectively:

a) $\frac{5R}{2}, \frac{3R}{2}$ b) monoatomic, $\frac{7R}{2}, \frac{5R}{2}$ c) diatomic, $\frac{7R}{2}, \frac{5R}{2}$ d) triatomic, $\frac{7R}{2}, \frac{5R}{2}$

209. A gas is taken through a number of thermodynamic states. What happens to its specific heat?

a) It is always constant b) It increases c) It decreases

d) It can have any value depending upon process of heat absorbed or evolved

210. Suppose the distance between the atoms of a diatomic gas remains constant. Its specific heat at constant volume per gram mole is:

a) 5R/2 b) 3R/2 c) R d) R/2

211. For a gas molecule with 6 degrees of freedom, the law of equipartition of energy gives the following relation between the molar specific heat (C_v) and gas constant R:

a) $C_v=\frac{R}{2}$ b) $C_v=R$ c) $C_v=2R$ d) $C_v=3R$

212. A Carnot engine whose efficiency is 50% has an exhaust temperature of 500 K. If the efficiency is to be 60% with the same intake temperature, the exhaust temperature must be (in K).

a) 800 b) 200 c) 400 d) 600

213. If the temperature of the sun is doubled, the rate of energy received on earth will be increased by a factor of:

a) 2 b) 4 c) 8 d) 16

214. 110 J of heat is added to a gaseous system, whose internal energy is 40 J, then the amount of external work done is:

a) 150 J b) 70 J c) 110 J d) 40 J

215. The maximum amount of mechanical energy that can be converted into heat in any process:

a) is 100% b) depends upon the temperatures at intake and exhaust

c) depends upon the amount of friction present

d) depends upon the nature of mechanical energy

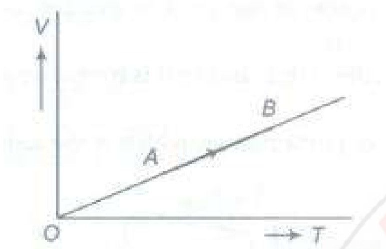
216. If Q, E and W denote respectively the heat added, change in internal energy and the work done in a closed cycle process, then:

a) W=0 b) Q=W≠0 c) E=0 d) Q=0

217. A refrigerator works between 3°C and 40°C. To keep the temperature of the refrigerator constant, 600 calories of heat are to be removed every second. The power required is:
a) 33.78 watt b) 337.8 watt c) 7.77 watt d) 10.77 watt

218. The efficiency of an ideal heat engine working between the freezing point and boiling point of water, is:
a) 6.25% b) 20% c) 26.8% d) 12.5%

219. The volume (V) of a monatomic gas varies with its temperature (T), as shown in the graph. The ratio of work done by the gas, to the heat absorbed by it, when it undergoes a change from state A to state B, is



a) 1/3 b) 2/3 c) 2/5 d) 2/7

220. The degrees of freedom of a molecule of a triatomic gas are:
a) 2 b) 4 c) 6 d) 8

221. If c_s be the velocity of sound in air and c be the rms velocity, then:
a) C_s b) $c_S = c$ c) $c_S = c\left(\frac{\gamma}{3}\right)^{1/2}$ d) None of these

222. If heat Q is added reversibly to a system at temperature T and heat Q' is taken away from it reversibly at temperature T', then which one of the following is correct?
a) $\frac{Q}{T} - \frac{Q'}{T'}=0$ b) $\frac{Q}{T} - \frac{Q'}{T'}>0$ c) $\frac{Q}{T} - \frac{Q'}{T'}<0$
d) $\frac{Q}{T} - \frac{Q'}{T'}$=change in internal energy of system

223. dW + dU = 0 is valid for:
a) adiabatic process b) isothermal process c) isobaric process
d) isochoric process

224. An ideal Carnot engine, whose efficiency is 40%, receives heat at 500 K. If its efficiency is 50%, then the intake temperature for the same exhaust temperature is:
a) 600 K b) 700 K c) 800 K d) 900 K

225. What amount of heat must be supplied to 35 g of oxygen at room temperature to raise its temperature by 80°C at constant volume (molecular mass of oxygen is 32 and R = 8.3 J mol^{-1} K^{-1})
a) 1.52 kJ b) 3.23 kJ c) 1.81 kJ d) 1.62 kJ

226. An ideal gas at pressure P is adiabatically compressed so that its density becomes n times the initial value, The final pressure of the gas will be $\left(\gamma = \frac{C_p}{C_v}\right)$

a) n^γP b) (n - γ)P c) n(γ - 1) P d) n(1 - γ)P

227. A monoatomic gas supplied the heat Q very slowly keeping the pressure constant. The work done by the gas will be:

a) $\frac{2}{3}$Q b) $\frac{3}{5}$Q c) $\frac{2}{5}$Q d) $\frac{1}{5}$Q

228. If ΔU and ΔW represent the increase in internal energy and work done by the system respectively in a thermodynamical process, which of the following is true?

a) Δu = -ΔW, in a isothermal process b) Δu = -ΔW, in a adiabatic process

c) Δu = -ΔW, in a isothermal process d) Δu = -ΔW, in a adiabatic process

229. One mole of an ideal gas expands isothermally so that its pressure falls from 1.0 x 10^5 Pa to 0.5 x 10^5 Pa. The change in entropy of the gas is equal to:

a) zero b) 0.693 J/K c) 5.76 J/K d) none of these

230. If the door of a refrigerator is kept open, then which of the following is true:

a) Room is cooled b) Room is heated c) Room is either cooled or heated

d) Room is neither cooled nor heated

231. A gas expands with temperature according to the relation V = $KT^{2/3}$ work done when the temperature changes by 60 K is:

a) 10 R b) 30 R c) 40 R d) 20 R

232. One mole of an ideal gas at an initial temperature of T K does 6R joules of work adiabatically. If the ratio of specific heats of this gas at constant pressure and at constant volume is 5/3, the final temperature of gas will be:

a) (T-4)K b) (T+2.4)K c) (T-2.4)K d) (T+4)K

233. For a heat engine sink temperature is 280 K and its efficiency is 50%. What will be the temperature of source?

a) 327 K b) 560 K c) 283 K d) 227 K

234. If R is the universal gas constant, the amount of heat needed to raise the temperature of 2 moles of an ideal monoatomic gas from 273 K to 373 K when no work is done is

a) 100 R b) 150 R c) 300 R d) 500 R

235. Two Carnot engines A and B are operated in series. The engine A receives heat from the source at temperature T_1 and rejects the heat to the sink at temperature T. The second engine B receives the heat at temperature T and, rejects to its sink at temperature T_2. For what value of T the efficiencies of the two engines are equal?

a) $\frac{T_1+T_2}{2}$ b) $\frac{T_1-T_2}{2}$ c) T_1T_2 d) $\sqrt{T_1T_2}$

236. 1 mole of a gas having $\gamma=\frac{7}{5}$ is mixed with 1 mole of a gas having $\gamma=\frac{4}{3}$. What will be the y for the mixture?
a) $\frac{5}{11}$ b) $\frac{15}{13}$ c) $\frac{15}{11}$ d) $\frac{5}{13}$

237. Which of the following relations is correct between pressure and temperature?
a) $P^{1-\gamma}T^{\gamma}$ b) $P^{\gamma}T^{\gamma}$ c) $P^{\gamma}T^{1-\gamma}$ d) $P^{\gamma}T^{\gamma-1}$

238. (A) It is not possible for a system, unaided by an external agency to transfer heat from a body at lower temperature to another body at a higher temperature.
(R) According to Clausius statement "No process is possible whose sole result is the transfer of heat from a cooled object to a hotter object."
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

239. 5 moles of hydrogen $\left(\gamma=\frac{7}{5}\right)$ initially at STP are compressed adiabatically so that its temperature becomes 400°C. The increase in the internal energy of the gas (in kilo-joules) is: (R = 830 J/mol^{-K})
a) 21.55 b) 41.50 c) 65.55 d) 80.55

240. If the degrees of freedom of a gas molecule be f then the ratio of two specific heats C_p / C_v is given by:
a) $\frac{2}{f}+1$ b) $1-\frac{2}{f}$ c) $1+\frac{1}{f}$ d) $1-\frac{1}{f}$

241. A Carnot engine absorbs 750 J of heat energy from a reservoir at 137°C and rejects 500 J of heat during each cycle, then the temperature of sink is:
a) 0.25°C b) 0.34°C c) 0.44°C d) 0.54°C

242. 540 calories of heat convert 1 cubic centimetre of water at 100^0C into 1671 cm^3 of steam at 100^0C. Then, the work done against atmospheric pressure is nearly
a) 540 cal b) 40 cal c) zero cal d) 500 cal

243. The Zeroth law of thermodynamics leads to the concept of
a) internal energy b) heat content c) pressure d) temperature

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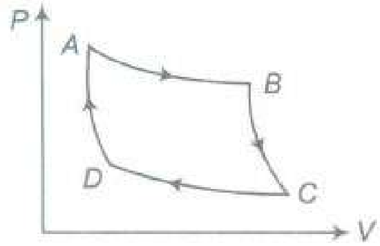
244. The P-V graph of an ideal gas cycle is shown here as below. The adiabatic process is described by:



a) AB and BC b) AB and CD c) BC and DA d) BC and CD

245. A Camet's cycle operating between T_1 = 600 K and T_2 = 300 K producing 1.5 kJ of mechanical work per cycle, The heat transferred to the engine by the reservoirs is

a) 2.5 kJ b) 3 kJ c) 3.5 kJ d) 4 kJ

246. A gas at 27°C temperature and 30 atmosp-heric pressure is allowed to expand to the atmospheric pressure. If the volume becomes 10 times its initial volume, then the final temperature becomes:

a) 100°C b) 173°C c) 273°C d) -173°C

247. The equation of state, corresponding to 8 kg of O_2 is:

a) PV=RT b) PV=8RT c) PV=$\frac{RT}{2}$ d) PV=$\frac{RT}{4}$

248. Match the column I with column II

Type of processes	Feature
(A) Isothermal	(p) $\triangle Q = 0$
(B) Isobaric	(q) Volume constant
(C) Isochoric	(r) Pressure constant
(D) Adiabatic	(s) Temperature constant

a) (A) - (s), (B) - (r), (C) - (q), (D) - (p) b) (A) - (p), (B) - (s), (C) - (r), (D) - (q)

c) (A) - (q), (B) - (r), (C) - (p), (D) - (s) d) (A) - (r), (B) - (p), (C) - (q), (D) - (s)

249. Temperature is a measure of coldness or hotness of an object. This definition is based on:

a) zeroth law of thermodynamics b) first law of thermodynamics

c) second law of thermodynamics d) Newton's law of cooling

250. (A) It is not possible for a system, unaided by an external agency to transfer heat from a body at lower temperature to another at a higher temperature.

(R) It is not possible to violate the second law of thermodynamics.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

251. A polyatomic gas with n degrees of freedom has a mean kinetic energy per molecule given by:

a) $\frac{nKT}{N}$ b) $\frac{nKT}{2N}$ c) $\frac{nKT}{2}$ d) $\frac{3KT}{2}$

252. (A) The work done along any adiabatic between two isothermals is independent of the particular adiabatic.

(R) Adiabatic curve has steeper slope than isothermal curve.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

253. The first law of thermodynamics is concerned with the conservation of

a) Momentum b) Energy c) Mass d) Temperature

254. A sample of ideal gas (γ = 1.4) is heated at constant pressure. If 100 J of heat is supplied to the gas the work done by the gas is:

a) 28.57 J b) 56.54 J c) 38.92 J d) 65.38 J

255. (A) A room can be cooled by opening the door of a refrigerator in a closed room.

(R) Heat flows from lower temperature (refrigerator) to higher temperature (room).

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

256. Carnot engine is

a) reversible engine

b)

operating between two temperatures T_1 (source) and T_2 (sink) have maximum efficiency

Processing math: 100%

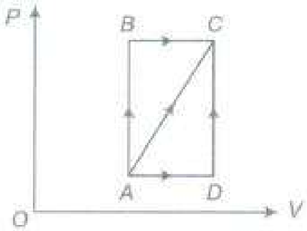
c) consisting of two isothermal processes connected by two adiabatic processes

d) all of these

257. A bubble of 8 mole of helium is submerged at a certain depth in water. The temperature of water increases by 30°C. How much heat is added approximately to helium during expansion?

a) 4000 J b) 3000 J c) 3500 J d) 4500 J e) 5000 J

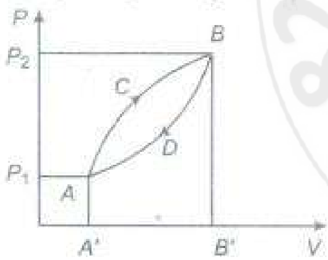
258. A thermodynamic process is shown in the figure. The pressures and volumes corresponding to some points in the figure are:



$P_A = 3 \times 10^4$ Pa, $P_B = 8 \times 10^4$ Pa and $V_A = 2 \times 10^{-3}$ m^3, $V_D = 5 \times 10^{-3}$ m^3. In process AB, 600 J of heat is added to the system and in process BC, 200 J of heat is added to the system. The change in internal energy of the system in process AC would be :

a) 560 J b) 800 J c) 600 J d) 640 J

259. A thermodynamic' system is taken from state A to B along ACB and is brought back to A along BDA as shown in the P-V diagram. The network done during the complete cycle is given by the area:



a) $P_1ACBP_2P_1$ b) ACBB'A'A c) ACBDA d) ADBB'A'A

260. In thermodynamic processes which of the following statements is not true?

a) In an isochoric process pressure remains constant

b) In an isothermal process the temperature remains constant

c) In an adiabatic process PV^{γ} = constant

d) In an adiabatic process the system is insulated from the surroundings

261. A Carnot engine whose efficiency is 40%, receives heat at 500 K. If the efficiency is to be 50%, the source temperature for the same exhaust temperature is:

a) 900 K b) 600 K c) 700 K d) 800 K e) 550 K

262. Two Carnot engines A and B have their sources at 1000 K and 1100 Kand their sinks at 400 K and 500 K respectively. If ηA and ηB be their efficiencies, then which of the following statement about their efficiencies is true?

a) ηA=ηB b) ηA<ηB c) ηA>ηB

Processing math: 100%

d) The data is not sufficient to make the above prediction

263. (A) The entropy of the solids is the highest.

(R) Atoms of the solids are arranged in orderly manner.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

264. If 1 g of steam is mixed with 1g of ice, then the resultant temperature of the mixture is:

a) $270^{o}C$ b) $230^{o}C$ c) $100^{o}C$ d) $50^{o}C$

265. 5 mole of hydrogen gas is heated from 30°C to 60°C at constant pressure. Heat given to the gas is:

(given R = 2 cal/mole- ^{0}C)

a) 750 cal b) 630 cal c) 1050 cal d) 1470 cal

266. An ideal gas heat engine operates in a Carnot cycle between $227^{o}C$ and $127^{o}C$. It absorbs 6 kcal at the higher temperature. The amount of heat (in kcal) converted into work is equal to:

a) 1.2 b) 4.8 c) 3.5 d) 1.6

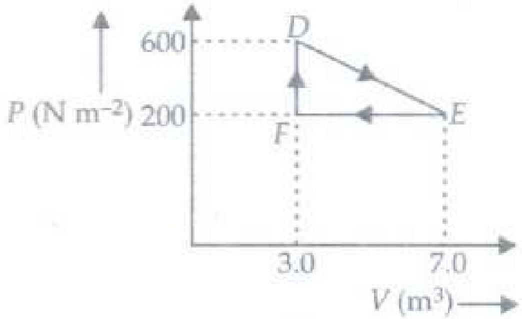
267. If γ denotes the ratio of the two specific heats of a gas, the ratio of the slopes of adiabatic and isothermal curves at their point of intersection is:

a) $(1/\gamma)$ b) γ c) γ-1 d) γ+1

268. If the internal energy does not depend on the path, then the process is called:

a) isothermal b) adiabatic c) both (a) and (b) d) none of these

269. A thermodynamic process is carried out from an original state D to an intermediate state E by the linear process shown in figure. The total work is done by the gas from D to E to F is total work is done by the gas from D to E to F is:



a) 100 J b) 800 J c) 300 J d) 250 J

Processing math: 100%

270. A thermodynamical system goes from state
(i) P_1,V to $2P_1$V (ii) P_1,V to P_1, 2V then the work done in the two cases is:
a) (i) zero (ii) zero b) (i) zero (ii) P_1V c) (i) P_1V (ii) zero d) (i) P_1V (ii) P_1V

271. (A) In adiabatic expansion of monoatomic ideal gas, if volume increases by 12%, then pressure decreases by 20%.
(R) In adiabatic process $PV^{5/3}$ = constant.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

272. **Assertion:** No engine can have efficiency greater than that of the carnot engine.
Reason: The efficiency of a carnot engine is given.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

273. (A) Change in internal energy is zero if the temperature is constant, irrespective of the process being cyclic or non-cyclic.
(R) For all process change in internal energy $\Delta U = nC_v\Delta T$ is independent of path.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

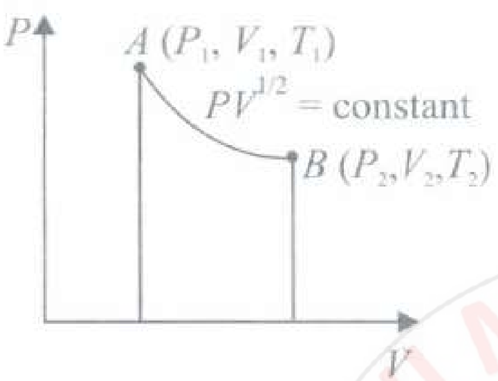
274. The ideal gas equation for an adiabatic process is
a) PV^{γ} = constant b) $TV^{\gamma+1}$ = constant c) $P^{(\gamma-1)}$T= constant
d) $P^{\gamma+1}$T= constant

Processing math: 100%

275. What is the most likely value for C_r (molar heat capacity at constant temperature)?
a) 0 b) $0 < C_r < C_v$ c) $C_v < C_r < C_p$ d) infinity

276. Efficiency of a Carnot engine is 50% when temperature of outlet is 500 K In order to increase efficiency up to 60% keeping temperature of intake the same what is temperature of outlet:
a) 200 K b) 400 K c) 600 K d) 800 K

277. 1 mole of an ideal gas in a cylindrical container have the P- V diagram as shown in figure. If $V_2 = 4 V1$, then the ratio of temperatures T_1 / T_2 will be:



a) 1/2 b) 1/4 c) 3/2 d) 3/4

278. The molar heat capacity at constant volume of oxygen gas at STP is nearly $\frac{5R}{2}$ and it approaches $\frac{7R}{2}$ as the temperature is increased. This happens because at higher temperature:
a) oxygen becomes triatomic b) oxygen does not behaves as an ideal gas
c) oxygen molecules rotates more vigorously d) oxygen molecules start vibrating

279. A Carnot engine takes 900 kcal of heat from a reservoir at 723°C and exhausts it to a sink at 30°C, The work done by the engine is
a) 2.73×10^6 Cal b) 3.73×10^6 Cal c) 6.27×10^5 Cal d) 3.73×10^5 Cal

280. **Assertion:** Thermodynamic process in nature are irreversible.
Reason: Dissipative effects cannot be eliminated.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

281. **Assertion:** In an isolated system, the entropy increases.
Reason: The processes in an isolated system are adiabatic.

Processing math: 100%

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

282. Ideal gas undergoes an adiabatic change in its state from (P_1, v_1, T_1)to (P_2, v_2, T_2). The work done W in the process is: (μ = number of moles, C_p and C_v are molar specific heats of gas)
a) $W=\mu(T_1-T_2)C_p$ b) $W=\mu(T_1-T_2)C_v$ c) $W=\mu(T_1+T_2)C_p$ d) $W=\mu(T_1+T_2)C_v$

283. Molar specific heat at constant volume C_v for a monoatomic gas is
a) $\frac{3}{2}R$ b) $\frac{5}{2}R$ c) $\frac{6}{2}R$ d) $\frac{4}{2}R$

284. A Carnot engine has efficiency 1/5. Efficiency becomes 1/3 when temperature of sink is decreased by 50 K. What is the temperature of sink?
a) 325 K b) 375 K c) 300 K d) 350 K

285. Theoretically, the efficiency of a Carnot engine is 100% when the temperature of the sink is at:
a) 0^0F b) 0^0C c) 0 K d) 0^0R

286. 5.6 L of helium gas at STP is adiabatically compressed to 0.7 L. Taking the initial temperature to be TI, the work done in the process is:
a) $\frac{9}{8}RT_1$ b) $\frac{3}{2}RT_1$ c) $\frac{15}{8}RT_1$ d) $\frac{9}{2}RT_1$

287. An ideal refrigerator has a freezer at a temperature of -13°C. The coefficient of performance of the engine is 5. The temperature of the air (to which heat is rejected) will be :
a) 325° C b) 325° K c) 39° C d) 320° C

288. A quantity of heat Q is supplied to a monoatomic ideal gas which expands at constant pressure. The fraction of heat that goes into work done by the gas is:
a) $\frac{2}{5}$ b) $\frac{3}{5}$ c) $\frac{2}{3}$ d) 1

289. If a carnot engine is working between steam point and ice point, then its efficiency will be:
a) 24.9% b) 25.7% c) 26.8% d) 28.8%

290. Which of the following is incorrect regarding the first law of thermodynamics?
a) It introduces the concept of the internal energy
b) It introduces the concept of entropy c) It is applicable to any cyclic process
d) It is a restatement of the principle of conservation of energy

291. (A) The temperature of a gas rises during an adiabatic compression, although no heat is given from outside.

(R) During adiabatic compression pressure of gas decreases.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

292. Two moles of an ideal monoatomic gas occupy a volume 2V at temperature 300 K, it expands to a volume 4V adiabatically, then the final temperature of gas is

a) 179K b) 189 K c) 199 K d) 219 K

293. Consider two containers A and B containing identical gases at the same pressure, volume and temperature. The gas in container A is compressed to half of its original volume isothermally while the gas in container B is compressed to half of its original value adiabatically. The ratio of final pressure of gas in B to that of gas in A is

a) $2\gamma^{-1}$ b) $\left(\frac{1}{2}\right)^{\gamma-1}$ c) $\left(\frac{1}{1-\gamma}\right)^2$ d) $\left(\frac{1}{\gamma-1}\right)^2$

294. When an ideal diatomic gas is heated at constant pressure the fraction of the heat energy supplied which increases the internal energy of the gas is:

a) $\frac{2}{5}$ b) $\frac{3}{5}$ c) $\frac{3}{7}$ d) $\frac{5}{7}$

295. (A) Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a greater rise in the temperature of helium as compared to that of oxygen.

(R) The molecular weight of oxygen is more than the molecular weight of helium.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

296. In an isochoric change, there is no:

Processing math: 100%

a) work done only b) change in volume only c) change in volume and work done d) change in pressure

297. A reversible engine converts one-sixth of the heat input into work. When the temperature of the sink is reduced by 62°C, the efficiency of the engine is doubled. The temperatures of the source and sink are:

a) 99°C,37°C b) 80°C,37°C c) 95°C,37°C d) 90°C,37°C

298. A scientist says that the efficiency of his heat engine which works at source temperature 127°C and sink temperature 27°C is 26%, then:

a) it is impossible b) it is possible but less probable c) it is quite probable d) data is incomplete

299. If an ideal gas at 27°C is compressed suddenly to one fourth of its initial volume, then rise in its temperature is (γ= 7/5)

a) 222.33 K b) 233.33 K c) 244.33 K d) 255.33 K

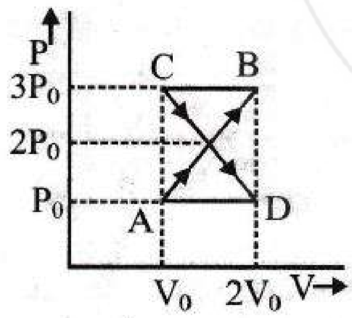
300. A Carnot engine whose sink is at 300 K has an efficiency of 40%. By how much should the temperature of source be increased so as to increase, its efficiency by 50% of original efficiency?

a) 325K b) 250K c) 380K d) 275K

301. For an adiabatic expansion of a perfect gas, the value of ΔP/P is equal to:

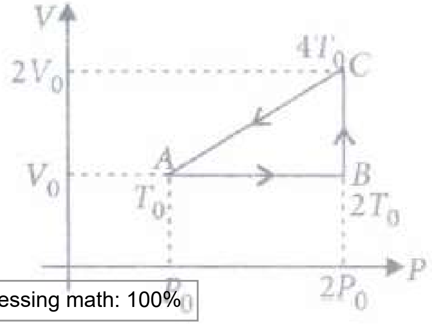
a) $\frac{\Delta V}{V}$ b) $\gamma\frac{\Delta V}{V}$ c) $-\gamma\frac{\Delta V}{V}$ d) $\gamma^2\frac{\Delta V}{V}$

302. A thermodynamic system undergoes cyclic process ABCDA as shown in fig. The work done by the system in the cycle is:



a) P_0V_0 b) $2P_0V_0$ c) $\frac{P_0V_0}{2}$ d) Zero

303. A thermo dynamic process Qf one mole ideal gas is shown in the figure. The efficiency of cyclic process ABCA will be



a) 25% b) 12.5% c) 50% d) 7.7%.

304. A Centigrade and a Fahrenheit thermometer are dipped in boiling water. The water temperature is lowered until the Fahrenheit thermometer registers 140°. What is the fall in temperature as registered by the Centigrade thermometer?
a) 80° b) 60° c) 40° d) 30°

305. At atmospheric pressure, 2 g of water having a volume of 2.00 cm^3 becomes 3342 cm^3 of steam when boiled. The latent heat of vaporization of water is 539 cal/g at 1 atm. What is the amount of heat added to the system?
a) 2156 cal b) 1078 cal c) 539 cal d) 269.5 cal

306. One mole of O_2 gas having a volume equal to 22.4 litres at O°C and 1 atmospheric pressure is compressed isothermally so that its volume reduces to 11.2 litres. The work done in this process is
a) -1572 J b) -1728 J c) 1728 J d) 1672.5 J

307. If two bodies at different temperature T_1 and T_2 are brought in thermal contact, the mean temperature is $\frac{T_1+T_2}{2}$, when:
a) mass of two bodies are equal b) pressure on two bodies are equal
c) thermal capacities of two bodies are equal d) volume of two bodies are equal

308. A sink, that is a system where heat is rejected, is essential for the conversion of heat into work. From which law the above inference follows?
a) Zeroth b) First c) Second d) Third

309. During an isothermal expansion, a confined ideal gas does -150 J of work against its surrounding. This implies that:
a) 150 J of heat has been added to the gas
b) 150 J of heat has been removed from the gas
c) 300 J of heat has been added to the gas
d) No heat is transferred because the process is isothermal

310. **Assertion:** When a bullet is fired from a gun, the bullet pierces a wooden block and stops, changing the temperature of the bullet and the surrounding layers of wood.
Reason: Temperature is related to the energy of motion of the bullet as a whole.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

311. The freezer in a refrigerator is located at the top section so that

a) the motor is not heated b) the heat gained from the environment is high

c) the heat gained from the environment is low.

d) the entire chamber of the refrigerator is cooled quickly due to convection

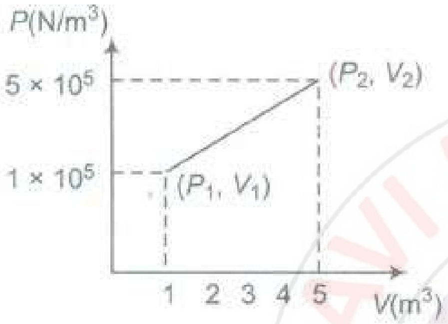
312. The latent heat of vaporisation of water is 2240 J. If the work done in the process of vaporisation of 1 gm is 168 J, then increase in internal energy is:

a) 2408 J b) 2240 J c) 2072 J d) 1904 J

313. One mole of an ideal gas at temperature T_1 expands according to the law (P/V)= constant. Find the work done when the final temperature becomes T_2.

a) $R(T_2-T_1)$ b) $(R/2)(T_2-T_1)$ c) $(R/4)(T_2-T_1)$ d) $PV(T_2-T_1)$

314. A system changes from the state (P_1, V_1) to (P_2, V_2) as shown in the figure. What is the work done by the system



a) 7.5×10^5 Joule b) 7.5×10^5 erg c) 12×10^5 Joule d) 6×10^5 Joule

315. In the question number 61, the heat exchanged by the engine with the surroundings for path D to A is (at constant pressure)

a) $\frac{5}{2}P_A\left(V_D - V_A\right)$ b) $\frac{5}{2}P_A\left(V_A - V_D\right)$ c) $= \frac{3}{2}P_A\left(V_D - V_A\right)$ d) $= \frac{1}{2}P_A\left(V_D - V_A\right)$

316. A gaseous mixture enclosed in a vessel of volume V consists of one mole of a gas A with γ = 5/3 and another gas B with γ = 7/5 at a certain temperature T. The molar masses of the gases A and B are 4 and 32, respectively. The gases A and B do not react with each other and are assumed to be ideal. The gaseous mixture follows the equation $PV^{19/13}$ = constant, in adiabatic processes. The number of moles of the gas B in the gaseous mixture.

a) 2 b) 3 c) 4 d) 5

317. A Carnot engine takes in 3000 kcal of heat from a reservoir at 627°C and gives it to a sink at 27°C. The work done by the engine is:

a) 4.2×10^6 J b) 8.4×10^6 J c) 16.8×10^6 J d) zero

318. For a gas of molecular weight M specific heat C capacity at constant pressure is ($\gamma = \frac{C_P}{C_V}$)

a) $\frac{R}{\gamma - 1}$ b) $\frac{\gamma R}{\gamma - 1}$ c) $\frac{\gamma R}{M(\gamma - 1)}$ d) $\frac{\gamma RM}{(\gamma - 1)}$

319. A Carnot engine used first an ideal monoatomic gas and then an ideal diatomic gas. If the source and sink temperature are 411°C and 69°C respectively and the engine extracts 1000 J of heat in each cycle, then area enclosed by P - V diagram is:
a) 500 J b) 700 J c) 100 J d) 300 J

320. In an adiabatic change, the pressure P and temperature T of a monoatomic gas are related as $P \propto T^C$,where C equals to:
a) $\frac{2}{5}$ b) $\frac{5}{2}$ c) $\frac{3}{5}$ d) $\frac{5}{3}$

321. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its temperature. The ratio of C_p/C_v for the gas is:
a) 3/2 b) 4/3 c) 2 d) 5/3

322. One gm mole of an ideal gas expands adiabatically from an initial temperature T_I to a final temperature T_F ($T_I > T_F$); then the work done is:
a) $C_v(T_I-T_F)$ b) $C_p(T_I-T_F)$ c) $R(T_I-T_F)$ d) zero

323. The internal energy of a gas during isothermal expansion:
a) increases b) decreases c) remains constant d) becomes zero

324. (A) Thermodynamics processes in nature are irreversible.
(R) Dissipative effects cannot be eliminated.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

325. If the ratio of specific heat of a gas at constant pressure to that at constant volume is g, the change in internal energy of a mass of gas when the volume changes from V to 2V at constant pressure p is:
a) $\frac{R}{(\gamma-1)}$ b) pV c) $\frac{pV}{(\gamma-1)}$ d) $\frac{\gamma pV}{(\gamma-1)}$

326. (A) The specific heat of a gas in an adiabatic process is zero and in an isothermal process is infinite.
(R) Specific heat of gas is directly proportional to change of heat in system and inversely proportional to change in temperature.

Processing math: 100%

a)
If both assertion and reason are true and reason is the correct explanation of assertion

b)
If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

327. The internal energy of an ideal gas depends upon:
a) Specific volume b) Pressure c) Temperature d) Density

328. In Carnot engine efficiency is 40% at hot reservoir temperature T. For efficiency to be 50%, what will be the temperature of hot reservoir?
a) $\frac{T}{5}$ b) $\frac{2T}{5}$ c) 6T d) $\frac{6T}{5}$

329. The work of 146 kJ is performed in order to compress one kilo mole of gas adiabatically and in this process the temperature of the gas increases by 7^0C. The gas is:
(R=8.3 J $mol^{-1}k^{-1}$)
a) monoatomic b) diatomic c) triatomic
d) a mixture of monoatomic and diatomic

330. The first law of thermodynamics confirms the law of:
a) conservation of momentum b) conservation of energy
c) flow of heat in a particular direction
d) separate conservation of heat energy and mechanical energy

331. A polyatomic gas with n degrees of freedom has a mean energy per molecule given by:
a) $\frac{nkT}{N}$ b) $\frac{nkT}{2N}$ c) $\frac{nkT}{2}$ d) $\frac{3kT}{2}$

332. An ideal gas undergoing adiabatic change has the following pressure-temperature relationship:
a) $p^{\gamma-1}T^{\gamma}$= constant b) $p^{\gamma}T^{-1}$= constant c) $p^{\gamma}T^{1-\gamma}$= constant
d) $p^{1} - \gamma^{\gamma}_{T}$= constant

333. The slopes of isothermal and adiabatic curves are related as:
a) isothermal curve slope = adiabatic curve slope
b) isothermal curve slope = γ x adiabatic curve slope
c) adiabatic curve slope =γ x isothermal curve slope
d) adiabatic curve slope = $\frac{1}{2}$ x isothermal curve slope

334. One mole of an ideal gas require 207 J heat to rise the temperature by 10K when heated at constant pressure. If the same gas is heated at constant volume to raise the temperature by the same 10K, the heat required is (Given the gas constant $R = \beta.3\ J/mol - K$)

a) 198.7 J b) 29 J c) 215.3 J d) 124 J

335. In a P-V diagram for an ideal gas (where P is along the y-axis and V is along the x - axis), the value of the ratio; slope of the adiabatic curve/slope of the isothermal curve at any point will be: (where symbols have their usual meanings)

a) 1 b) C_p/C_v c) 2 d) C_v/C_p

336. The temperature at which a black body ceases to radiate energy, is

a) 0 K b) 273 K c) 30 K d) 400 K

337. For a gas. the difference between two specific heats is 5000 J/mole-°C. If the ratio of specific heats is 1.6, the two specific heats are: (in J/mole-°C)

a) $C_p = 1.33 \times 10^4$, $C_v = 2.66 \times 10^4$ b) $C_p = 1.33 \times 10^4$, $C_v = 83.3 \times 10^3$

c) $C_p = 1.33 \times 10^4$, $C_v = 8.33 \times 10^3$ d) $C_p = 2.6 \times 10^4$, $C_v = 8.33 \times 10^4$

338. The fractional change in internal energy when a gas is cooled from 927°C to 27°C is:

a) 0.75 b) 4 c) 0.97 d) none of these

339. During the adiabatic expansion of two moles of a gas the internal energy of a gas is found to decrease by 2 joule. The work done during the process on gas will be equal to:

a) -2 J b) 3 J c) 1 J d) 2 J

340. The radius of a star is R and it acts as a black body. What would be the temperature of the star if the rate of production of energy is Q?

a) $\left(\frac{4\pi R^2 Q}{\sigma}\right)^{1/4}$ b) $(Q/4\pi R^2\sigma)^{1/4}$ c) $(Q/4\pi R^2\sigma)$ d) $(Q/4\pi R2\sigma)^{-1/2}$

341. The isochoric modulus of elasticity is:

a) equal to isothermal modulus of elasticity b) zero c) infinity

d) equal to isoentropic modulus of elasticity

342. During the melting of a slab of ice at 273 K at atmospheric pressure:

a) positive work is done by the ice-water system on the atmosphere

b) positive work is done on the ice-water system by the atmosphere

c) internal energy of ice-water system decreases d) none of the above

343. In which of the following processes, heat is neither absorbed nor released by a system?

a) Adiabatic b) Isobaric c) Isochoric d) Isothermal

Processing math: 100%

344. (A) Two isothermal curves intersect each other at a certain point.

(R) The isothermal change are done slowly, so the isothermal curves have very little slope.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

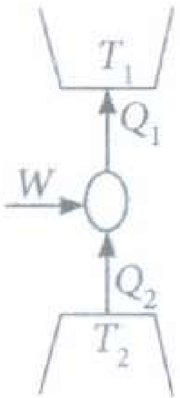
345. Consider a heat engine as shown in figure Q1 and Q2 are heat added to heat bath TI and heat taken from T2 in one cycle of engine. W is the mechanical work done on the engine. If W > 0, then possibilities are:

$(i)\quad Q_1 > Q_2 > 0$

$(ii)\quad Q_2 > Q_1 > 0$

$(iii)\quad Q_2 < Q_1 < 0$

$(iv)\quad Q_1 < 0, Q_2 > 0$



a) (i) and (ii) b) (i) and (iii) c) (ii) and (iii) d) (ii) and (iv)

346. **Assertion:** In an adiabatic process, change in internal energy is equal to work done on or by the gas in the process.

Reason: The temperature remains constant in an adiabatic process.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

Processing math: 100%

347. P_i, V_i and P_f, V_f are initial and final pressures and volumes of a gas in a thermodynamic process respectively. If PV^n= constant, then the amount of work done is:

a) minimum for n = γ b) minimum for n = 1 c) minimum for n = 0

d) minimum for n =1/γ

348. For nitrogen Cp - Cv = x and for argon, Cp - Cv = y. The relation between x and y is given by:

a) x = y b) x = 7y c) y = 7x d) x = $\frac{1}{2}$y

349. If for a gas R/C_v = 0.67, this gas is made up of molecules which are:

a) monoatomic b) diatomic c) polyatomic

d) mixture of diatomic and polyatomic molecules

350. The pressure of a monoatomic gas increases linearly from 4 x 10^5 N / m^2 to 8 x 10^5N / m^2 when its volume increases from 0.2 m^3 to 0.5 m^3. The work done by the gas and increase in internal energy are given by:

a) 1.8 x 10^5 J, 1.8 x 10^5 J b) 4.8 x 10^5 J, 4.8 x 10^5 J c) 1.8 x 10^5 J, 4.8 x 10^5 J

d) 4.8 x 10^5 J, 1.8 x 10^5 J

351. During an adiabatic compression of 5 moles of a gas, 250 J of work was done. The change in the internal energy will be:

a) 50 J b) -150 J c) 250 J d) -250 J

352. The specific heat of air at constant volume is 0.172 Cal g^{-1} $^oC^{-1}$. The change in internal energy when 5 g of air is heated from O°C to 4°C at constant volume is

a) 28.8 J b) 14.4 J c) 7.2 J d) 3.51 J

353. If a gas is heated at constant pressure, its isothermal compressibility:

a) remains constant b) increases linearly with temperature

c) decreases linearly with temperature d) decreases inversely with temperature

354. I gm of an ideal gas expands isothermally, heat flow will be:

a) from the gas to outside atmosphere b) from outside atmosphere to gas

c) zero d) both (a) and (b)

355. 22 gm of CO_2 at 27°C is mixed with 17 gm of O_2 at 37°C. If both gases are considered as ideal kinetic theory gases, then the temperature of the mixture is:

a) 32°C b) 27°C c) 37°C d) 30.5°C

356. A Carnot engine operating between temperatures T_1 and T_2 has efficiency $\frac{1}{6}$ When T_2 is lowered by 62 K, its efficiency increases to $\frac{1}{3}$ Then T_1 and T_2 are, respectively

a) 372 K and 310 K b) 372 K and 330 K c) 330 K and 268 K

d) 310 K and 248 K

357. For an isochoric thermodynamic transformation:
a) $\Delta Q=\Delta W$ b) $\Delta Q=\Delta U$ c) $\Delta U=\Delta W$ d) $\Delta U=0$

358. The work done W, during an isothermal process in which the gas expands from an initial volume V_1 to a final volume V_2 is given by: (R is gas constant, T is temperature)

a) $RT\log_e\left(\frac{V_2}{V_1}\right)$ b) $2RT\log_e\left(\frac{V_1}{V_2}\right)$ c) $R(V_2-V_1)\log_e\left(\frac{T_1}{T_2}\right)$ d) $R(T_2-T_1)\log_e\left(\frac{V_2}{V_1}\right)$

359. (A) Reversible system are difficult to find in real world.
(B) Most processes are dissipative in nature.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

360. The efficiency of a Carnot engine working between 800 K and 500 K is:
a) 0.625 b) 0.375 c) 0.4 d) 0.5

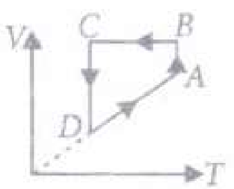
361. In a cyclic process, the change in internal energy of a system is:
a) minimum but not zero b) zero c) maximum but not infinite d) infinite

362. First law of thermodynamics is a consequence of conservation of ____________ .
a) Work b) Energy c) Heat d) All of these

363. The ratio of the specific heats $\frac{C_p}{C_v}=\gamma$, in terms of degrees of freedom (n) is given by:

a) $\left(1+\frac{n}{3}\right)$ b) $\left(1+\frac{2}{n}\right)$ c) $\left(1+\frac{n}{2}\right)$ d) $\left(1+\frac{1}{n}\right)$

364. Some gas (CpfCv = y = 1.25) follows the cycle ABCDA as shown in the figure. The ratio of the energy given out by the gas to its surroundings during the isochoric section of the cycle to the expansion work done during the isobaric section of the cycle is



a) 2 b) 4 c) 6 d) 8

Processing math: 100%

365. The volume of an ideal diatomic gas is doubled isothermally. The internal energy:

a) doubles b) is halved c) increases four times d) remains unchanged

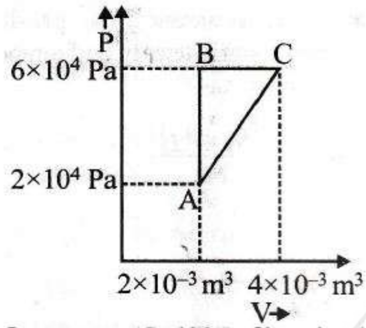
366. A Carnot engine operates between 327°C and 27°C. How much heat does it take from the 327°C reservoir for every 100 J of work done?

a) 100 J b) 200 J c) 300 J d) 400 J

367. A gas undergoes a process in which its pressure P and volume V are related as VP^n= constant. The bulk modulus of the gas in this process is:

a) nP b) $P^{1/n}$ c) P/n d) P^n

368. In figure shows two paths that may be taken by a gas to go from a state A to a state C.



In process IB, 400 J of heat is added to the system and in process BC, 100 J of heat is added to the system. The heat absorbed by the system in the process AC will be ____________ .

a) 500 J b) 460 J c) 300 J d) 380 J

369. **Assertion:** In an isothermal expansion, the gas absorbs heat and does work while in an isothermal compression, work is done on the gas by the environment and heat is released.

Reason: In an isothermal process, there is no change in internal energy of an ideal gas.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

370. The change in the entropy of I mole of an ideal gas which went through an isothermal process from an initial state (P_1, V_1, T) to the final state (P_2, V_2, T) is equal to:

a) zero b) R In T c) R In $\frac{V_1}{V_2}$ d) R In $\frac{V_2}{V_1}$

Processing math: 100%

371. A Carnot engine, having an efficiency of h = $\frac{1}{10}$ as heat engine. is used as a refrigerator. If the work done on the system is 10 J, the amount of energy absorbed from the reservoir at lower temperature is ____________ .

a) 99 J b) 90 J c) 1 J d) 100 J

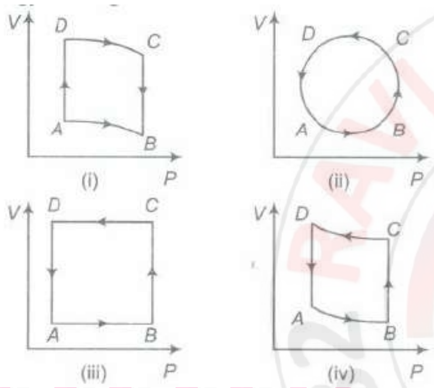
372. γ for a gas is always:

a) negative b) negative c) between zero and one d) more than one

373. An ideal gas is taken through a cyclic thermodynamical process through four steps. The amounts of heat involved in these steps are; Q_1 = 5960 J , Q_2 = - 5585 J, Q_3 = - 2980 J, Q_4 = 3645 J respectively. The corresponding works involved are; W_1 = 2200 J , W_2 = -825 J, W_3 = - 1100 J and W_4 respectively. The value of W_4 is:

a) 1315 J b) 275 J c) 765 J d) 675 J

374. In the diagrams (i) to (iv) of variation of volume with changing pressure is shown. A gas is taken along the path ABCD. The change in internal energy of the gas will be :



a) Positive in all cases (i) to (iv)

b) Positive in cases (i), (ii) and (iii) but zero in (iv) case

c) Negative in cases (i), (ii) and (iii) but zero in (iv) case d) Zero in all four cases

375. Heat is supplied to a diatomic gas at constant pressure. The ratio of Δ1Q : Δ1U: Δ 1W is:

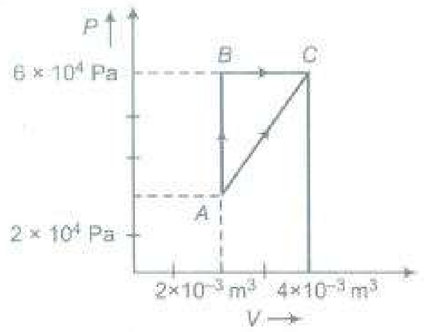
a) 5: 3: 2 b) 7: 5: 2 c) 2: 3: 5 d) 2: 5: 7

376. If C_p and C_v denote the specific heat of nitrogen per unit mass at constant pressure and constant volume respectively, then:

a) C_p-C_v=28R b) C_p-C_v=R/28 c) C_p-C_v=R/14 d) C_p-C_v=R

377. Figure below shows two paths that may be taken by a gas to go from a state A to a state C. In process AB, 400 J of heat is added to the system and in process BC, 100 J of heat is added to the system. The heat absorbed by the system in the process AC

will be:



a) 380 J   b) 500 J   c) 460 J   d) 300 J

378. For a monoatomic gas, the work done at constant pressure is W. The heat supplied at constant volume for the same rise in temperature of the gas is:

a) $\frac{W}{2}$ b) $\frac{3W}{2}$ c) $\frac{5W}{2}$ d) W

379. If 150 J of heat is added to a system and the work done by the system is 110 kJ, then change in internal energy will be:

a) 260 J   b) 150 J   c) 110 J   d) 40 J

380. In a given process on an ideal gas, dW = 0 and dQ < 0 . Then, for the gas

a) the temperature will decrease   b) the volume will increase

c) the pressure will remain constant   d) the temperature will increase

381. **Assertion:** A quasi-static isothermal expansion of an ideal gas in a cylinder fitted with a frictionless movable piston is a irreversible process.

Reason: A process is irreversible only if system remains in equilibrium with the surroundings at every stage.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false.   d) If both assertion and reason are false

382. (A) When a bottle of cold carbonated drink is opened, a slight fog forms around the opening.

(R) Adiabatic expansion of the gas causes lowering of temperature which start condensation of water vapours.

Processing math: 100%

a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false   d) If both assertion and reason are false

e) If assertion is false but reason is true

383. At constant volume temperature is increased, then
a) collision on walls will be less   b) number of collisions per unit time will increase
c) collisions will be in straight lines   d) collisions will not change

384. If $\Delta Q > 0$ when heat flows into a system, $\Delta W > 0$ when work is done on the system then the increase in the internal energy ΔU is:
a) $\Delta W+\Delta Q$ b) $\Delta W-\Delta Q$ c) $\Delta Q-\Delta W$ d) $-(\Delta Q+\Delta W)$

385. When a gas enclosed in a closed vessel was heated so as to increase its temperature by 5°C, its pressure was seen to have increase by 1%. The initial temperature of the gas was nearly:
a) 500°C   b) 227°C   c) 273°C   d) 105°C

386. The fall in temperature of helium gas initially at 20°C when it is suddenly expanded to 8 times its original volume is $\left(\gamma = \frac{5}{3}\right)$
a) 70.25 K   b) 71.25 K   c) 72.25 K   d) 73.25 K

387. (A) Air quickly leaking out of a balloon becomes cooler.
(R) The leaking air undergoes adiabatic expansion.

a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false   d) If both assertion and reason are false

e) If assertion is false but reason is true

388. For an ideal gas the equation of a process for which the heat capacity of the gas varies with temperature as $C = \alpha/T$ (α is a constant) is given by
a) VlnT=constant   b) $VT^{1/\gamma-1}e^{\alpha/RT}$ c) $V^{\frac{1}{\gamma-1}}T^{\alpha/RT}$=constant   d) $V^{\gamma-1}T$=constant

389. An ideal heat engine exhausting heat at 77°C is to have a 30% efficiency. It must take heat at:
a) 127°C b) 227°C c) 327°C d) 673°C

390. **Assertion:** A refrigerator transfers heat from a lower temperature to a higher temperature.
Reason: Heat cannot flow from a lower temperature to a higher temperature.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

391. Heat added to a system is equal to:
a) a change in its internal kinetic energy
b) a change in its internal potential energy c) work done by it
d) sum of above all the three factors

392. One mole of an ideal monoatomic gas is heated at a constant pressure of one atmosphere from 0°C to 100°C. Then, the change in the internal energy is:
a) 6.56 joule b) 8.32×10^2 joule c) 12.48×10^2 joule d) 20.80×10^2 joule

393. A process is said to be reversible if
a) the system return to their original states
b) the surroundings return to their original states
c) both the system as well as the surroundings return to their original states
d) neither system nor surroundings return to their original states

394. (A) First law of thermodynamics is a restatement of the principle of conservation of energy.
(R) Energy is a fundamental physical quantity in SI system.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

Processing math: 100%

395. Three containers of the same volume contain three different gases. The masses of the molecules are m_1, m_2, and m_3 and the number of molecules in their respective containers are N_1, N_2 and N_3. The gas pressure in the containers are p_1, p_2 and p_3 respectively. All the gases are now mixed and put in one of these containers. The pressure p of the mixture will be:

a) $p < (p_1 + p_2 + p_3)$ b) $p = \frac{p_1+p_2+p_3}{3}$ c) $p = p_1 + p_2 + p_3$ d) $p > (p_1 + p_2 + p_3)$

396. The temperatures of inside and outside of a refrigerator are 273 K and 303 K respectively. Assuming that the refrigerator cycle is reversible, for every joule of work done, the heat delivered to the surroundings will be nearly:

a) 10 J b) 20 J c) 30 J d) 50 J

397. An ideal gas having molar specific heat capacity at constant volume is $\frac{3}{2}$R , the molar specific heat capacities at constant pressure is

a) $\frac{1}{2}$R b) $\frac{5}{2}$R c) $\frac{7}{2}$R d) $\frac{9}{2}$R

398. One mole of an ideal monatomic gas at temperature To expands slowly according to the law $\frac{P}{V}$ = constant. If the final temperature is 2 To, heat V supplied to the gas is:

a) 2RTo b) RTo c) $\frac{3}{2}$RTo d) $\frac{1}{2}$RTo

399. (A) In an isochoric process, work done by the gas is zero.

(R) In a process, if initial volume is equal to the final volume, work done by the gas is zero.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

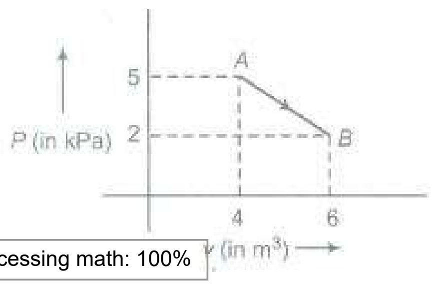
b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

e) If assertion is false but reason is true

400. One mole of an ideal diatomic gas undergoes a transition from A to B along a path AB as shown in figure. The change in the internal energy of the gas during the transition is:



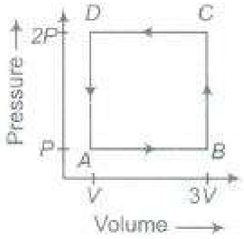
Processing math: 100%

a) 20 kJ b) -20 kJ c) 20 J d) -12 kJ

401. A Carnot engine operates with source at 127°C and sink at 27°C. If the source supplies 40 kJ of heat energy, the work done by the engine is:
a) 30 kJ b) 10 kJ c) 4 kJ d) 1 kJ

402. Isobaric modulus of elasticity is equal to:
a) isochoric modulus of elasticity b) isothermal modulus of elasticity c) zero
d) infinite

403. A thermodynamic system is taken through the cycle ABCD as shown in figure. Heat rejected by the gas during the cycle is :



a) (1/2) PV b) PV c) 2PV d) 4PV

404. In which process will the internal energy of the gas increase?
a) Adiabatic expansion b) Adiabatic compression c) Isothermal expansion
d) Isothermal compression

405. An ideal refrigerator has its freezer at a temperature of -13 °C. The η of the engine is 17%. The temperature of air is:
a) 39°C b) 312°C c) 39 K d) 234°C

406. An engineer claims to have made an engine delivering 10 kW power with fuel consumption of I gm/sec. The calorific value of fuel is 2 kcal/gm. This claim is:
a) valid b) invalid c) dependent on engine design d) dependent on load

407. Check the correct statement.
a) Internal energy is a path function, while heat is not
b) Heat is path function, while internal energy is not
c) Both heat and internal energy are path functions
d) Both heat and internal energy are not path functions

408. An ideal heat engine works between temperatures T_1=500K and T_2 = 375K. If the engine absorbs 600 J of heat from the source, then the amount of heat released to the sink is:
a) 450 J b) 600 J c) 45 J d) 500 J

409. A reversible engine and an irreversible engine are operating between the same temperatures. The efficiency of:
a) both the engines will be 100% b) reversible engine will be 100%
c) reversible engine will be greater d) irreversible engine will be greater

410. A geyser heats water flowing at the rate of 4 litre per minute from 30°C to 85 °C. If the geyser operates on a gas burner then the amount of heat used per minute is
a) 9.24×10^5 J b) 9.24×10^7 J c) 6.24×10^7J d) 6.24×10^5 J

411. A refrigerator with coefficient of performance 1/3 releases 200 J of heat to a hot reservoir, then the work done on the working substance is:
a) $\frac{100}{3}$Joule b) 100 Joule c) $\frac{200}{3}$ Joule d) 150 Joule e) 50 Joule

412. A monoatomic gas at a pressure P, having a volume V expands isothermally to a volume 2V and then adiabatically to a volume 16V. The final pressure of the gas is: (take g = $\frac{5}{3}$)
a) 64 P b) 32 P c) $\frac{p}{64}$ d) 16 P

413. First law of thermodynamics is a special case of :
a) Newton's law b) Law of conservation of energy c) Charle's law
d) Law of heat exchange

414. Which of the following relations does not give the equation of an adiabatic process, where terms have their usual meaning?
a) $P^{\gamma}T^{1-\gamma} = constant$ b) $P^{1-\gamma}T^{\gamma} = \text{constant}$ c) $PV^{\gamma} = constant$ d) $TV^{\gamma-1} = \text{constant}$

415. (A) The Carnot cycle is useful in understanding the performance of Heat Engines.
(R) The Carnot cycle provides a way of determing the maximum possible efficiency achievable with reservoirs of given temperature.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

416. Air in a cylinder is suddenly compressed by a piston, which is then maintained at the same position. With the passage of time:
a) The pressure decreases b) The pressure increases
c) The pressure remains the same
d) The pressure may increase or decrease depending upon the nature of the gas

417. A thermos flask made of stainless steel contains several tiny lead shots. If the flask .is quickly shaken up and down several times, the-temperature of lead shots:
a) increases by adiabatic process b) increases by isothermal process
c) decreases by adiabatic process d) remains same

e) first decreases and then increases

418. A Carnot engine uses first an ideal monoatomic gas (γ = 5/3) and then an ideal diatomic gas (γ = 7/ 5) as its working substance. The source and sink temperatures are 411°C and 69°C respectively and the engine extracts 1000 J of heat from the source in each cycle. Then:

a) the efficiencies of the engine in the two cases are in the ratio 21 : 25

b) the area enclosed by the P- V diagram in the first case only is 500 J

c) the area enclosed by the P-V diagram in both cases is 500 J

d)

the heat energy rejected by the engine in the first case is 600 J while that in the second case is 714.3 J

419. (A) When a glass of hot milk is placed in a room and allowed to cool, its entropy decreases.

(R) Allowing hot object to cool does not violate the second law of thermodynamics.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false   d) If both assertion and reason are false

e) If assertion is false but reason is true

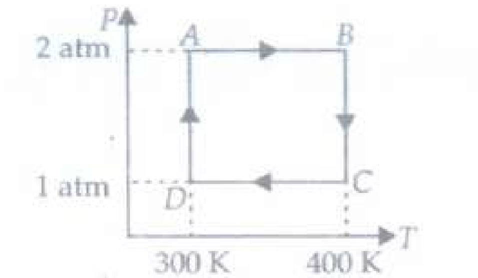
420. In an adiabatic expansion of a gas, the product of pressure and volume:

a) increases   b) decreases   c) remains unchanged   d) changes erratically

421. If an average person jogs, he produces 14.5 x 10^4 cal min^{-1}. This is removed by the evaporation of sweat. The amount of sweat evaporated per minute (assuming 1 kg requires 580 x 10^3 cal for evaporation) is

a) 0.25 kg   b) 2.25 kg   c) 0.05 kg   d) 0.20 kg

422. Two moles of helium gas undergo a cyclic process as shown in figure. Assuming the gas to be ideal, the net work done by the gas is



a) 200Rln2   b) 100Rln2   c) 300Rln2   d) 400Rln2

423. Two mole of oxygen is mixed with eight mole of helium. The effective specific heat of the mixture at constant volume is:
a) 1.3 R b) 1.4 R c) 1.7 R d) 1.9 R e) 1.2 R

424. For an ideal monoatomic gas, the universal gas constant R is n times the molar heat capacity at constant pressure C_p. Here n is:
a) 0.67 b) 1.4 c) 0.4 d) 1.67

425. Entropy of a thermodynamic system does not change when this system is used for:
a) conduction of heat from higher to lower temperature
b) conversion of heat into work isobarically
c) conversion of heat into internal energy isochorically
d) conversion of work into heat isochorically

426. When an ideal diatomic gas (γ = I.4) is heated at constant pressure, what is the fraction (approximate) of the heat energy supplied which increases the internal energy of the gas?
a) 0.2 b) 0.3 c) 0.5 d) 0.7

427. By opening the door of a refrigerator inside a closed room:
a) you can cool the room to a certain degree
b) you can cool it to the temperature inside the refrigerator
c) you ultimately warm the room slightly
d) you can neither cool nor warm the room

428. In the condensation of a gas, the mean KE (K) and potential energy (U) of molecules change; thus:
a) K decreases, U decreases b) K increases, U keeps constant
c) K keeps constant, U decreases d) K decreases, U increases

429. If at 60°C and 80 em of mercury pressure, a definite mass of a gas is compressed slowly, then the final pressure of the gas if the final volume is half of the initial volume (γ = 3/2) is:
a) 120 cm of Hg b) 140 cm of Hg c) 160 cm of Hg d) 180 cm of Hg

430. 100 g of water is heated from 30°C to 50°C. Ignoring the slight expansion of the water, the change in its internal energy is :(specific heat of water is 4184 J $kg^{-1}K^{-1}$)
a) 4.2 kJ b) 8.4 kJ c) 84 kJ d) 2.1 kJ

431. Four moles of hydrogen, two moles of helium and one mole of water vapour form an ideal gas mixture. What is the molar specific heat at constant pressure of mixture?
a) $\frac{16}{7}$R b) $\frac{7R}{16}$ c) R d) $\frac{23}{7}$R

432. Which of the following processes is reversible:

Processing math: 100%

a) Transfer of heat by radiation b) Electrical heating of a nichrome wire
c) Transfer of heat by conduction d) Isothermal compression

433. $C_p > C_v$, as in the case of C_p:
a) more heat is required to increase the internal energy
b) heat is required to do work against external pressure also
c) more heat is required to do external work
d)
more heat is required to do external work as well as for increase in internal energy

434. A gas under constant pressure of 4.5×10^5 Pa when subjected to 800 kJ of heat, changes the volume from $0.5\ m^3$ to $2.0\ m^3$. The change in internal energy of the gas is:
a) 6.75×10^5 J b) 5.25×10^5 J c) 3.25×10^5 J d) 1.25×10^5 J

435. The cycle is shown in figure is made of one mole of perfect gas in a cylinder with a piston. The processes A to B and C to D are isochoric whereas process B to C and D to A are adiabatic, the work done in one cycle is ($V_A = V_B = V$, $V_C = V_D = 2V$ and y = 5/3)
a) $\left[1-4^{3/2}\right]\left(P_B-P_A\right)V$ b) $\frac{3}{2}\left[1-3^{2/3}\right]\left(P_B-P_A\right)V$ c) $\frac{3}{2}\left[1-2^{-2/3}\right]\left(P_B-P_A\right)V$
d) $\frac{5}{2}\left[1-2^{-2/3}\right]\left(P_B-P_A\right)V$

436. In a cyclic process, work done by the system is:
a) zero b) equal to heat given to the system
c) more than the heat given to the system
d) independent of heat given to the system

437. Six moles of O_2 gas is heated from 20°C to 35°C at constant volume. If specific heat capacity at constant pressure is 8 cal/mol-K and R = 8.31 J/mol-K. What is the change in internal energy of the gas?
a) 180 cal b) 300 cal c) 360 cal d) 540 cal

438. (A) The molecules of ice at O°C and water at 0°C will have same potential energy.
(R) Potential energy depends only on temperature of the system.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false
e) If assertion is false but reason is true

Processing math: 100%

439. A Carnot engine whose efficiency is 40%, takes in heat from a source maintained at a temperature of 500 K. It is desired to have an engine of efficiency 60%. Then, the intake temperature for the same exhaust (sink) temperature must be:
a) 1200 K b) 750 K c) 600 K d) 800 K

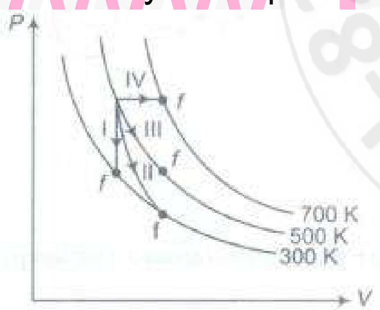
440. Amonoatomic gas at a pressure P, having a volume V expands isothermally to a volume 2 V and then adiabatically to a volume 16 V. The final pressure of the gas is (take γ =5/3)
a) 64 P b) 32 P c) P/64 d) 16 P

441. The efficiency of Carnot engine is 50% and temperature of sink is 500 K. If the temperature of source is kept constant and its efficiency is to be raised to 60%, then the required temperature of sink will be:
a) 600 K b) 500 K c) 400 K d) 100 K

442. The pressure P_1 and density d_1 of a diatomic gas (γ = 7/5) change to P_2 and d_2 during an adiabatic operation. If $\frac{d_2}{d_1} = 32$, then $\frac{P_2}{P_1}$ is
a) 76 b) 128 c) 168 d) 298

443. Internal energy of n_1 moles of hydrogen at temperature T is equal to the internal energy of n_2 mole of helium at temperature 2T. Then the ratio n_1, n_2 is:
a) $\frac{3}{5}$ b) $\frac{2}{3}$ c) $\frac{6}{5}$ d) $\frac{3}{7}$

444. Thermodynamic processes are indicated in the following diagram:



Match the following:
Column-1 Column-2
P. Process I a. Adiabatic
Q. Process II b. Isobaric
R. Process IIIc. Isochoric
S. Process IVd. Isothermal
a) P - c, Q - a, R - d, S - b b) P-c, Q - d, R- b, S-a c) P-d, Q-b, R-a, S-c
d) P-a, Q-c, R-d, S-b

445. The number of translational degree of freedom for a diatomic gas is:
a) 2 b) 3 c) 5 d) 6

446. While boiling 1 gm of water at pressure 1.013 x 10^5 N/m^3 , its volume becomes 1471 cm^3 from 1 cm^3;then work done by the system is:

a) 148.911 J b) 150 J c) 130.24 J d) 120.57 J

447. A system goes from A to B by two different paths in the P- V diagram as shown in figure. Heat given to the system in path 1 is 1100 J, the work done by the system along path 1 is more than path 2 by 150 J. The heat exchanged by the system in path 2 is:

a) 800 J b) 750 J c) 1050 J d) 950 J

448. Which one of the following is not possible in a cyclic process?

a) Work done by the system is positive b) Heat added to the system is positive

c) Work done on the system is positive

d) Heat removed from the system is negative

449. The specific heats of argon at constant pressure and constant volume are 525 J/kg and 315 J/kg respectively. Its density at NTP will be:

a) 1.77 kg/m^3 b) 0.77 kg/m^3 c) 1.77 gm/m^3 d) 0.77 gm/m^3

450. A gas (γ = 1.3) is at a pressure 10^5 N/m^2 in a vessel surrounded by non-conducting medium and having a non-conducting piston. The volume becomes half of its initial value by suddenly pressing the piston. Then, calculate the pressure afterwards:

a) $2^{0.7} \times 10^5$ N/m^2 b) $2^{1.3} \times 10^5$ N/m^2 c) $2^{1.4} \times 10^5$ N/m^2 d) none of these

Ravi Maths Tuition Centre

Time : 1 Mins | **BEHAVIOUR OF PERFECT GAS AND KINETIC ENERGY 1** | **Marks : 510**

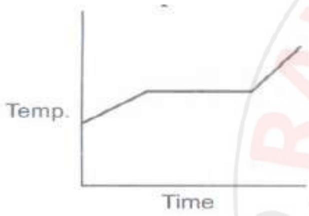
1. The internal energy of one gram of helium at 100 K and one atmospheric pressure is:
   a) 100 J b) 1200 J c) 300 J d) 500 J
2. Amonoatomic gas at a pressure P, having a volume V expands isothermally to a volume 2 V and then adiabatically to a volume 16 V. The final pressure of the gas is: (take γ = 5/3)
   a) 64 P b) 32 P c) P/64 d) 16 P
3. At what temperature is the root mean square velocity of gaseous hydrogen molecules is equal to that of oxygen molecules at 47^0C :
   a) 20 K b) 80 K c) -73 K d) 3 K
4. The equation of state for 5 g of oxygen at a pressure P and temperature 7, when occupying a volume V, will be:
   a) PV = (5/16) RT b) PV = (5/32) RT c) PV = 5 RT d) PV = (5/2) RT
5. At what temperature is the root mean square speed of an atom in an argon gas cylinder equal to the rms speed ofa helium gas atom at -20°C? (Atomic mass of Ar = 39 u and He = 400 u)
   a) 2.52×10^3 K b) 2.52×10^2 K c) 4.03×10^3 K d) 4.03×10^2 K
6. The mean free path for a gas, with molecular diameter d and number density n can be expressed as:
   a) $\frac{1}{\sqrt{2n^2\pi^2d^2}}$ b) $\frac{1}{\sqrt{2n\pi d}}$ c) $\frac{1}{\sqrt{2n\pi d^2}}$ d) $\frac{1}{\sqrt{2n^2\pi d^2}}$
7. A gas is filled in a cylinder. Its temperature is increased by 20% on kelvin scale and volume is reduced to 90%. How much percentage of the gas has to leak for pressure to remain constant?
   a) 20% b) 25% c) 30% d) 40%
8. **Assertion:** For a mixture of non reactive ideal gases, the total pressure gets contribution from each gas in the mixture.
   Reason: In equilibrium, the average kinetic energy of the molecules of different gases will be equal.

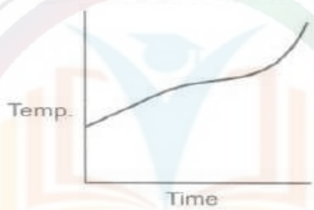
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

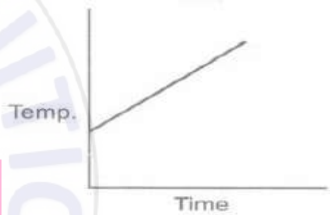
9. 1 mole of H_2 gas is contained in a box of volume V = 1.00 m^3 at T = 300 K. The gas is heated to a temperature of T = 3000 K and the gas gets converted to a gas of hydrogen atoms. The final pressure would be (considering all gases to be ideal)
a) same as the pressure initially b) 2 times the pressure initially
c) 10 times the pressure initially d) 20 times the pressure initially

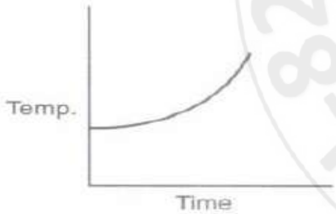
10. The volume of water molecule is (Take, density of water is 10^3 kg m^3 and avogadros number = 6 x 10^{23} $mole^{-1}$)
a) 3 x 10^{-28} m^3 b) 3 x 10^{-29} m^3 c) 1.5 x 10^{-28} m^3 d) 1.5 x 10^{-29} m^3

11. Liquid oxygen at 50 K is heated to 300 K at constant pressure of 1 atm. The rate of heating is constant. Which one of the following graphs represents the variation of temperature with time?

a) 

b) 

c) 

d) 

12. An insulated container containing monatomic gas of molar mass m moving with a velocity v_0, If the container is suddenly stopped. The change in temperature is
a) $\frac{mv_0^2}{2R}$ b) $\frac{mv_0^2}{3R}$ c) $\frac{R}{mv_0^2}$ d) $\frac{3mv_0^2}{2R}$

13. The equation of state, corresponding to 8g of O_2 is:
a) PV = 8RT b) PV = RT/4 c) PV = RT d) PV = RT/2

14. Pressure of a gas at constant volume is proportional to
a) total internal energy of the gas b) average kinetic energy of the molecules
c) average potential energy of the molecules d) total energy of the gas

15. At constant volume, temperature is increased then:
a) Collision on walls will be less b) Number of collisions per unit time will increase
c) Collisions will be in straight lines d) Collisions will not change.

16. Three moles of oxygen are mixed with two moles of helium. What will be the ratio of specific heats at constant pressure and constant volume for the mixture?
a) 2.5 b) 3.5 c) 1.5 d) 1

17. A sample of an ideal gas occupies a volume V at pressure P and absolute temperature T. The mass of each molecule is m, then the density of the gas is

a) mKT b) $\frac{pm}{KT}$ c) $\frac{P}{Km}$ d) $\frac{P}{KT}$

18. N molecules, each of mass m, of gas A and 2 N molecules, each of mass 2 m, of gas B are contained in the same vessel which maintained at a temperature T. the mean square of the velocity of molecules of B type is denoted by v^2 and the mean square of the X component of the velocity of A type is denoted by ω^2, then (ω^2/ v^2) is:

a) 2 b) 1 c) 1/3 d) 2/3

19. **Assertion :** In case of collision of gas molecules in a given amount of gas, total kinetic energy is conserved.

Reason : All collisions of the gas molecules in a given amount of gas are elastic.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

20. A gas mixture consists of 2 moles of O_2 and 4 moles of Ar at temperature T. Neglecting all vibrational modes, the total internal energy of the system is

a) 15 RT b) 9 RT c) 11 RT d) 4 RT

21. If three molecules have velocities 0.5 km s^{-1}, 1 km s^{-1} and 2 km s^{-1}, the ratio of the rms speed and average speed is:

a) 2.15 b) 1.13 c) 0.53 d) 3.96

22. A vessel contains two non-reactive gases neon (monatomic) and oxygen (diatomic). The ratio of their partial pressures is 3 : 2. The ratio of number of molecules is

a) $\frac{3}{2}$ b) $\frac{2}{3}$ c) $\frac{1}{3}$ d) $\frac{1}{2}$

23. A cubic vessel (with faces horizontal + vertical) contains an ideal gas at NTP. The vessel is being carried by a rocket which is moving at a speed of 500 m/s in vertical direction. The pressure of the gas inside the vessel as observed by us on the ground.

a) remains the same because 500 m/s is very much smaller than V_{rms} of the gas

b)

remains the same because motion of the vessel as a whole does not affect the relative motion of the gas molecules and the walls

c)

will increase by a factor equal to $\left[V_{rms}^2 + (500)^2\right] / V_{rms}^2$,where V_{rms} was the original rms mean square velocity of the gas

d) will be different on the top wall and bottom wall of the vessel.

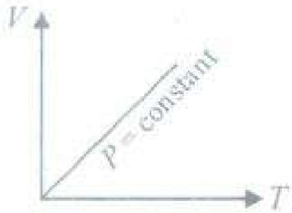
24. The average kinetic energy of O_2 at a particular temperatures is 0.768 eV. The average kinetic energy of N_2 molecules in eV at the same temperature is

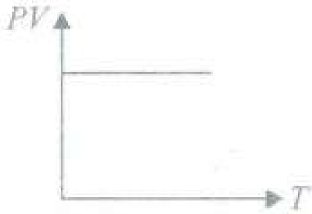
a) 0.0015 b) 0.0030 c) 0.048 d) 0.768

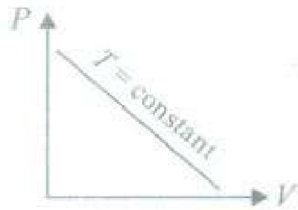
25. If a given mass of gas occupies a volume of 10 cc at 1 atmospheric pressure and temperature of 100°C (373.15K). What will be its volume at 4 atmospheric pressure the temperature being the same?

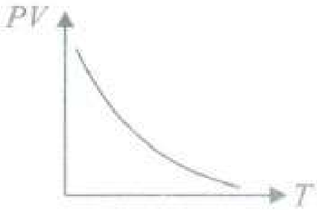
a) 100 cc b) 400 cc c) 2.5 cc d) 104 cc

26. Which of the following graphs represent the behaviour of an ideal gas?

a) 

b) 

c) 

d) 

27. One mole of an ideal monoatomic gas requires 207 J heat to raise the temperature by 10 K when heated at constant pressure. If the same gas is heated at constant volume to raise the temperature by the same 10 K, the heat required is:
[Given the gas constant R = 8.3 J/mol.K]

a) 198.7 J b) 29 J c) 215.3 J d) 124 J

28. A gas at 300 K has pressure 4×10^{-10} N m^{-2}. If $k_B = 1.38 \times 10^{-23}$ J K^{-1}, the number of molecules per cm^3 is of the order of

a) 10^3 b) 10^5 c) 10^6 d) 10^9

29. If for a gas $(R/C_V) = 0.67$ this gas is made up of molecules which are:

a) Diatomic b) Mixture of diatomic and polyatomic c) Monoatomic d) Polyatomic

30. N molecules each of mass m of gas A and 2N molecules each of mass 2m of gas B are contained in the vessel which is maintained at a temperature T. The mean square of velocity of the molecules of B type is denoted by v^2 and the mean square of the x-component of the velocity of A type is denoted by w^2. The ratio of w^2: v^2 is

a) 3: 2 b) 1: 3 c) 2: 3 d) 1: 1

31. **Assertion:** Molecules of air in a room do not all fall and settle on the ground due to gravity.

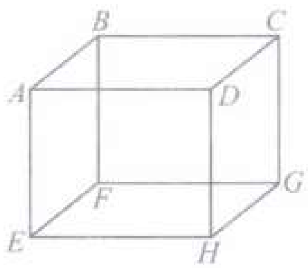
Reason: Air molecules move with high speed and there is incessant collision of air molecules.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

32. 1 mole of an ideal gas iscontained in a cubical volume V, A BCDEFGH at 300 K as shown in figure. One face of the cube (EFGH) is made up of a material which totally absorbs any gas molecule incident on it. At any given time,



a) the pressure on EFGH would be zero b) the pressure on all the faces will be equal
c) the pressure of EFGH would be double the pressure on ABCD
d) the pressure on EFGH would be half that on ABCD.

33. Which one of the following is not an assumption of kinetic theory of gases?
a) The volume occupied by the molecules of the gas is negligible
b) The force of attraction between the molecules is negligible.
c) The collision between the molecules are elastic. d) All molecules have same speed.

34. If pressure of a gas contained in a closed vessel is increased by 0.4% when heated by 1^0C, the initial temperature must be:
a) 250 K b) 250^0C c) 2500 K d) 25^0C

35. The pressure and temperature of two different gases is P and T having the volume V for each. They are mixed keeping the same volume and temperature, the pressure of the mixture will be :
a) P/2 b) P c) 2P d) 4P

36. Ratio specific heats of monoatomic molecule is:
a) γ=5/3 b) γ=3/5 c) γ=4/3 d) γ=2/3

37. The heat capacity per mole of water is (R is universal gas constant)
a) 9R b) $\frac{9}{2}R$ c) 6R d) 5R

38. The average thermal energy for a mono-atomic gas is : $(k_B$ is Boltzmann constant and T, absolute temperature)
a) $\frac{7}{2}k_BT$ b) $\frac{1}{2}k_BT$ c) $\frac{3}{2}k_BT$ d) $\frac{5}{2}k_BT$

39. When an ideal gas is compressed adiabatically, its temperature rises the molecules on the average have more kinetic energy than before. The kinetic energy increases
a) because of collisions with moving parts of the wall only.
b) because of collisions with the entire wall.
c) because the molecules gets accelerated in their motion inside the volume.
d) because the redistribution of energy amongst the molecules.

40. If C_p and C_v denoted the specific heats of unit mass of nitrogen at constant pressure and volume respectively, then

a) $C_p - C_v = \frac{R}{28}$ b) $C_p - C_v = \frac{R}{7}$ c) $C_P - C_v = \frac{R}{14}$ d) C_P-C_V=R

41. Temperature of an ideal gas is T K and average kinetic energy is E = 2.07 x 10^{-23} T Joule/molecule. Number of molecules in 1 litre gas at S.T.P. will be:
a) 2.68 x 10^{22} b) 2.68 x 10^{25} c) 2.68 x 10^{28} d) 1.68 x 10^{22}

42. If C_p and C_v denote the specific heats (per unit mass) of an ideal gas of molecular weight M, then: where R is the molar gas constant
a) C_p-C_v = R/M^2 b) C_p-C_v = R c) C_p-C_v = R/M d) C_p-C_v = M/R

43. A gas is filled in a container at pressure P_o' If the mass of molecules is halved and their rms speed is doubled, then the resultant pressure would be
a) $2P_o$ b) $4P_o$ c) $\frac{P_0}{4}$ d) $\frac{P_0}{2}$

44. The temperature of 5 mole of a gas which was held at constant volume was changed from 100°C to 120^{0}C. The change in internal energy was found to be 80 J. The total heat capacity of the gas at constant volume will be equal to:
a) 8 JK^{-1} b) 0.8 JK^{-1} c) 4 JK^{-1} d) 0.4 JK^{-1}

45. 0.014 kg of nitrogen is enclosed in a vessel at a temperature of 27°C. At which temperature the rms velocity of nitrogen gas is twice its the rms velocity at 27°C?
a) 1200 K b) 600 K c) 300 K d) 150 K

46. Pressure versus temperature graph of an ideal gas of equal number of moles of different volumes are plotted as shown in figure. Choose the correct alternative.
a) $V_1 = V_2 = V_3$ = Vol b) $V_4 > V_3 > V_2 > V_1$ c) $V_1 = V_2$; $V_3 = V_4$ and $V_2 > V_3$
d) $V_1 = V_2$, $V_3 = V_4$ and $V_2 < V_3$

47. Three containers of the same volume contain three different gases. The masses of the molecules are m_1, m_2 and m_3 and the number of molecules in their respective containers are N_1, N_2 and N_3. The gas pressure in the containers are P_1, P_2 and P_3 respectively. All the gases are now mixed and put in one of these containers. The pressure P of the mixture will be:
a) $P < (P_1 + P_2 + P_3)$ b) $P = \frac{(P_1+P_2+P_3)}{3}$ c) $P = P_1 + P_2 + P_3$
d) $P > (P_1 + P_2 + P_3)$

48. 22 gm of CO_2 at 27^{0}C is mixed with 16 gm of O_2 at 37^{0}C. The temperature of the mixture is :
a) 32^{0}C b) 27^{0}C c) 37^{0}C d) 30.5^{0}C

49. A disc of radius 2 m and mass 100 kg rolls on a horizontal floor. Its centre of mass has speed of 20 cm/s. How much work is needed to stop it?
a) 30 KJ b) 2 J c) 1 J d) 3 J

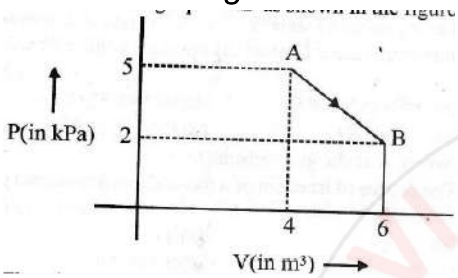
50. A cylinder contains 10 kg of gas at a pressure of 10^7 N m^{-2}. The quantity of gas taken out of the cylinder, if final pressure is 2.5 x 10^6 N m^{-2} is
a) 9.5 kg b) 7.5 kg c) 14.2 kg d) zero

51. From a certain apparatus, the diffusion rate of hydrogen has an average value of 28.7 $cm^3\ s^{-1}$. The diffusion of another gas under the same conditions is measured to have an average rate of 7.2 $cm^3\ s^{-1}$. The gas is
    a) Nitrogen b) Helium c) Argon d) Oxygen

52. The average energy per molecule of a triatomic gas at room temperature T is
    a) 3kT b) $\frac{1}{2}kt$ c) $\frac{3}{2}kT$ d) $\frac{5}{2}kT$

53. A cylinder contains hydrogen gas at pressure of 249 kPa and temperature $27^\circ\mathrm{C}$.
    Its density is: $(\mathrm{R}=8.3\ \mathrm{J\ mol^{-1}\ K^{-1}})$
    a) $0.02\ \mathrm{kg/m^3}$ b) $0.5\ \mathrm{kg/m^3}$ c) $0.2\ \mathrm{kg/m^3}$ d) $0.1\ \mathrm{kg/m^3}$

54. One mole of an ideal diatomic gas undergoes a transition from A to B along a path AB as shown in the figure.



The change in internal energy of the gas during the transition is:
    a) -20 KJ b) 20 J c) -12 KJ d) 20 KJ

55. In a certain region of space there are only 5 gaseous molecules per em" on an average. The temperature there is 3 K The pressure of this gas is
    (k_B = 1.38 X 10^{-23} J mol^{-1} K^{-1})
    a) 20.7 x 10^{-16} N m^{-2} b) 20.7 x 10^{-17} N m^{-2} c) 10.7 x 10^{-16} N m^{-2}
    d) 10.7 x 10^{-17} N m^{-2}

56. An air bubble of volume 1.0 cm- rises from the bottom of a lake 40 m deep at a temperature of 12°C. To what volume does it grow when it reaches the surface, which is of a temperature of 35 °C ?
    a) 10.6 x 10^{-6} m^3 b) 5.3 x 10^{-6} m^3 c) 2.8 x 10^{-6} m^3 d) 15.6 x 10^{-6} m^3

57. According to kinetic theory of gases, at absolute zero temperature:
    a) Water freezes b) Liquid helium freezes c) Molecular motion stops
    d) Liquid hydrogen freezes

58. Ten small planes are flying at a speed of 150 km h^{-1} in total darkness in an air space that is 20 x 20 x 1.5 km^3, in volume. You are in one of the planes, flying at random within this space with no way of knowing where the other planes are. On the average about how long a time will elapse between near collision with your plane. Assume for this rough computation that a safety region around the plane can be approximated by a sphere of radius 10m.
    a) 125h b) 220h c) 432h d) 225h

59. For a certain gas, the ratio of specific heats is given to be g = 1.5. For this gas:
    a) $C_V=3\mathrm{R/J}$ b) $C_p=3\mathrm{R/J}$ c) $C_p=5\mathrm{R/J}$ d) $C_V=5\mathrm{R/J}$

60. A thin tube of uniform cross-section is sealed at both ends. When it lies horizontally, the middle 5 cm length contains mercury and the two equal ends contain air at the same pressure P. When the tube is held at an angle of 60° with the vertical, then the lengths of the air columns above and below the mercury column are 46 cm and 44.5 cm respectively. Calculate the pressure P in cm of mercury. The temperature of the system is kept at 30°C.
a) 75.4 b) 45.8 c) 67.5 d) 89.3

61. Two specific heats of a perfect gas are related by :
a) $C_p - C_v = R/J$ b) $C_p - C_v = J$ c) $C_p - C_v = RJ$ d) $C_p + 1/C_v = 2.4$ cal

62. The molecules of a given mass of a gas have r.m.s velocity of 200 m/s at 27^0C and 1.0 x 10^5 N/m^2 pressure. When the temperature and pressure of the gas are respectively 127°C and 0.05 x 10^5Nm^{-2}, the rms velocity of its molecules in ms^{-1} is
a) 100/3 b) $100\sqrt{2}$ c) $400\sqrt{3}$ d) $100\sqrt{2/3}$

63. Cooking gas containers are kept in a lorry moving with uniform speed. The temperature of the gas molecules inside wil
a) increase b) decrease c) remains the same
d) decrease for some and increase for others

64. The ratio of the molar heat capacities of a diatomic gas at constant pressure to that at constant volume is
a) $\frac{7}{5}$ b) $\frac{3}{2}$ c) $\frac{3}{5}$ d) $\frac{5}{2}$

65. The pressure of a gas is raised from 27^0C to 927^0C. The root mean square speed is:
a) $\sqrt{(927/27)}$ times the earlier value b) Remain the same c) Get halved
d) Get doubled

66. Calculate the means free path of nitrogen molecule at 27°C when pressure is 1.0 atm. Given, diameter of nitrogen molecule = 1.5 Å, k_B = 1.38 x 10^{-23} J K^{-1}. If the average speed of nitrogen molecule is 675 ms^{-1}. The time taken by the molecule between two successive collisions is
a) 0.6ns b) O.4ns c) 0.8ns d) O.3ns

67. The molecules of a given mass of a gas have root mean square speeds of 100 ms^{-1} at 27°C and 1 atmospheric pressure. The root mean square speeds of the molecules of the gas at 127°C and 2 atmospheric pressure is
a) $\frac{200}{\sqrt{3}}$ b) $\frac{100}{\sqrt{3}}$ c) $\frac{400}{3}$ d) $\frac{200}{3}$

68. A cylinder of fixed capacity 44.8 litres contains helium gas at standard temperature and pressure. What is the amount of heat needed to raise the temperature of the gas in the cylinder by 15°C ? (R = 8.31 J mol^{-1} K^{-l})
a) 265 J b) 310.10 J c) 373.95 J d) 387.97 J

69. Two cylinders A and B of equal capacity are connected to each other via a stop cock. The contains an ideal gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. The stop cock is suddenly opened. The process is:

a) Isobaric b) Isothermal c) Adiabatic d) Isochoric

70. One kg of a diatomic gas is at a pressure of 8 x 10^4 m^{-2}. The density of the gas is 4 kg m^{-3}. The energy of the gas due to its thermal motion is:

a) 3 x 10^4 J b) 5 x 10^4 J c) 6 x 10^4 J d) 7 x 10^4 J

71. **Assertion:** The ratio of specific heat of a gas at constant pressure and specific heat at constant volume for a diatomic gas is more than that for a monoatomic gas.

Reason : The molecules of a mono atomic gas have more degree of freedom than those of a diatomic gas.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

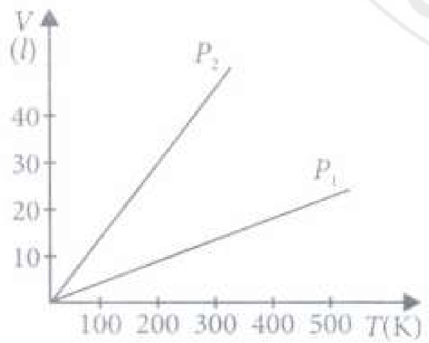
72. The equation of state corresponding to 8 g of O_2 is:

a) PV = 8RT b) PV = RT/4 c) PV = RT d) PV = RT/2

73. Molecular motion shows itself as

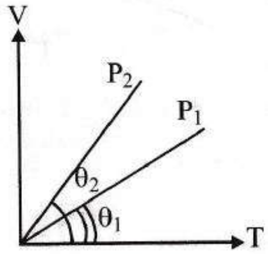
a) temperature b) internal energy c) friction d) viscosity

74. Volume versus temperature graphs for a given mass of an ideal gas are shown in figure at two different values of constant pressure. What can be inferred about relation between P_1 and P_2?



a) $P_1 > P_2$ b) $P_1 = P_2$ c) $P_1 2$ d) data is insufficient

75. In the given (V-T) diagram, what is the relation between pressure P_1 and P_2?



a) $P_2 > P_1$ b) $P_2 < P_1$ c) Cannot be predicted d) $P_2 = P_1$

76. **Assertion:** Average kinetic energy per molecule of any ideal monoatomic gas is $\frac{3}{2}k_BT$
Reason : Average kinetic energy depends only on temperature and is independent of the nature of the gas.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

77. At 10^o C the value of the density of a fixed mass of an ideal gas divided by its pressure is x. At 110^o'C this ratio is:
a) x b) $\frac{383}{283}x$ c) $\frac{10}{110}x$ d) $\frac{283}{383}x$

78. According to equipartition law of energy each particle in a system of particles have thermal energy E equal to
a) $E=k_BT$ b) $E=\frac{1}{2}k_BT$ c) $E=3k_BT$ d) $E=\frac{3}{2}k_BT$

79. The temperature of an ideal gas is increased from 120 K to 480 K. If at 120 K, the rms velocity of the gas molecules is v_{rms}, then at 480 K, it becomes
a) $4v_{rms}$ b) $2\ v_{rms}$ c) $\frac{v_{rms}}{2}$ d) $\frac{v_{rms}}{4}$

80. For hydrogen gas C_p - C_v = a, and for oxygen gas C_p - C_v = b, so that relation between a and b given by:
a) a=16 b b) 16a=b c) a=b d) a=4b

81. A perfect gas at 27°C is heated at constant pressure to 327^{0}C. If original volume of gas at 27°C is V then volume at 327° C is:
a) V b) 3V c) 2V d) V/2

82. Increase in temperature of a gas filled in a container would lead to:
a) Increase in its kinetic energy b) Decrease in its pressure
c) Decrease in intermolecular distance d) Increase in its mass

83. **Assertion:** Specific heat of a gas at constant pressure is greater than its specific heat at constant volume.
Reason: At constant pressure, some heat is spent in expansion of the gas.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

84. One half mole each of nitrogen, oxygen and carbon dioxide are mixed in enclosure of volume 5 litres and temperature 27°C. The pressure exerted by mixture is (R = 8.31 J rnol^{-1} K^{-1})
a) 7.48 x 10^5 N m^{-2} b) 5 x 10^5 N m^{-2} c) 6 x 10^5 N m^{-2} d) 3 x 10^5 N m^{-2}

85. The diameter of an oxygen molecule is 3 A. The ratio of molecular volume to the actual volume occupied by the oxygen gas at STP is:
a) 2 x 10^{-4} b) 1 x 10^{-4} c) 1.5 x 10^{-4} d) 4 x 10^{-4}

86. One mole of an ideal monatomic gas at temperature T_o expands slowly according to the law $\frac{P}{V}$ = constant. If the final temperature is 2 T_o heat supplied to the gas is
a) $2RT_0$ b) RT_0 c) $\frac{3}{2}RT_0$ d) $\frac{1}{2}RT_0$

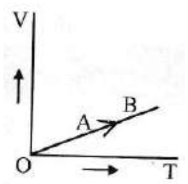
87. A balloon contains 1500 m^3 of helium at 27°C and 4 atmospheric pressure. The volume of helium at -3 °C temperature and 2 atmospheric pressure will be
a) 1500 m^3 b) 1700 m^3 c) 1900 m^3 d) 2700 m^3

88. The degree of freedom of a molecule of a triatomic gas is:
a) 2 b) 4 c) 6 d) 8

89. At what temperature is the rms velocity of hydrogen molecule equal to that of an oxygen molecule at 47°C?
a) 10 K b) 20 K c) 30 K d) 40 K

90. A vessel is filled with a gas at a pressure of 76 cm of mercury at a certain temperature. The mass of the gas is increased by 50% by introducing more gas in the vessel at the same temperature. The resultant pressure of the gas is:
a) 76 cm of mercury b) 108 cm of mercury c) 112 cm of mercury
d) 114 cm of mercury

91. The volume (V) of a monoatomic gas varies with its temperature (T), as shown in the graph. The ratio of work done by the gas, to the heat absorbed by it, when it undergoes a change from state A to state B, is:



a) $\frac{1}{3}$ b) $\frac{2}{3}$ c) $\frac{2}{5}$ d) $\frac{1}{7}$

92. The ratio of specific heats $C_p/C_v = \gamma$ in terms of degree of freedom (n) is given by:
a) (1+n/3) b) (1+2/n) c) (1+n/2) d) (1+ 1/n)

93. The temperature of a gas is raised from 27^{0}C to 927^{0}C. The root mean square speed:
a) $(\sqrt{927/27})$ times the earlier value b) Gets halved c) Remains the same
d) Gets doubled

94. The ratio of the specific heats $\frac{C_p}{C_v} = \gamma$ in terms of degrees of freedom (n) is given by:
a) $\left(1+\frac{n}{3}\right)$ b) $\left(1+\frac{2}{n}\right)$ c) $\left(1+\frac{n}{2}\right)$ d) $\left(1+\frac{1}{n}\right)$

95. Two identical containers A and B with frictionless pistons contain the same ideal gas at the same temperature and the same volume V. The mass of the gas in A is mA and that in B is m_B' The gas in each cylinder is now allowed to expand isothermally to the same final volume 2 V. The changes in the pressure in A and B are found to be Δp and 1.5 Δp, respectively. Then

a) $4m_A=9m_B$ b) $2m_A=3m_B$ c) $3m_A=2m_B$ d) $9m_A=4m_B$

96. 1 mole of a gas with $\gamma = \frac{7}{5}$ is mixed with 1 mole of gas with $\gamma = \frac{5}{3}$ the value of y of the resulting mixture of.

a) $\frac{7}{5}$ b) $\frac{2}{5}$ c) $\frac{3}{2}$ d) $\frac{12}{7}$

97. Two moles of a gas A at 27°C mixed with a 3 moles of gas at 37°C. If both are monatomic ideal gases, what will be the temperature of the mixture?

a) 66 °C b) 11 °C c) 22°C d) 33 °C

98. Two mole of oxygen is mixed with eight mole of helium. The effective specific heat of the mixture at constant volume is

a) 1.3R b) 1.4R c) 1.7R d) 1.9R

99. A real gas behaves like an ideal gas if its

a) both pressure and temperature are high b) both pressure and temperature are low
c) pressure is high and temperature is low d) pressure is low and temperature is high

100. The equation of state for 5 g of oxygen at a pressure P and temperature T, when occupying a volume V, will be
(where R is the gas constant)

a) PV = (5/32)RT b) PV = 5RT c) PV = (5/2)RT d) PV = (5/16)RT

101. An inflated rubber balloon contains one mole of an ideal gas, has a pressure P,volume V and temperature T. If the temperature rises to 1.1 T, and the volume is increased to 1.05 V, the final pressure will be

a) 1.1 P b) P c) less than P d) between P and 1.1 P

102. The kinetic theory of gases gives the formula $PV = \frac{1}{3}Nmv^{-2}$ for the pressure P exerted by a gas enclosed in a volume V. The term Nm represents

a) the mass of a mole of the gas b) the mass of the gas present in the volume V
c) the average mass of one molecule of the gas
d) the total number of molecules present in volume V

103. **Assertion:** Each vibrational mode gives two degrees of freedom.
Reason : By law of equipartition of energy, the energy for each degree of freedom in thermal equilibrium is $2k_BT$.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

104. The r.m.s. velocity of the molecules in the sample of helium is 5/7th that of the molecules in the sample of hydrogen. If the temperature of the hydrogen sample is 0^0C that of helium is :
a) 0^0C b) 0^0K c) 273^0C d) 100^0C

105. A molecule of a gas has six degrees of freedom. Then the molar specific heat of the gas at constant volume is:
a) $\frac{R}{2}$ b) R c) $\frac{3R}{2}$ d) 3R

106. Consider a rectangular block of wood moving with a velocity Vo in a gas at temperature T and mass density p. Assume the velocity is along x-axis and the area of cross-section of the block perpendicular to V_o is A. The drag force on the block is (where m is the mass of the gas molecule.)
a) $4\rho A v_0\sqrt{\frac{kT}{m}}$ b) $2\rho A v_0\sqrt{\frac{kT}{3m}}$ c) $\frac{\rho A}{2v_0}\sqrt{\frac{kT}{m}}$ d) $\frac{v_0}{\rho A}\sqrt{\frac{kT}{2m}}$

107. A gaseous mixture enclosed in a vessel contains 1 g mole of a gas A (with γ = 5/3) and another gas B (with γ = 7/5) at a temperature T. The gases A and B do not react with each other and assumed to be ideal. The number of gram moles of B, if Y for the gaseous mixture is 19/13 is
a) 2 b) 12 c) 16 d) 8

108. A vessel of volume V contains a mixture of 1 mole of hydrogen and 1 mole of oxygen (both considered as ideal). Let $f_1(v)dv$ denote the fraction of molecules with speed between *v* and (v + dv) with $f_2(v)dv$, similarly for oxygen. Then
a) $f_1(v) + f_2(v) = f(v)$ obeys the Maxwell's distribution law
b) f_1 (v),f_2(v) will obey the Maxwell's disribution law separately
c) Neither $f_1(v)$ nor $f_2(v)$ will obey the Maxwell's distribution law
d) $f_2(v)$ and $f_1(v)$ will be the same

109. If a gas has n degrees of freedom ratio of specific heats of gas is
a) $\frac{1+n}{2}$ b) $1+\frac{1}{n}$ c) $1+\frac{n}{2}$ d) $1+\frac{2}{n}$

110. If the pressure and the volume of certain quantity of ideal gas are halved, then its temperature
a) is doubled b) becomes one-fourth c) remains constant d) become four times

111. When a block of iron floats in mercury at 0^0C, fraction k_1 of its volume is submerged, while at the temperature 60° C, a fraction k_2 is seen to be submerged. If the coefficient of volume expansion of iron γ_{Fe} and that of mercury is γ_{Hg}, then the ratio k_1/k_2 can be

expressed as

a) $(1+60\gamma_{Fe})/(1+60\gamma_{Hg})$ b) $\frac{1-60\gamma_{Fe}}{1+60\gamma_{Hg}}$ c) $\frac{1+60\gamma_{Fe}}{1-60\gamma_{Fe}}$ d) $\frac{1+60\gamma_{Hg}}{1+60\gamma_{Fe}}$

112. The root mean square speed of smoke particles each of mass 5 x 10^{-17} kg in their Brownian motion in air at N.T.P is:

a) 3 x 10^{-2} ms^{-1} b) 1.5 x 10^{-2} m s^{-1} c) 3 x 10^{-3} m s^{-1} d) 1.5 x 10^{-3} m s^{-1}

113. A cylinder containing an ideal gas is in vertical position and has a piston of mass M that is able to move up or down without friction. If the temperature is increased,

a) both P and V of the gas will change

b) only P will increase according to Charle's law. c) V will change but not P

d) V will change but not P

114. **Assertion:** The ratio of rms speed and average speed of a gas molecules at a given temperature is $\sqrt{3}$: $\sqrt{8/\pi}$

Reason: $c_{rms} > c_{av}$.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

115. In a vessel, the gas is at a pressure P. If the mass of all the molecules is halved and their speed is doubled, then the resultant pressure will be:

a) 4 P b) 2 P c) P d) p/2

116. A vessel has 6 g of hydrogen at pressure P and temperature 500 K A small hole is made in it so that hydrogen leaks out. How much hydrogen leaks out if the final pressure is $\frac{P}{2}$ and temperature falls to 300 K?

a) 2 g b) 3 g c) 4 g d) 1 g

117. Relation between pressure (P) and energy (E) of a gas is:

a) P = 3 E b) $P=\frac{1}{3}E$ c) $P=\frac{1}{2}E$ d) P = 3 E

118. The temperature of an ideal gas is increased from 27°C to 927^{0}C. The root mean square speed of its molecules becomes:

a) Twice b) Half c) Four times d) One-fourth

119. **Assertion:** The root mean square and most probable speeds of the molecules in a gas are the same.

Reason: The Maxwell distribution for the speed of molecules in a gas is symmetrical.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

120. A polyatomic gas with z degrees of freedom has a mean energy per molecule given by:

a) $\frac{nkT}{N}$ b) $\frac{nkT}{2N}$ c) $\frac{nkT}{2}$ d) $\frac{3kT}{2}$

121. When the temperature of a gas filled in a closed vessel is increased by 1°C, its pressure increases by 0.4 percent. The initial temperature of gas was

a) 250°C b) 25°C c) 250 K d) 25 K

122. The temperature of an ideal gas is increased from 27°C to 127°C, then percentage increase in v_{rms} is

a) 37% b) 11% c) 33% d) 15.5%

123. The volume of vessel A is twice the volume of another vessel B, and both of them are filled with the same gas. If the gas in A is at twice the temperature and twice the pressure in comparison to the gas in B, then the ratio of the gas molecules in A to that of B is

a) $\frac{1}{2}$ b) $\frac{2}{1}$ c) $\frac{3}{2}$ d) $\frac{2}{3}$

124. Boyle's law is applicable for an

a) adiabatic process b) isothermal process c) isobaric process d) isochoric process

125. A vessel containing 1 mole of 0_2 gas (molar mass 32) at a temperature T. The pressure of the gas is P. An identical vessel containing one mole of He gas (molar mass 4) at temperature 2T has a pressure of:

a) $\frac{P}{8}$ b) P c) 2P d) 8P

126. The kinetic energy of 1g molecule of a gas, at normal temperature and pressure, is:

a) 0.56×10^4 J b) 2.7×10^2 J c) 1.3×10^2 J d) 3.4×10^3 J

127. A gas is taken in a sealed container at 300K it is heated at constant volume to a temperature 600 K the mean KE. of its molecules is :

a) Halved b) Doubled c) Tripled d) Quadrupled

128. Two chamber containing m_1 and m_2 grams of a gas at pressures P_l and P_2 respectively are put In communication with each other, temperature remaining constant. The common pressure reached will be

a) $\frac{P_1P_2(m_1+m_2)}{P_2m_1+P_1m_2}$ b) $\frac{P_1P_2m_1}{P_2m_1+P_1m_2}$ c) $\frac{m_1m_2(P_1+P_2)}{P_2m_1+P_1m_2}$ d) $\frac{m_1m_2P_2}{P_2m_1+P_1m_2}$

129. The number of translational degrees of freedom for a diatomic gas is:

a) 2 b) 3 c) 5 d) 6

130. A gas has molar heat capacity C = 37.55 J $mole^{-1}$, K^{-1} in the process PT = constant. The number of degrees of freedom of the molecules of the gas.
a) 6 b) 3 c) 1 d) 5
131. Two containers A and B are partly filled with water and closed. The volume of A is twice that of B and it contains half the amount of water in B. If both are at the same temperature, the water vapour in the containers will have pressure in the ratio of:
a) 1: 2 b) 1: 1 c) 2: 1 d) 4: 1
132. **Assertion:** In a mixture of gases at a fixed temperature, the heavier molecule has the lower average speed.
Reason : Temperature of a gas is a measure of the average kinetic energy of a molecule.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.
133. At 0 K, which of the following properties of a gas will be zero?
a) Kinetic energy b) Potential energy c) Density d) Mass
134. 1/2 mole of helium is contained in a container at STP How much heat energy is needed to double the pressure of the gas, (volume is constant) heat capacity of gas is 3 J s' K^{-1}
a) 1436 J b) 736 J c) 1638 J d) 5698 J
135. The amount of heat energy required to raise the temperature of 1 g of Helium at NTP, from T_1K to T_2K is:
a) $\frac{3}{2} N_a k_B (T_2 - T_1)$ b) $\frac{3}{4} N_a k_B (T_2 - T_1)$ c) $\frac{3}{4} N_a k_B \frac{T_2}{T_1}$
d) $\frac{3}{8} N_a k_B (T_2 - T_1)$
136. The mean free path of molecules of a gas (radius 'r') is inversely proportional to:
a) r^3 b) r^2 c) r d) $\sqrt{r}$
137. If C_s be the velocity of sound in air and C be the r.m.s velocity, then:
a) $C_s < C$ b) $C_s = C$ c) $C_s = C(\gamma/3)^{1/2}$ d) None of these
138. A litre of an ideal gas at 27°C is heated at a constant pressure to 297^0C. Then the final volume is approximately:
a) 1.2 litres b) 1.9 litres c) 19 litres d) 2.4 litres

Ravi Maths Tuition Centre

Time : 1 Mins **OSCILLATIONS' AND WAVES 1 1** **Marks : 1453**

1. The displacement of an elastic wave is given by the function y = 3sinωt + 4 cosωt, where y is in cm and t is in s. The resultant amplitude is:
   a) 3 cm b) 4 cm c) 5 cm d) 7 cm
2. The picture of a progressive transverse wave at a particular instant of time gives:
   a) shape of the wave b) motion of the particles of the medium c) velocity of the wave
   d) none of the above
3. A wave is represented by the equation: $y = 7\sin\left(7\pi t - 0.04x + \frac{\pi}{3}\right)$. Where, x is in metres and t in seconds. The speed of the waves is:
   a) (175π)m/s b) (49π)m/s c) (49/π)m/s d) (0.28π)m/s
4. To demonstrate the phenomenon of interference, we need:
   a) two sources which emit radiation of nearly the same frequency
   b) two sources which emit radiation of exactly the same frequency
   c) two sources which emit radiation of exactly the same frequency and have a definite phase relationship
   d) two sources which emit radiation of exactly the same wavelength
5. A standing wave having 3 node and 2 antinodes is formed between two atoms having a distance 1.21 A^o between them. The wavelength of the standing wave is _____________ .
   a) 1.21 A^o b) 1.42 A^o c) 6.05 A^o d) 3.63 A^o
6. Assertion: Variation in air pressure do not affect the speed of sound when temperature remains constant.
   Reason: Speed of sound is directly proportional to square root of pressure.
   a) If both assertion and reason are true and reason is the correct explanation of assertion.
   b) If both assertion and reason are true but reason is not the correct explanation of assertion.
   c) If assertion is true but reason is false. d) If both assertion and reason are false.
7. Through binoculars a man watches a carpenter driving nails at a regular rate of 1 stroke per second. He hears the sound of the blow exactly synchronized with the blows he sees. He hears two more blows after he sees the carpenter stops hammering. The distance of the carpenter is: (c = 340m/s)
   a) 340 m b) 680 m c) 510 m d) 170 m

8. A guitar string is 90 cm long and has a fundamental frequency of 124 Hz. To produce a fundamental frequency of 186 Hz, the guitar should be pressed
a) 60 cm b) 30 cm c) 20 cm d) 10 cm

9. Two sources of intensity I and 4I are used in an interference experiment. The intensity at points where the waves from the two sources superpose with a phase difference(i) zero (ii) $\pi/2$ and (iii) π, are:
a) $5I, 3I, 0$ b) $5I, 3I, 2I$ c) $9I, 5I, I$ d) $9I, 5I, 0$

10. The general equation of a wave in a string is: $y = 0.1\sin\pi(0.10x - 8t + 1.3)$. The equation of the wave that would produce a stationary wave with the given wave is:
a) $y = 0.1\cos\pi(0.10x - 8t + 1.3)$ b) $y = 0.1\sin\pi(0.10x + 8t + 1.3)$ c) $y = 0.1\sin\pi(8x + 0.10t + 1.3)$
d) $y = 0.1\cos\pi(8x + 0.10t + 1.3)$

11. Out of the following gases under similar condition of temperature and pressure, the velocity of sound will be maximum in
a) hydrogen b) nitrogen c) oxygen d) chlorine

12. Two pendulums differ in lengths by 22 cm. They oscillate at the same place so that one of them makes 30 oscillations and the other makes 36 oscillations during the same time. The lengths (in crn) of the pendulums are
a) 72 and 50 b) 60 and 38 c) 50 and 28 d) 80 and 58

13. A spring is loaded with two blocks m_1 and m_2, where m_1 is rigidly fixed with the spring and m_1 is Just kept on the block m_1. The maximum energy of oscillation is possible for the system having the block m_2 in contact with m_1 is.

a) $\frac{m_1^2g^2}{k}$ b) $\frac{m_1g^2}{2k}$ c) $\frac{m_2^2g^2}{2k}$ d) $\frac{(m_1+m_2)^2g^2}{2k}$

14. The distance between two points differing in phase by 60° on a wave having a wave velocity 360 m/s and frequency 500 Hz is:
a) 0.72 metre b) 0.18 metre c) 0.12 metre d) 0.36 metre

15. A string of length L is stretched by L/20 and the speed of transverse waves along it is v. The speed of wave when it is stretched by L/10 will be: (assume that Hooke's law is applicable)
a) $2v$ b) $v/\sqrt{2}$ c) $\sqrt{2}v$ d) $2v$

16. The speed of sound waves in a gas:
a) does not depend upon density of the gas b) does not depend upon changes in pressure
c) does not depend upon temperature d) depends upon density of the gas

17. If sound waves can be assumed to be diffracted which of the following objects will diffract sound waves in air from a 384 Hz tuning fork?
a) A sphere of radius 10 m b) A sphere of radius 1 m c) A sphere of radius 1 mm
d) A sphere of radius 1 cm

18. A particle executing simple harmonic motion with an amplitude A. The distance travelled by the particle in one time period is
a) zero b) A c) 2A d) 4A

19. A standing wave is represented by y = a sin (100 t) cos (0.01)x, where y and a are in millimetre, t in second and x is in metre. Velocity of wave is _______________ .

a) 10^4 m/s b) 1 m/s c) 10^{-4} m/s d) None of these

20. There are three sources of sound of equal intensity with frequencies 400, 401 and 402 vibrations/sec. The number of beats heard per second is:
a) 0 b) 1 c) 2 d) 3

21. Two points are located at a distance of 10 m and 15 m from the source of oscillation. The period of oscillation is 0.05 sec and the velocity of the wave is 300 m/sec, What is the phase difference between the oscillations of two points?
a) π/6 b) π/3 c) 2π/3 d) π

22. Which of the following motions is not simple harmonic?
a) Vertical oscillations of a spring b) Motion of a simple pendulum
c) Motion of planet around the sun d) Oscillation of liquid in aU-tube

23. 56 tuning forks are so arranged in series that each fork gives 4 beats per see with the previous one. The frequency of the last fork is 3 times that of the first. The frequency of the first fork is:
a) 110 b) 56 c) 60 d) 52

24. The equation of a sound wave is y = 0.0015 sin (62.4x+ 316t).Find the wavelength of this wave:
a) 0.2 unit b) 0.1 unit c) 0.3 unit d) cannot be calculated

25. At what temperature the velocity of sound in a gas is thrice of its velocity at 0° C?
a) 2184°C b) 2457°C c) 2184 K d) 819 K

26. A non viscous liquid of density p is filled in a tube with A as the area of cross section, as shown in the figure. If the liquid is slightly depressed in one of the arms, the liquid column oscillates with a frequency

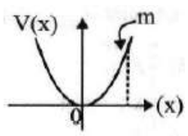
a) $\frac{1}{2\pi}\sqrt{\frac{\rho gA\sin\left(\frac{\theta_1+\theta_2}{2}\right)}{m}}$ b) $\frac{1}{2\pi}\sqrt{\frac{\rho gA\left(\sin\theta_1-\sin\theta_2\right)}{m}}$ c) $\frac{1}{2\pi}\sqrt{\frac{\rho gA\left(\sin\theta_1+\sin\theta_2\right)}{m}}$ d) $\frac{1}{2\pi}\sqrt{\frac{\rho gA\left(\frac{\theta_1-\theta_2}{2}\right)}{m}}$

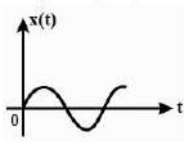
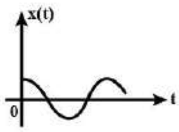
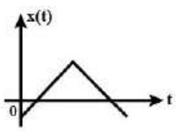
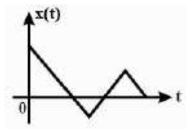
27. One end of a taut string of length 3 m along the x-axis is fixed at x = O. The speed of the waves in the string is 100 m s^{-1}. The other end of the string is vibrating in the y direction so that stationary waves are set up in the string. The possible waveform(s) of these stationary waves is (are).

a) $y(t) = A\sin\frac{2\pi x}{6}\cos\frac{50\pi t}{3}$ b) $y(t) = A\sin\frac{\pi x}{3}\cos\frac{100\pi t}{3}$ c) $y(t) = A\sin\frac{5\pi x}{6}\cos\frac{255\pi t}{3}$ d) $y(t) = A\sin\frac{5\pi x}{2}\cos 250\pi t$

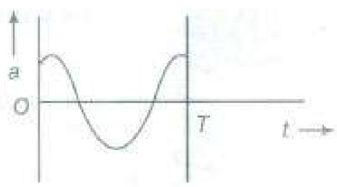
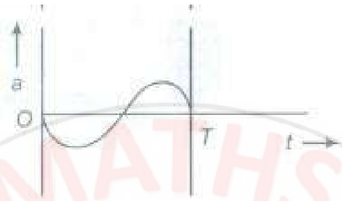
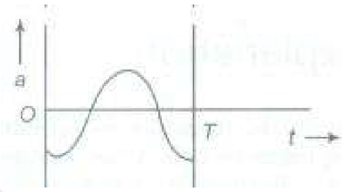
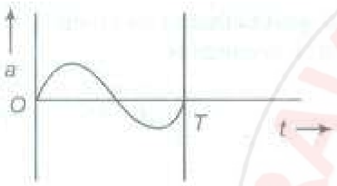
28. The total energy of a particle executing simple harmonic motion is proportional to:
a) displacement from equilibrium position b) frequency of oscillation
c) velocity of equilibrium position d) square of amplitude of motion

29. A particle of mass m is released from rest and follows a parabolic path as shown. Assuming that the displacement of the mass from the origin is small, which graph correctly depicts the position of the particle as a function of time.



a)  b)  c)  d) 

30. The oscillation of a body on a smooth horizontal surface is represented by the equation X = A cos (ωt), where X = displacement at time t, ω = frequency of oscillation. Which one of the following graph shows correctly variation of 'a' with 't'?

a) 
b) 
c) 
d) 

31. Two waves are represented by: $y_1 = a\sin\left(\omega t + \frac{\pi}{6}\right)$ and $y_2 = a\cos\omega t$. What will be their resultant amplitude?

a) a b) $\sqrt{2}a$ c) $\sqrt{3}a$ d) 2a

32. The wave described by y = 0.25 sin(10 πx - 2πt), where x and y are in meters and t in seconds, is a wave travelling along the:

a) -ve x direction with amplitude 0.25 m and wavelength λ= 0.2 m

b) -ve x direction with frequency 1 Hz

c) +ve x direction with frequency Hz and wavelength λ= 0.2 m

d) +ve x direction with frequency 1 Hz and wavelength λ= 0.2 m

33. When a tuning fork vibrates, the waves produced in the fork are:

a) longitudinal b) transverse c) progressive d) stationary

34. When two tuning forks (fork 1 and fork 2) are sounded simultaneously, 4 beats per second are heard. Now, some tape is attached on the prong of fork 2. When the tuning forks are sounded again, 6 beats per second are heard. If the frequency of fork 1 is 200 Hz, then what was the original frequency of fork 2?

a) 196 Hz b) 204 Hz c) 200 Hz d) 202 Hz

35. Two sitar strings A and B are slightly out of tune and produce beats of frequency 5 Hz. When the tension in the string B is slightly increased, the beat frequency is found to reduce to 3 Hz. If the frequency of string A is 427 Hz, the original frequency of string B is

a) 422 Hz b) 424 Hz c) 430 Hz d) 432 Hz

36. A person hears the sound of a jet aeroplane after it has passed over his head. The angle of the jet plane with the horizontal when the sound appears to be coming vertically downwards is 60°, If the velocity of sound is υ, then the velocity of the jet plane should be:
a) 2υ b) $\upsilon/\sqrt{3}$ c) $\sqrt{3}\upsilon$ d) υ

37. A point source emits sound equally in all directions in a non-absorbing medium. Two points P and Q are at a distance of 9 m and 25 m respectively from the source. The ratio of the amplitude of waves at P and Q is:
a) $\frac{3}{5}$ b) $\frac{5}{3}$ c) $\frac{9}{25}$ d) $\frac{25}{9}$

38. Standing waves are produced in a 10 m long stretched string. If the string vibrates in 5 segments and the wave velocity is 20 m/s, the frequency is ______________ .
a) 10 Hz b) 5 Hz c) 4 Hz d) 2 Hz

39. With the propagation of a longitudinal wave through a material medium, the quantities transmitted in the direction of propagation are:
a) energy, momentum and mass b) energy c) energy and mass
d) energy and linear momentum

40. The power of sound from the speaker of a radio is 20 mW. By turning the knob of volume control the power of sound is increased to 400 mW. What is the power increase as compared to the original power?
a) 1.3 dB b) 3.1 dB c) 13 dB d) 30.1 dB

41. Pick out the wrong statement.
a) Transvene waves can be generated in solids.
b) A system having ice floating on water has the same volume even after the i. e is melted.
c) Heat radiations have the velocity of light.
d) Phase will not change when sound or light waves art reflected back

42. A particle is subjected to two mutually perpendicular simple harmonic motions such that its x and Y coordinates are given by $x = 2\sin\omega t$ and $y = 2\sin\left(\omega t + \frac{\pi}{4}\right)$. The path of the particle will be:
a) an ellipse b) a straight line c) a parabola d) a circle

43. Two sources P and Q produce notes of frequency 660 Hz each. A listener moves from P to Q with a speed of 1 ms^{-1}. If the speed of sound is 330 rn/s, then the number of beats heard by the listener per second will be:
a) zero b) 4 c) 8 d) 2

44. Beats are produced by two progressive waves. Maximum loudness at the waxing is x times the loudness of each wave. The value of x is:
a) 1 b) $\sqrt{2}$ c) 2 d) 4

45. Which of the following equations represents a wave travelling along y-axis?
a) $y = A\sin(kx - \omega t)$ b) $y = A\sin(ky - \omega t)$ c) $y = A\sin\quad ky\cos\omega t$ d) $y = A\cos ky\sin\omega t$

46. Two coherent sources must have the same:
a) amplitude b) phase difference only c) frequency only d) both (b) and (c)

47. Two identical straight wires are stretched so as to produce 6 beats per second when vibrating simultaneously. On changing the tension slightly in one of them, the beat frequency still remains unchanged. Denoting by T_1, T_2 the higher and the lower initial tensions in the string, it could be said that while making the above changes in tension:

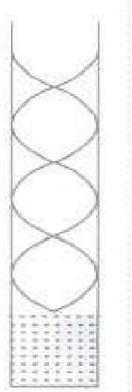
a) T_1 was decreased b) T_1 was increased c) T_2 was increased d) T_2 was decreased

48. If the amplitude of sound is doubled and the frequency reduced to one-fourth, the intensity of sound at the same point will be:

a) increased by a factor of 2 b) decreased by a factor of 2 c) decreased by a factor of 4

d) unchanged

49. One of the modes of resonance in a tube containing water at one end has been shown. The tube in the present case is in



a) first harmonic b) third harmonic c) fifth harmonic d) seventh harmonic

50. A star which is emitting radiation at a wavelength of 5000 A° is approaching the earth with a velocity of 1.50 x 10^6 m/s. The change in wavelength of the radiation as received on the earth is ______________.

a) 0.25 A° b) 2.5 A° c) 25 A° d) 250 A°

51. peed ot sound wave in air

a) is independent of temperature b) increases with pressure

c) increases with increase in humidity d) decreases with increase in humidity.

52. A point source emits sound equally in all directions in a non-absorbing medium. Two points P and Q are at distances of 2m and 3m respectively from the source. The ratio of the intensities of the waves at P and Q is ______________ .

a) 3: 2 b) 2: 3 c) 9: 4 d) 4: 9

53. The equation of a simple harmonic wave is given by y = 3 sin π/2 (50t - x) where x and y are in meters and t is in seconds. The ratio of maximum particle velocity to the wave velocity is :

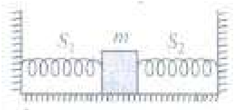
a) 3π/2 b) 3π c) 2π/3 d) 2π

54. Two simple harmonic motions are represented by the equations:

$Y_1 = 10\sin\left(3\pi t + \frac{\pi}{4}\right)$ and $Y_2 = 5(\sin 3\pi t + \sqrt{3}\cos 3\pi t)$. Their amplitudes are in the ratio of:

a) 2:1 b) 3:1 c) 1:3 d) 1:4

55. 1When a mass m is connected ~ individually to two springs S_1 m S_2 S_1 and S_2' the oscillation . frequencies are υ_l and υ_2. If the same mass is attached to the two springs as shown in figure, the oscillation frequency would be



a) $v_1 + v_2$ b) $\sqrt{v_1^2 + v_2^2}$ c) $\left(\frac{1}{v_1} + \frac{1}{v_2}\right)^{-1}$ d) $\sqrt{v_1^2 - v_2^2}$

56. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: The motion of a simple pendulum is simple harmonic for all angular displacement.
Reason: Motion of simple pendulum is independent of the angular displacement.
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

57. A bat emits ultrasonic sound of frequency 100 kHz in air. If this sound meets a water surface, the wavelengths of the reflected and transmitted sound are (Speed of sound in air = 340 m S^{-1} and in water = 1500 m S^{-1})
a) 3.4 mm, 30 mm b) 6.8 mm, 15 mm c) 3.4 mm, 15 mm d) 6.8 mm, 30 mm

58. The velocity of sound waves in an ideal gas at temperatures T_1(K) and T_2 (K) are respectively v_1 and v_2. The rms velocities of gas molecules at these two temperatures are W_1 and W_2 respectively; then:

a) $\frac{v_1}{v_2} = \frac{w_1}{w_2}$ b) $\frac{v_1}{v_2} = \sqrt{\gamma}\left(\frac{w_1}{w_2}\right)$ c) $\frac{v_1}{v_2} = \sqrt{\frac{\gamma}{3}}\left(\frac{w_1}{w_2}\right)$ d) $\frac{v_1}{v_2} = \sqrt{\frac{w_1}{w_2}}$

59. The bob of a simple pendulum of mass m and total energy E will have maximum linear momentum equal to:
a) $\sqrt{2E/m}$ b) $\sqrt{2mE}$ c) 2mE d) mE^2

60. A particle executing simple harmonic motion of amplitude 5 cm has maximum speed of 31.4 cm/s. The frequency of its oscillation is:
a) 1 Hz b) 3 Hz c) 2 Hz d) 4 Hz

61. A 5.5 m length of string has a mass of 0.035 kg. If the tension in the string is 77 N, the speed of a wave on the string is ______________ .
a) 110 ms^{-1} b) 165 ms^{-1} c) 77 ms^{-1} d) 102 ms^{-1}

62. Two vibrating tuning forks produce progressive waves given by Y_1 = 4 sin 500 pt and Y_2 = 2 sin 506 pt. Number of beats produced per minute is ______________ .
a) 360 b) 180 c) 60 d) 3

63. Two simple pendulums of length 0.5 m and 2.0 m respectively are given small linear displacement in one direction at the same time. They will again be in the same phase when the pendulum of shorter length has completed oscillations.
a) 5 b) 1 c) 2 d) 3

64. A stone is dropped into a lake from a tower of 500 m height. The sound of the splash will be heard by the man after:
a) 21 sec b) 10 sec c) 11.5 sec d) 14 sec

65. The equation of motion of a simple harmonic motion is

a) $\frac{d^2x}{dt^2} = -\omega^2 x$ b) $\frac{d^2x}{dt^2} = -\omega^2 t$ c) $\frac{d^2x}{dt^2} = -\omega x$ d) $\frac{d^2x}{dt^2} = -\omega t$

66. Tuning fork A of frequency 258 cycles/see gives 8 beats with a tuning fork B. When prongs of B are cut and again A and B are sounded the number of beats heard remains same. The frequency of B (in cycles/sec) is:

a) 250 b) 264 c) 242 d) 258

67. The equation of a wave is represented by $y = 10^{-4}\sin\left(100t - \frac{x}{10}\right)m,$ the velocity of wave will be:

a) 100 m/s b) 4 m/s c) 1000 m/s d) zero

68. The equation of a plane progressive wave is given by: y = 0.025 sin (100 t + 0.25x) . The frequency of this wave would be:

a) $(50/\pi)Hz$ b) 100 Hz c) $(100/\pi)Hz$ d) 50 Hz

69. The speed of sound in oxygen (0_2)at a certain temperature is 460 ms $^{-1}$. The speed of sound in helium (He) at the same temperature will be: (assume both gases to be ideal)

a) 1420 ms^{-1} b) 500 ms^{-1} c) 650 ms^{-1} d) 330 ms^{-1}

70. A man is watching two trains, one leaving and the other coming in with equal speed of 4 m/s. If they sound their whistles, each of frequency 240 Hz, the number of beats heard by the man (velocity of sound in air = 320 m/s) will be equal to :

a) 6 b) 3 c) 0 d) 12

71. Which of the following statements are true for the function used to describe the travelling wave?

a) Such a function at every instant should give the shape of the wave at that instant

b)

At very given location, it should describe the motion of the constituents of the medium at that instant

c) The function must be dependent on three distinct variables d) Both (a) and (b)

72. In the question number 64, the maximum acceleration of the collar is

a) 5 m s^{-2} b) 10 m s^{2} c) 15 m s^{-2} d) 20 m s^{-2}

73. The length of the simple pendulum which ticks seconds is:

a) 0.5 m b) 1 m c) 1.5 m d) 2 m

74. The angle between particle velocity and wave velocity in a transverse wave is:

a) zero b) π/4 c) π/2 d) π

75. Which of the following expressions does not represent simple harmonic motion?

a) $x = A\cos\omega t + B\sin\omega t$ b) $x = A\cos(\omega t + \alpha)$ c) $x = B\sin(\omega t + \beta)$ d) $x = A\sin\omega t\cos^2\omega t$

76. In a stationary sound wave produced in air:

a) each air particle executes vibrations with the same amplitude

b) amplitude of vibration is maximum at some places c) air particles are stationary

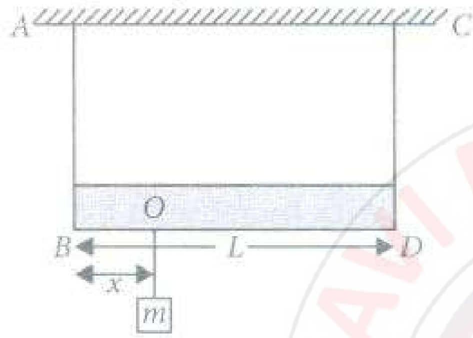
d) the particles do not execute periodic motion

77. Resonance is an example of
a) forced oscillation b) damped oscillation c) free oscillation d) none of these

78. The frequency of a tuning fork with an amplitude, A = 1cm is 250 Hz. The maximum velocity of any particle in air is equal to:
a) $\frac{5}{\pi} m/sec$ b) $5\pi m/sec$ c) $\frac{3.30}{\pi} m/sec$ d) none of these

79. A stationary wave $y = 0.4 \sin\frac{2\pi}{40}x\cos100\pi t$ is produced in a rod fixed at both end. The minimum possible length of the rod is given by:
a) 10 m b) $20\sqrt{2}$ m c) 20 m d) 28 m

80. A massless rod of length L is suspended by two identical strings AB and CD of equal length. A block of mass m is suspended from point 0 such that BO is equal to 'x' Further it is observed that the frequency of 1st harmonic in AB is equal to 2nd harmonic frequency in CD, 'x' is



a) $\frac{L}{5}$ b) $\frac{4L}{5}$ c) $\frac{3L}{5}$ d) $\frac{L}{5}$

81. A sound wave of wavelength 90 em in glass is refracted into air. If the velocity of sound in glass is 5400 m/sec, the wavelength of the wave in air is:
a) 55 cm b) 5.5 cm c) 55 m d) 5.5 m

82. A sound wave travels with a velocity of 300 m s^{-1} through a gas. 9 beats are produced in 3 s when two waves pass through it simultaneously. If one of the waves has 2 m wavelength, the wavelength of the other wave is:
a) 1.98 m b) 2.04 m c) 2.06 m d) 1.99 m

83. The particle executing simple harmonic motion has a kinetic energy $K_0 \cos^2 \omega t$. The maximum values of the potential energy and the total energy are respectively,
a) $K_0/2$ and K_0 b) K_0 and 2 K_0 c) K_0 and K_0 d) 0 and 2 K_0

84. The angular velocity and the amplitude of a simple pendulum is ω and a respectively. At a displacement x from the mean position if its kinetic energy is T and potential energy is V, then the ratio of T to V is :
a) $(a^2-x^2\omega^2)/x^2\omega^2$ b) $x^2\omega^2/(a^2-x^2\omega^2)$ c) $(a^2-x^2)/x^2$ d) x^2/a^2-x^2

85. Mechanical wave (sound wave) in a gas is:
a) transverse b) longitudinal c) neither transverse nor longitudinal
d) either transverse or longitudinal

86. According to Newton's formula, the speed of sound in air at STP is
(Take the mass of 1mole of air is 29 x 10^{-3} kg)

a) 250 m S^{-1} b) 260 m S^{-1} c) 270 m S^{-1} d) 280 m S^{-1}

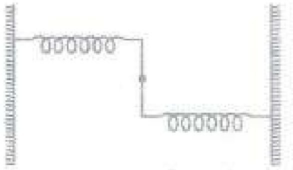
87. Two springs of spring constants k_1 and k_2 are joined in series. The effective spring constant of the combination is given by:

a) $k_1k_2/\left(k_1+k_2\right)$ b) k_1k_2 c) $\left(k_1+k_2\right)/2$ d) k_1+k_2

88. There are 26 tuning forks arranged in the decreasing order of their frequencies. Each tuning fork gives 3 beats with the next. The first one is octave of the last. What is the frequency of 18th tuning fork?

a) 100 Hz b) 99 Hz c) 96 Hz d) 103 Hz

89. A uniform rod of length l and mass M is pivoted at the centre. Its two ends are attached to two springs of equal spring constant k. The springs are fixed to rigid support as shown in figure and the rod is free to oscillate in the horizontal plane. The rod is gently pushed through a small angle e in one direction and released. The frequency of oscillation is



a) $\frac{1}{2\pi}\sqrt{\frac{2k}{6M}}$ b) $\frac{1}{2\pi}\sqrt{\frac{k}{M}}$ c) $\frac{1}{2\pi}\sqrt{\frac{6k}{M}}$ d) $\frac{1}{2\pi}\sqrt{\frac{24k}{M}}$

90. Out of the following functions, representing motion of a particle, which represents SHM?

$(A) y = \sin wt - \cos wt$

$(B) y = \sin^3 wt$

$(C) y = 5\cos\left(\frac{3\pi}{4} - 3\omega t\right)$

$(D) y = 1 + \omega t + \omega^2 t^2$

a) Only (A) and (C) b) Only (A) and (B) c) only (A) d) Only (D) does not represent SHM

91. A light pointer fixed to one prong of a tuning fork touches a vertical plate. The fork is set vibrating and the plate is allowed to fall freely. Eight complete oscillations are counted when the plate falls through 10 cm. What is the frequency of the tuning fork?

a) 112 Hz b) 56 Hz c) 8/7 Hz d) 7/8 Hz

92. Assertion: Sound wave is an example of longitudinal wave.

Reason : In longitudinal waves, the constituents of the medium oscillate perpendicular to the direction of wave propagation.

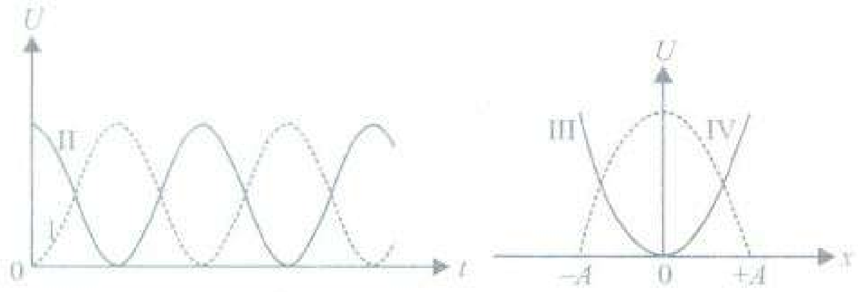
a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

93. For a particle executing simple harmonic motion, the displacement x is given by x = Acos oot. Identify the graph, which represents the variation of potential energy (U) as a function of time t and displacement x.



a) 1, III   b) II, III   c) I, IV   d) II, IV

94. When two coherent waves interfere, there is:
a) loss in energy   b) gain in energy   c) redistribution of energy which changes with time
d) redistribution of energy which does not change with time

95. A particle executes SHM of period 12 s. After two seconds, it passes through the centre of oscillation, the velocity is found to be 3.142 cm s^{-} The amplitude of oscillations is
a) 6 crn   b) 3 cm   c) 24 crn   d) 12 crn

96. A wave of wavelength 2 m is reflected from a surface. If a node is formed at 3 m from the surface, then at what distance from the surface, another node will be formed?
a) 1 m   b) 2 m   c) 3 m   d) 4 m

97. If the temperature is raised by I K from 300 K, then the percentage change in the speed of sound in the gaseous mixture is: (R = 8.31 J/mol-K)
a) 0.167%   b) 2%   c) 1%   d) 0.334%

98. Apparatus used to find out velocity of sound in gas is:
a) Melde's apparatus   b) Kundt's tube   c) Quincke's tube   d) none of these

99. If wave $y = A\cos(\omega t + kx)$ is moving along z-axis, the shape of pulse at t = 0 and t = 2 sec :
a) are different   b) are same   c) may not be same   d) none of these

100. The equation of the propagating wave is, y = 25sin(20t + 5x), where y is displacement. Which of the following statements is not true?
a) The amplitude of the wave is 25 units.
b) The wave is propagating in positive X-direction.   c) The velocity of the wave is 4 units.
d) The maximum velocity of the particles is 500 units.

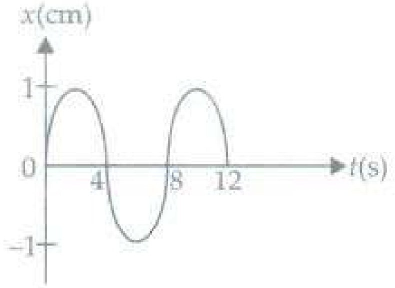
101. Assertion: Two sinusoidal waves on the same string exhibit interference.
Reason: These waves, add or cancel out according to the principle of superposition
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false.   d) If both assertion and reason are false.

102. The function sinω t- cosωt represents
a) a simple harmonic motion with a period $\frac{\pi}{\omega}$ b) a simple harmonic motion with a period $\frac{2\pi}{\omega}$

c) a periodic, but not simple harmonic motion with a period $\frac{\pi}{\omega}$

d) a periodic, but not simple harmonic motion WIth a period $\frac{2\pi}{\omega}$

103. The x-t graph of a particle undergoing simple harmonic motion is as shown in the figure.



The acceleration of the particle at $t = \frac{4}{3}s$

a) $\frac{\sqrt{3}}{32}\pi^2 cms^{-2}$ b) $-\frac{\pi^2}{32}cms^{-2}$ c) $\frac{\pi^2}{32}cms^{-2}$ d) $-\frac{\sqrt{3}}{32}\pi^2 cms^{-2}$

104. A progressive wave $y = A \sin(kx - \omega t)$ is reflected by a rigid wall at x =0. Then, the reflected wave can be represented by:

a) $y = A \sin(kx + \omega t)$ b) $y = A \cos(kx + \omega t)$ c) $y = -A \sin(kx - \omega t)$ d) $y = -A \sin(kx + \omega t)$
e) $y = A \cos(kx - \omega t)$

105. An echo is heard when minimum distance of the reflecting surface is:

a) 10 cm b) 17 m c) 34 m d) 340 m

106. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false d) If both assertion and reason are false

107. The kinetic energy and potential energy of a particle executing S.H.M. will be equal, when displacement is : (amplitude = a)

a) a/2 b) a$\sqrt{2}$ c) a/$\sqrt{2}$ d) a/$\sqrt{2/3}$

108. The ratio of velocity of sound in hydrogen and oxygen at STP is:

a) 16:1 b) 8:1 c) 4:1 d) 2:1

109. A transverse wave is described by the equation $y = y_0 \sin 2\pi\left(ft - \frac{x}{\lambda}\right)$. The maximum particle velocity is equal to four times the wave velocity if:

a) $\lambda = \frac{\pi y_0}{4}$ b) $\lambda = \frac{\pi y_0}{2}$ c) $\lambda = \pi y_0$ d) $\lambda = 2\pi y_0$

110. If the bulk modulus of water is 2100 MPa, what is the speed of sound in water?

a) 1450 ms^{-1} b) 2100 ms^{-1} c) 1400 ms^{-1} d) 1200 ms^{-1}

111. Which one of the following equation of motion represents simple harmonic motion? where k, k_0, k_1 and a are all positive

a) Acceleration =- k(x+a) b) Acceleration = k(x+a) c) Acceleration = kx
d) Acceleration = - $k_0x+k_1x_2$

112. If n_1, n_2 and n_3 are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency n of the string is given by:
a) $1/n = 1/n_l + 1/n_2 + 1/n_3$ b) $1/\sqrt{n_1}+1/\sqrt{n_2}+1/\sqrt{n_3}$ c) $\sqrt{n}=\sqrt{n_1}+\sqrt{n_2}+\sqrt{n_3}$ d) $n=n_1+n_2+n_3$

113. A tuning fork whose frequency as given by manufacturer is 512 Hz is being tested with an accurate oscillator. It is found that the fork produces a beat of 2 Hz when oscillator reads 514 Hz but produces a beat of 6 Hz when oscillator reads 510 Hz. The actual frequency of fork is:
a) 508 Hz b) 512 Hz c) 516 Hz d) 518 Hz

114. In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: The graph of total energy of a particle in SHM with respect to position is a straight line with zero slope.
Reason : Total energy of particle in SHM remains constant throughout its motion.
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

115. For production of beats the two sources must have
a) Different frequencies and same amplitude b) Different frequencies
c) Different frequencies, same amplitudes and same phase
d) Different frequencies and same phase

116. Assertion : Speed of mechanical wave in the medium depends on the velocity of source, relative to an observer at rest.
Reason: Speed of mechanical wave is independent of the elastic and other properties such as mass density of the medium.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

117. When sound propagates through a medium, say air, the particles of the medium in a particular region undergo:
a) only compression throughout the time b) only rarefaction throughout the time
c) successive compression or rarefaction
d) sometimes compression, sometimes rarefaction

118. In a stationary wave pattern that forms as a result of reflection of waves from an obstacle the ratio of the amplitudes at antinodes and a node is β= 1.5. The percentage of energy that passes across the obstacle is :
a) 96% b) 4% c) 94% d) 6%

119. When a guitar is sounded with a 440 Hz tuning fork, a beat frequency of 5 Hz is heard. If the experiment is repeated with a tuning fork of 437Hz, the beat frequency is 8 Hz. The string frequency (in Hz) is:

a) 445 b) 435 c) 429 d) 448

120. In simple harmonic motion, at the extreme positions

a) kinetic energy is minimum, potential energy is maximum.

b) kinetic energy is maximum, potential energy is minimum.

c) both kinetic and potential energies are maximum

d) both kinetic and potential energies are minimum

121. Two pendulums begin to swing simultaneously. The first pendulum makes 9 full oscillations when the other makes 7. The ratio of lengths of the two pendulums is:

a) 9/7 b) 7/9 c) 49/81 d) 81/49

122. A stationary source is emitting sound at a fixed frequency fo' which is reflected by two cars approaching the source. The difference between the frequencies of sound reflected from the cars is 1.2 % of fo' What is the difference in the speeds of the cars (in km per hour) to the nearest integer? The cars are moving at constant speeds much smaller than the speed of sound which is 330 ms^{-1}.

a) 2 b) 3 c) 5 d) 7

123. The frequency of tuning fork A is 2% more than the frequency of a standard tuning fork. The frequency of a tuning fork B is 3% less than the frequency of same standard tuning fork. If 6 beats per second are heard when the two tuning forks A and B are excited, the frequency of A is:

a) 120 Hz b) 122.4 Hz c) 116.4 Hz d) 130 Hz

124. A wave of frequency 100 Hz is sent along a string towards a fixed end. When this wave travels back after reflection, a node is formed at a distance of 10 cm from the fixed end of the string. The speed of incident (and reflected) wave ______________ .

a) 5 m/s b) 10 m/s c) 20 m/s d) 40 m/s

125. Which of the following properties of a wave does not change with a change in medium?

a) Frequency b) Wavelength c) Velocity d) Amplitude

126. For the travelling harmonic wave

$y(x, t) = 2\cos2\pi(10t - 0.008x + 0.35)$ where x and y are in em and t is in s. The phase difference between oscillatory motion of two points separated by a distance of 0.5 m is

a) 0.2π rad b) 0.4π rad c) 0.6π rad d) 0.8π rad

127. If we study the vibration of a pipe open at both ends, then the following statement is not true:

a) Pressure change will be maximum at both ends b) Open ends will be antinode

c) Odd harmonics of the fundamental frequency will be generated

d) All harmonics of the fundamental frequency will be generated

128. The equation of stationary wave along a stretched string is given by: $y = 5\sin\frac{\pi x}{3}\cos40\pi t$ where x and y are in centimetre and t in second. The separation between two adjacent nodes is:

a) 6 cm b) 4 cm c) 3 cm d) 1.5 cm

129. A block of mass m is attached to one end of a massless spring which is suspended vertically from a fixed point. The mass is held in hand so that the spring is neither stretched nor compressed. Suddenly the support of the hand is removed. The lowest position attained by the mass during oscillation is 4 cm below the point, where it was held in hand. The amplitude of the oscillation is

a) 1 cm b) 2 cm c) 3 cm d) 4 cm

130. A particle executing SHM with time period T and amplitude A. The mean velocity of the particle averaged over quarter oscillation is

a) $\frac{A}{4T}$ b) $\frac{2A}{T}$ c) $\frac{3A}{T}$ d) $\frac{4A}{T}$

131. A simple pendulum performs simple harmonic motion about x = 0 with an amplitude a and time period T. The speed of the pendulum at x = a/2 will be:

a) πa/T b) 3π2a/T c) πa$\sqrt{3}$/T d) πa$\sqrt{3/2}$/T

132. The phase difference between two waves, represented by

$Y_1 = 10^{-6}\sin\{100t + (x/50) + 0.5\}\mathrm{m}$

$Y_2 = 10^{-6}\cos\{100t + (x/50)\}\mathrm{m}$

where r is expressed in metres and t is expressed in seconds, is approximately

a) 1.5 radians b) 1.07 radians c) 2.07 radians d) 0.5 radians

133. A person is observing two trains one coming towards him and other leaving with the same velocity 4 m/s. If their whistling frequencies are 240 Hz each, then the number of beats per second heard by the person will be: (if velocity of sound is 320 m/s)

a) 3 b) 6 c) 9 d) zero

134. A simple harmonic motion has an amplitude A and time period T. The time required by it to travel from x = A to x = A/2 is:

a) T/6 b) T/4 c) T/3 d) T/2

135. A car is moving with a speed of 72 km/h towards a hill. Car blows horn at a distance of 1800 m from the hill. If echo is heard after 10 s, the speed of sound (in m/s) is:

a) 300 b) 320 c) 340 d) 360

136. The phenomenon of beats can take place

a) for longitudinal waves only b) for transverse wave only c) for sound waves only

d) for both longitudinal and transverse waves

137. Assertion: The interference of two identical waves moving in same direction produces standing waves.

Reason: Various elements of standing waves do not remain in constant phase

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

138. Assertion: In a stationary wave, no transfer of energy takes place.
Reason: There is no onward motion of the disturbance from one particle to adjoining particle in a stationary wave.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

139. If the velocity of wave is 360 m/s and frequency 500 Hz, the path difference corresponding to 60° phase difference is:
a) 10 cm b) 12 cm c) 15 cm d) 72 cm

140. Three waves of amplitudes $12\mu m$, $4\mu m$ and $9\mu m$ but of same frequency arrive at a point in a medium with the successive phase difference of (π/ 2). Then, the resultant amplitude in μm is :
a) 4 b) 7 c) 5 d) 25

141. Newton assumed that sound propagation in a gas takes under
a) isothermal condition b) adiabatic condition c) isobaric condition
d) isentropic condition

142. If a note x of unknown frequency produces 8 beats/see, with a source of 250 Hz and 12 beats/see with a source of 270 Hz, the frequency of unknown source will be:
a) 258 Hz b) 242 Hz c) 262 Hz d) 282 Hz

143. The principle of superposition in wave motion tells that in a motion in which two or more waves are simultaneously producing their displacement in a particle along the same line, then the resultant:
a) amplitude is the sum of the individual amplitudes
b) velocity is the sum of the individual velocities
c) displacement is the sum of the individual displacements
d) phase is the sum of the individual phases

144. The maximum particle velocity in a wave motion is half the wave velocity, then the amplitude of the wave is equal to:
a) $\lambda/4\pi$ b) $2\lambda/\pi$ c) $\lambda/2\pi$ d) λ

145. A body of mass 20 g connected to a spring of spring constant k, executes simple harmonic motion with a frequency of (5/π) Hz. The value of spring constant is:
a) 4 Nm^{-1} b) 3 Nm^{-1} c) 2 Nm^{-1} d) 5 Nm^{-1}

146. Which of the following is the example of transverse wave?
a) Sound waves b) Compressional waves in a spring
c)
In a transverse wave, the particles of the medium oscillate in a direction perpendicular to the direction of propagation
d) All of these

147. The source of sound s is moving with a velocity 50 m/s towards a stationary observer. The observer measures the frequency of the source as 1000 Hz. What will be the apparent frequency of the source when it is moving away from the observer after crossing him ? The

velocity of sound in the medium is 350 m/s :

a) 750 Hz b) 857 Hz c) 1143 Hz d) 1333 Hz

148. In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

Assertion : If the amplitude of a simple harmonic oscillator is doubled, its total energy becomes double.

Reason: The total energy is directly proportional to the amplitude of vibration of the harmonic oscillator.

a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

149. Two waves of frequencies 20 Hz and 30 Hz travel out from a common point. How will they differ in phase at the end of 0.75 sec?

a) 15π b) π c) 7π d) 2π

150. A block of mass 2 kg is attached to the spring of spring constant 50 N m^{-1}. The block is pulled to a distance of 5 cm from its equilibrium position at x = 0 on a horizontal frictionless surface from rest at t = O. The displacement of the block at any time t:

a) x = 0.05 sin 5t m b) x = 0.05 cos 5t m c) x = 0.5 sin 5t m d) x = 5 sin 5t m

151. A pulse of a wave train travels along a stretched string and reaches the fixed end of the string. It will be reflected back with

a) a phase change of 1800 with velocity reversed

b) the same phase as the incident pulse with no reversal of velocity

c) a phase change of 180° with no reversal of velocity

d) the same phase as the incident pulse but with velocity reversed.

152. A standing wave is produced in a string fixed at both ends. In this case:

a) all particles vibrate in phase b) all antinodes vibrate in phase

c) all alternate antinodes vibrate in phase

d) all particles between two consecutive antinodes vibrate in phase

153. A body of mass 5 gm is executing S.H.M. about a point with amplitude 10 cm. Its maximum velocity is 100 cm/sec. Its velocity will be 50 cm/sec, at a distance

a) 5 b) $5\sqrt{2}$ c) $5\sqrt{3}$ d) $10\sqrt{2}$

154. A simple harmonic oscillator has a period T and energy E. The amplitude of the oscillator is doubled. Choose the correct answer.

a) Period and energy get doubled. b) Period gets doubled while energy remains the same

c) Energy gets doubled while period remains the same

d) Period remains the same and energy becomes four times.

155. Choose the correct statement

a) Beats are due to destructive interference

b) Maximum beat frequency audible to a human being is 20.

c) Beats are as a result of Doppler's effect.

d) Beats are due to superposition of two waves of nearly equal frequencies.

156. When sound wave is refracted from air to water which of the following quantities remains unchanged?
a) Wavelength b) Wave number c) Wave velocity d) Frequency

157. In two similar wires of tensions 16 N and T, 3 beats are heard; then T is :
a) 49 N b) 6 N c) 25 N d) none of these

158. Velocity of sound waves in air is 330 m/s. For a particular sound in air, a path difference of 40 cm is equivalent to a phase difference of 1.6π. The frequency of the wave is:
a) 160 Hz b) 150 Hz c) 660 Hz d) 330 Hz

159. The complete destructive interference of two sound waves takes place when the two waves are travelling in the same direction:
a) with the same frequency and amplitude and are in phase

b) with the same frequency and amplitude and are in opposite phase

c) with the same frequency and amplitude d) with the same frequency and opposite phase

160. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: In the ideal case of zero damping, the amplitude of simple harmonic motion at resonance is infinite.
Reason: All real systems have some damping
a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

161. Three sound waves of equal amplitudes have frequencies (n - 1), n, (n + 1). They superimpose to give beats. The number of beats produced per second will be :
a) 1 b) 4 c) 3 d) 2

162. String A has a length L, radius of cross-section r, density of material p and is under tension T. String B has all these quantities double those of string A. If v_A and v_B are the corresponding fundamental frequencies of the vibrating string, then
a) $v_A=2v_B$ b) $v_A=4v_B$ c) $v_B=4v_A$ d) $v_A=v_B$

163. A transverse wave is represented by y = Asin(ωt - kx). For what value of the wavelength is the wave velocity equal to the maximum particle velocity?
a) $\frac{\pi}{2}$ b) πA c) 2πA d) A

164. Two identical piano wires kept under the same tension 7 have a fundamental frequency of 600 Hz. The fractional increase in the tension of one of the wires which will lead to occurrence of 6 beats/s when both the wires oscillate together would be:
a) 0.02 b) 0.03 c) 0.04 d) 0.01

165. For the stationary wave: $y = 4\sin(\pi x/15)\cos(96\pi t)$, the distance between a node and the next antinode is:
a) 7.5 b) 15 c) 22.5 d) 30

166. The equation for a transverse wave travelling along the positive x-axis with amplitude 0.2 m, velocity v=360 ms^{-1} and wavelength l=60 m can be written as _____________ .

a) $y = 0.2\sin\left[2\pi\left(6t - \frac{x}{60}\right)\right]$ b) $y = 0.2\sin\left[\pi\left(6t + \frac{x}{60}\right)\right]$ c) $y = 0.2\sin\left[\pi\left(6t - \frac{x}{60}\right)\right]$

d) $y = 0.2\sin\left[2\pi\left(6t + \frac{x}{60}\right)\right]$

167. Any periodic function can be expressed as a superposition of sine and cosine functions of different time periods with suitable coefficients. Which of the following mathematicians proved this result?

a) Pythagoras b) Carl Friedrich Gauss c) Leonhard Euler

d) Jean Baptiste Joseph Fourier

168. A mass oscillates along the x-axis according to the law, $x = x_0\cos\left(\omega t - \frac{\pi}{4}\right)$. If the acceleration of the particle is written as $a = A\cos(\omega t + \delta)$ then

a) $A = x_0\omega^2, \delta = \frac{3\pi}{4}$ b) $A = x_0, \delta = -\frac{\pi}{4}$ c) $A = x_0\omega^2, \delta = \frac{\pi}{4}$ d) $A = x_0\omega^2, \delta = -\frac{\pi}{4}$

169. The panicles of a medium vibrate about their mean positions whenever a wave travels through that medium. The phase difference between the vibratons of two such particles:

a) varies with time b) varies with distance separating them

c) varies with time as well as distance d) is always zero

170. In stationary waves, nodes are the points where there is :

a) minimum displacement and minimum pressure change

b) minimum displacement and maximum pressure change

c) maximum displacement and maximum pressure change

d) maximum displacement and minimum pressure change

171. A motorcyclist is moving towards a stationary car which is emitting a sound of 165 Hz and a police car is chasing the motorcyclist blowing siren at frequency 172 Hz. If speed of police car is 22 m/s, then speed of motorcyclist for which the motorcyclist hears no beats is:

a) 33 m/s b) 22 m/s c) 11 m/s d) zero

172. If x, v and a represent the displacement, the velocity and the acceleration of a particle executing simple harmonic motion of time period T then which of the following does not change with time?

a) $\frac{\alpha T}{v}$ b) $\alpha T + 2\pi v$ c) $\frac{\alpha T}{x}$ d) $\alpha^2 T + 4\pi^2 v^2$

173. A transverse wave is represented by the equation

$y = y_0\sin\frac{2\pi}{\lambda}(vt - x)$

For what value of λ is the maximum particle velocity equal to two times the wave velocity?

a) $\lambda = 2py_0$ b) $\lambda = \frac{\pi y_0}{3}$ c) $\lambda = \frac{\pi y_0}{2}$ d) $\lambda = \pi y_0$

174. If a simple harmonic motion is represented by $\frac{d^2}{dt^2} + \alpha x = 0$ time period is

a) $2\pi\sqrt{\alpha}$ b) $2\pi\alpha$ c) $\frac{2\pi}{\sqrt{\alpha}}$ d) $\frac{2\pi}{\alpha}$

175. When the potential energy of a particle executing simple harmonic motion is one-fourth of the maximum value during the oscillation, its displacement from the equilibrium position in terms of amplitude 'a' is :
a) a/4 b) a/3 c) a/2 d) 2a/3

176. Which of the following statements is correct for waves?
a) Nodes and antinodes are formed in case of transverse stationary waves only
b) Nodes and antinodes are formed in case of longitudinal stationary waves only
c) Nodes and antinodes are formed in case of all the stationary waves
d) None of the above

177. Sound waves from a whistle of frequency 1100 Hz reach a point by two different paths. When the paths differ by 15 cm or 45 cm there is silence at that point. The speed of sound is:
a) 1100 x 15 cm/s b) 1100 x 30 cm/s c) 1100 x 45 cm/s d) 1100 x 60 cm/s

178. When two displacement represented by $y_1 = a\sin(\omega t)$ and $y_2 = b\cos(\omega t)$ are superimposed the motion is :
a) simple harmonic with amplitude $\frac{a}{b}$ b) simple harmonic with amplitude $\sqrt{a^2+b^2}$
c) simple harmonic with amplitude $\frac{(a+b)}{2}$ d) not a simple harmonic

179. The velocities of sound in an ideal gas at temperatures T_1 and T_2 K are found to be V_1 and V_2 respectively. If the root mean square speeds of the same gas at the same temperatures T_1 and T_2 are v_1 and v_2 respectively, then:
a) $v_2 = v_1(V_2/V_1)$ b) $v_2 = v_1(V_1/V_2)$ c) $v_2 = v_1\sqrt{V_2/V_1}$ d) $v_2 = v_1\sqrt{V_1/V_2}$

180. A tuning fork of unknown frequency makes 3 beats/sec with a standard fork of frequency 384Hz. The beat frequency decreases when a small piece of wax is put on the prong of the first. The frequency of the fork is:
a) 387 Hz b) 381 Hz c) 384 Hz d) 390 Hz

181. A sinusoidal travelling wave is described as linear combination of sine and cosine functions as follows:$y(x,t) = 4\sin(kx - \omega t) + 3\cos(kx - \omega t)$The sinusoidal wave can be described as :

a) $y(x,t) = 5\sin(kx - \omega t + \phi) \quad where \quad \phi = \tan^{-1}\left(\frac{3}{4}\right)$ b) $y(x,t) = 5\sin(kx - \omega t)$

c) $y(x,t) = 5\sin\left(kx - \omega t + \frac{\pi}{3}\right)$ d) both (a) and (b)

182. Two waves have equations: $x_1 = a\sin\left(\omega t + \phi_1\right)$ and $x_2 = a\sin\left(\omega t + \phi_2\right)$. If in the resultant wave the frequency and amplitude remain equals to amplitude of superimposing waves, the phase difference between them is:

a) $\frac{\pi}{6}$ b) $\frac{2\pi}{3}$ c) $\frac{\pi}{4}$ d) $\frac{\pi}{3}$

183. A closed organ pipe (closed at one end) is excited to support the third overtone. It is found that air in the pipe has:

a) Four nodes and three antinodes b) Four nodes and four antinodes

c) Three nodes and three antinodes d) Three nodes and four antinodes

184. A simple pendulum is suspended from the roof of a trolley which moves in a horizontal direction with an acceleration a. then the time period is given by $T = 2\pi\sqrt{\left(\frac{1}{g}\right)}$ where g is equal to:

a) g b) g-a c) g+a d) $\sqrt{\left(g^2 + \alpha^2\right)}$

185. The speed of a wave on a string is 150 m/s when the tension is 120 N. The percentage increase in the tension in order to raise the wave speed by 20% is:

a) 44% b) 40% c) 20% d) 10%

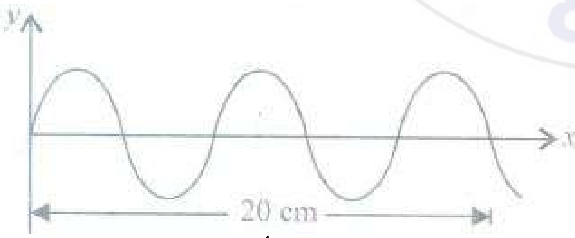
186. If the pressure amplitude of a sound wave is tripled, then by what factor the intensity of the sound wave is increased?

a) 3 b) 6 c) 9 d) $\sqrt{3}$

187. Two waves of the same frequency, travelling in the same medium but in opposite directions if superposed give rise to:

a) resonance b) beats c) standing waves d) harmonics

188. Figure given shows a sinusoidal wave on a string. If the frequency of the wave is 150 Hz, what is the velocity and wavelength of the given wave?



a) 0.04 m, 10 m s^{-1} b) 0.06 m, 12 m s^{-1} c) 0.08 m, 10 m s^{-1} d) 0.08 m, 12 m s^{-1}

189. Which of the following is true regarding beats?

a) Frequency different, amplitude same b) Frequency same, amplitude same

c) Frequency same, amplitude same d) None of the above

190. The periodic time of a mass suspended by a spring (force constant k) is T. If the spring is cut in three equal pieces, what will be the force constant of each part and what will be the periodic time, if the same mass is suspended from one piece?

a) k,T$\sqrt{3}$ b) 3k,T c) 3k. d) 3k,T$\sqrt{3}$

191. Distance between successive compressions and rarefactions is 1m and velocity of sound is 360 m s^{-1}. Find frequency:

a) 180 Hz b) 45 Hz c) 120 Hz d) 90 Hz

192. The velocity of sound in any gas depends upon:
a) wavelength of sound b) density and elasticity of gas c) intensity of sound waves
d) amplitude and frequency of sound

193. When a sound wave of wavelength λ is propagating in a medium, the maximum velocity of the particle is equal to the wave velocity. The amplitude of wave is:
a) λ b) $\frac{\lambda}{2}$ c) $\frac{\lambda}{2\pi}$ d) $\frac{\lambda}{4\pi}$

194. The displacement y of a wave travelling in the X-direction is given by:
$y = 10^4 \sin\left(600t - 2x + \frac{\pi}{3}\right) meters,$ where x is expressed in metres and t in seconds. The speed of the wave motion is:
a) 200 m/s b) 300 m/s c) 600 m/s d) 1200 m/s

195. A travelling wave represented by $y(x, t) = a\sin(kx - \omega t)$ is superimposed on another wave represented by $y(x, t) = a\sin(kx + \omega t)$. The resultant is a :
a) standing wave having nodes at $x = \left(n + \frac{1}{2}\right)\frac{\lambda}{2}$; n =0,1,2,........
b) standing wave having nodes at $x = n\frac{\lambda}{2}$; n=0,1,2, ...
c) wave travelling along + x-direction d) wave travelling along - x-direction

196. A body sends waves 100 mm long through medium A and 0.25 m long in medium B. If the velocity of waves in medium A is 80 cm S^{-1}. The velocity of waves in medium B is
a) 1 m S^{-1} b) 2 m S^{-1} c) 3 m S^{-1} d) 4 m S^{-1}

197. Two sound waves with wavelength 5.0 m and 5.5 m respectively, each propagate in a gas with velocity 330 m/s. We expect the following number of beats per second.
a) 0 b) 1 c) 6 d) 12

198. The amplitude of a pendulum executing damped simple harmonic motion falls to 1/3 the original value after 100 oscillations. The amplitude falls to S times the original value after 200 oscillations, where S is:
a) 1/9 b) 1/2 c) 2/3 d) 1/3

199. In a sports meet, the timing of a 200-metre straight dash is recorded at the finish point by starting an accurate stopwatch on hearing the sound of starting gun fired at the starting point. The time recorded will be more accurate:
a) in winter b) in summer c) in all seasons d) none of these

200. What is the maximum possible sound level of sound waves in air? Given that density of air = 1.3 kg/m^3, v =332 m/s and atmospheric pressure = 1.01 x 10^5 N/m^2:
a) 120 dB b) 60 dB c) 190 dB d) 50 dB

201. Which one of the following statements is true for the speed 'v' and the acceleration 'a' of a particle executing simple harmonic motion:
a) Value of a is zero, whatever may be the value of 'v' b) When 'v' is zero, a is zero
c) When 'v' is maximum, a is zero d) When 'v' is maximum, a is maximum

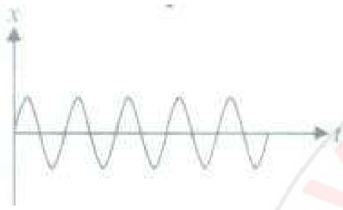
202. It is possible to distinguish between transverse and longitudinal waves by studying the property of:
a) interference b) diffraction c) reflection d) polarization

203. A body executes SHM with an amplitude a. At what displacement from the mean position, the potential energy of the body is one-fourth of its total energy?
a) $\frac{a}{4}$ b) $\frac{a}{2}$ c) $\frac{3a}{4}$ d) Some other fraction of a

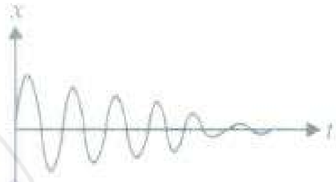
204. If the pressure amplitude in a sound Wave is tripled, then the intensity of sound is increased by a factor of:
a) 6 b) 3 c) 9 d) $\sqrt{3}$

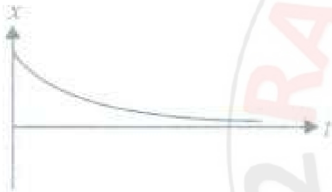
205. The disc of a siren containing 60 holes rotates at a constant speed of 360 rpm. The emitted sound is in unison with a tuning fork of frequency:
a) 10 Hz b) 360 Hz c) 216 Hz d) 6 Hz

206. Which of the following displacement-time graphs represent damped harmonic oscillation?

a) 

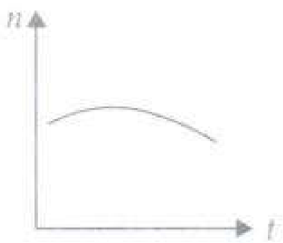
b) 

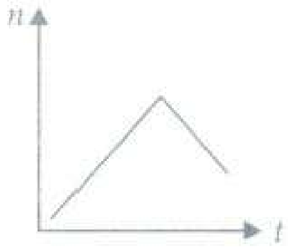
c) 

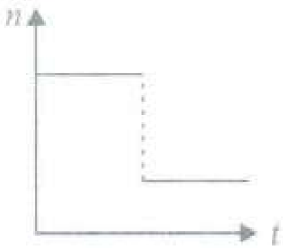
d) 

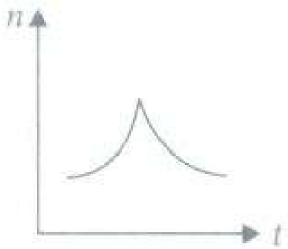
207. The stationary wave y = 2a sinkx cosωt in a stretched string is the result of superposition of Y_1 = a sin(kx - ωt) and
a) Y_2 = a cos(kx + ωt) b) Y_2 = a sin(kx + ωt) c) Y_2 = a cos(kx - ωt) d) Y_2 = asin(kx - ωt)

208. A train whistling at constant frequency is moving towards a station at a constant speed v. The train goes past a stationary observer on the station. The frequency n of the sound as heard by the observer is plotted as a function of time t. Identify the expected curve.

a) 

b) 

c) 

d) 

209. Two radio stations broadcast their programmes at the same amplitude A and at slightly different frequencies ω_1 and ω_2 respectively, where $\omega_2 - \omega_1 = 10^3$ Hz. A detector is receiving signals from the two stations simultaneously. It can only detect signals of intensity > $2A^2$. The time interval between successive maxima of the intensity of the signal received by the detector is:

a) 10^3 sec b) 10^{-3} sec c) 10^{-4} sec d) 10^4 sec

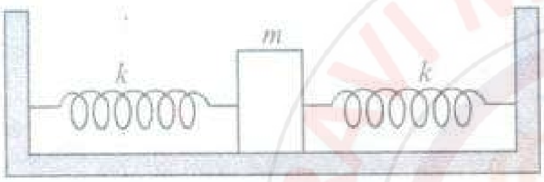
210. The velocities of sound at the same temperature in two monoatomic gases of densities ρ_1 and ρ_2 are υ_1 and υ_2 respectively. If $\rho_1/\rho_2 = 4$, then the value of υ_1/υ_2 is:

a) $\frac{1}{4}$ b) $\frac{1}{2}$ c) 2 d) 4

211. A particle executing simple harmonic motion with an amplitude A and angular frequency ω. The ratio of maximum acceleration to the maximum velocity of the particle is

a) ωA b) $\omega^2 A$ c) ω d) $\frac{\omega^2}{A}$

212. Two identical springs of spring constant k are attached to a block of mass m and to fixed supports as shown in the figure. The time period of oscillation IS

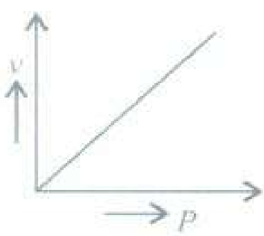


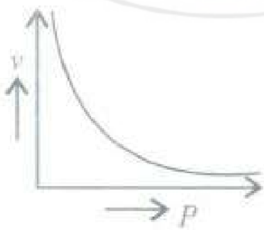
a) $2\pi\sqrt{\frac{m}{k}}$ b) $2\pi\sqrt{\frac{m}{2k}}$ c) $2\pi\sqrt{\frac{2m}{k}}$ d) $\pi\sqrt{\frac{m}{k}}$

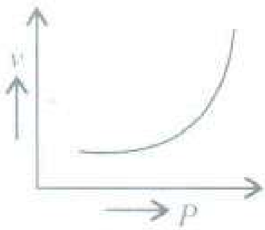
213. In a gas, two waves of wavelengths 1 m and 1.01 m are superposed and produce 10 beats in 3 seconds. The velocity of sound in the medium is:

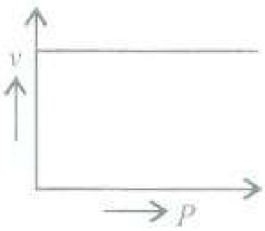
a) 300 m/s b) 336.7 m/s c) 360.2 m/s d) 270 m/s e) 390 m/s

214. A student plotted the following four graphs representing the variation of velocity of sound in a gas with the pressure P. Which one is correct?

a) 

b) 

c) 

d) 

215. The time of reverberation of a room A is one second. What will be the time (in seconds) of reverberation of a room, having all the dimension double of those of room A?

a) 4 b) $\frac{1}{2}$ c) 1 d) 2

216. Of the materials mentioned below the speed of sound is the largest in:

a) water b) steel c) vacuum d) air

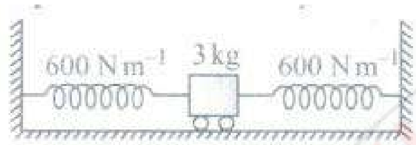
217. A particle executing SHM has a maximum speed of 30 cm s^{-1} and a maximum acceleration of 60 cm s^{-2}. The period of oscillation is:

a) π b) $\frac{\pi}{2}s$ c) $\frac{\pi}{2}s$ d) $\frac{\pi}{t}s$

218. A block of mass m is attached to a spring of spring constant k and has a natural frequency ω_0. An external force pet) proportional to $\cos\omega t\left(\omega \neq \omega_0\right)$ is applied to the oscillator. The time displacement of the oscillator will be proportional to

a) $\frac{m}{\omega_0^2 - \omega^2}$ b) $\frac{1}{m\left(\omega_0^2 - \omega^2\right)}$ c) $\frac{1}{m\left(\omega_0^2 - \omega^2\right)}$ d) $\frac{m}{\omega_0^2 - \omega^2}$

219. A trolley of mass 3 kg, as shown in figure, is connected to two identical springs, each of spring constant 600 N m^{-1}. If the trolley is displaced from its equilibrium position by 5 cm and released, the maximum speed of the trolley is



a) 0.5 m s^{-1} b) 1 m s^{-1} c) 2 m s^{-1} d) 3 m s^{-1}

220. The frequency of tuning fork is 256 Hz. It will not resonate with a fork of frequency

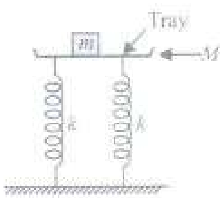
a) 768 Hz b) 738 Hz c) 512 Hz d) 256 Hz

221. In an organ pipe of length L open at both ends, the fundamental mode has a frequency (where v is a speed of sound in air)

a) $\frac{v}{2L}$ and only odd harmonics are present. b) $\frac{v}{2L}$ and only even harmonics are present.

c) $\frac{v}{2L}$ and all harmonics are present. d) $\frac{v}{4L}$ and only odd harmonics are present.

222. A tray of mass M = 10 kg is supported on two identical springs, each of spring constant k, as shown in figure When the tray is depressed a little and released, it executes simple harmonic motion of period 1.5 s. When a block of mass m is placed on the tray, the period of oscillation becomes 3 s. The value of m is



a) 10 kg b) 20 kg c) 30 kg d) 40 kg

223. Two particles execute Simple harmonic motions of same amplitude and frequency along the same straight line. They cross one another when going opposite directions. The phase difference between them when their displacements are one half of their amplitudes is

a) 60° b) 30° c) 120° d) 150°

224. A bomb explodes on the,moon. How long will it take for the sound to reach the earth?

a) 10 sec b) 1000 sec c) 1 day d) None of these

225. The displacement of a particle executing simple harmonic motion is given by $y = A_0 + A\sin wt + B\cos wt$. Then the amplitude of its oscillation is given by:

a) $\sqrt{A^2+B^2}$ b) $\sqrt{A_0^2+(A+B)^2}$ c) $A+B$ d) $A_0+\sqrt{A^2+B^2}$

226. Two turning forks of frequencies n_1 and n_2 produces n beats per second. If n_2 and n are known, n_1 may be given by

a) $\frac{n_2}{n}+n_2$ b) n_2n c) $n_2 \pm n$ d) $\frac{n_2}{n}-n_2$

227. If amplitude of waves at distance r from a point source is A, the amplitude at a distance 2r will be:

a) 2A b) A c) A/2 d) A/4

228. A travelling wave in a gas along the positive X-direction has an amplitude of 2 cm, velocity 45 m/s and frequency 75 Hz. Particle acceleration after an interval of 3 sec at a distance of 135 cm from the origin is:

a) $0.44 \times 10^2 cm/s^2$ b) $4.4 \times 10^5 cm/s^2$ c) $4.4 \times 10^3 cm/s^2$ d) $44 \times 10^5 cm/s^2$

229. If the temperature of atmosphere is increased the following character of sound waves is effected:

a) amplitude b) frequency c) velocity d) wavelength

230. Two periodic waves of intensities I_1 and I_2 pass through a region at the same time in the same direction. The sum of the maximum and minimum intensities is :

a) $2(I_1+I_2)$ b) I_1+I_2 c) $(\sqrt{I_1}+\sqrt{I_2})^2$ d) $(\sqrt{I_1}-\sqrt{I_2})^2$

231. A window whose area is 2 m^2 opens on a street where street noises result in an intensity level at the window of 60 dB. How much acoustic power enters the window via sound waves and if an acoustic absorber is fitted at the window, how much energy from street noise will it collect in five hours?

a) $3\mu W, \quad 2\times10^{-3}J$ b) $2\mu W, \quad 36\times10^{-3}J$ c) $36\mu W, \quad 2\times10^{-3}J$ d) $2\mu W, \quad 3.6\times10^{-3}J$

232. A sound wave of wavelength λ, travels towards the right horizontally with a velocity V. It strikes and reflects from a vertical plane surface, travelling at a speed υ towards the left. The number of positive crests striking in a time interval of three seconds on the wall is:

a) $3(V+\upsilon)/\lambda$ b) $3(V-\upsilon)/\lambda$ c) $(V+\upsilon)/3\lambda$ d) $(V-\upsilon)/3\lambda$

233. When two displacements represented by y_l = a sin (ωt) and y_2 = b cos (ωt)are superimposed the motion is :

a) not a simple harmonic b) simple harmonic with amplitude a/b

c) simple harmonic with amplitude $\sqrt{a^2+b^2}$ d) simple harmonic with amplitude (a+b)/2

234. A particle executing SHM with an amplitude A. The displacement of the particle when its potential energy is half of its total energy is

a) $\frac{A}{\sqrt{2}}$ b) $\frac{A}{2}$ c) $\frac{A}{4}$ d) $\frac{A}{3}$

235. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

Assertion: A child in a garden swing periodically presses his feet against the ground to maintain the oscillations.

Reason : All free oscillations eventually die out because of the ever present damping force.

a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

236. In case of a travelling wave the reflection at a rigid boundary will take place with a phase change of :

a) $\frac{\pi}{2} radian$ b) $\frac{\pi}{4} radian$ c) $\frac{\pi}{6} radian$ d) π $radian$

237. If the density of air at NTP is 1.293 kg/m^3 and γ = 1.41, then the velocity of sound in air at NTP is:

a) 102.3 m/s b) 252.3 m/s c) 332.3 m/s d) 432.3 m/s

238. A point performs simple harmonic oscillation of period T and the equation of motion is given by x = a sin (ωt + π/6). After the elapse of what fraction of the time period the velocity of the point will be equal to half of its maximum velocity?

a) T/12 b) T/8 c) T/6 d) T/3

239. How long after the beginning of motion is the displacement of a harmonically oscillating point equal to one half its amplitude, if the period is 24 see and initial phase is zero?

a) 12 see b) 2 see c) 4 sec d) 6 see

240. When the displacement of a particle executing SHM is one-fourth of its amplitude, what fraction of the total energy is the kinetic energy?

a) $\frac{16}{15}$ b) $\frac{15}{16}$ c) $\frac{3}{4}$ d) $\frac{4}{3}$

241. Two oscillations: $x_1 = A\sin\omega t$ and $x_2 = A\cos\omega t$. Superimpose at right angles in x and y-axis respectively. What will be the resultant wave form?

a) Ellipse b) Straight line c) Circle d) Sinusoidal

242. A wave in a string has an amplitude of 2cm. The wave travels in the + ve direction of axis with a speed of 128 m/ sec and it is noted that 5 complete waves fit in 4 m length of the string. The equation describing the wave is ____________ .

a) $y = (0.02)\text{m}\sin(15.7x - 2010t)$ b) $y = (0.02)\text{m}\sin(15.7x + 2010t)$

c) $y = (0.02)\text{m}\sin(7.85x - 1005t)$ d) $y = (0.02)\text{m}\sin(7.85x + 1005t)$

243. The distance between maximum and the next minimum displacement in a wave is 6 cm. The wavelength of the wave would be:

a) 6 cm b) 3 cm c) 12 cm d) 24 cm

244. A spring balance has a scale that reads from 0 to 50 kg. The length of the scale is 20 cm. A block of mass m is suspended from this balance, when displaced and released, it oscillates with a period 0.5 s. The value of m is (Take g = 10 m s^{-2})

a) 8 kg b) 12 kg c) 16 kg d) 20 kg

245. Sound waves in air are always longitudinal, because:

a) density of air is very small b) air is a mixture of several gases

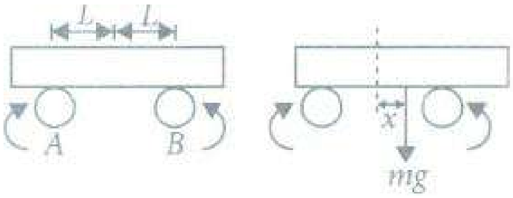
c) air does not have a modulus of rigidity

d) of the inherent characteristics of sound waves in air

246. Two tuning forks, A and B, produce notes of frequencies 258 Hz and 262 Hz. An unknown note sounded with A produces certain beats. When the same note is sounded with B, the beat frequency gets doubled. The unknown frequency is

a) 250 Hz b) 252 Hz c) 254 Hz d) 256 Hz

247. A uniform bar with mass m lies symmetrically across two rapidly rotating fixed rollers, A and B with distance L = 2.0 cm between the bar's centre of mass and each roller. The rollers, whose directions of rotation are shown in figures slip against the bar with coefficient of kinetic friction llk = 0.40. Suppose the bar is displaced horizontally by a distance x as shown in figure and then released. The angular frequency co of the resulting horizontal simple harmonic motion of the bar is (in rad s^{-1})



a) 14 b) 15 c) 16 d) 17

248. A sound source of frequency 170 Hz is placed near a wall. A man walking from the source normally towards the wall finds that there is a periodic rise and fall of sound intensity. If speed of sound in air is 340 rn/s, the distance in metres separating the two adjacent positions of minimum intensity is:

a) (1/2) b) 1 c) (3/2) d) 2

249. Which of the following expressions is that of a simple harmonic progressive wave?

a) $A\sin\omega t$ b) $A\sin\omega t\cos kx$ c) $A\sin(\omega t - kx)$ d) $A\cos \quad kx$

250. If two waves of same frequency and same amplitude respectively on superimposition produced a resultant disturbance of the same amplitude the wave differ in phase by :

a) π b) 2π/3 c) π/2 d) zero

251. $x_1 = A\sin(\omega t - 0.1x)$ and $x_2 = A\sin\left(\omega t - 0.1x - \frac{\phi}{2}\right)$, resultant amplitude of combined wave is:

a) $2A\cos\frac{\phi}{4}$ b) $A/\sqrt{2\cos\phi/2}$ c) $2A\cos\frac{\phi}{2}$ d) $A\sqrt{2\left(1+\cos\frac{\phi}{4}\right)}$

252. The SHM of a particle is given by: $X(t) = 5\cos\left(2\pi t + \frac{\pi}{4}\right)$ (in MKS units).Calculate the displacement and magnitude of acceleration of the particle at f = 1.5 seconds.

a) - 3.0m, 100m/s ^{2} b) +2.54m, 200m/s ^{2} c) - 3.54m, 140m/s ^{2} d) +3.55m, 120m/s ^{2}

253. What is the effect on the time period of a simple pendulum if the mass of the bob is doubled?

a) Halved b) Doubled c) Becomes 8 times d) No effect

254. In which medium sound has maximum velocity

a) In gases b) In liquids c) In solids d) In vacuum

255. Two tuning forks when sounded together produced 4 beats/sec. The frequency of one fork is 256 Hz. The number of beats heard increases when the fork of frequency 256 Hz is loaded with wax. The frequency of the other fork is :
a) 504 Hz b) 520 Hz c) 260 Hz d) 252 Hz

256. A simple harmonic oscillator has an amplitude A and time period T.The time required by it to travel from x = A to x = A/2 is :
a) T/6 b) T/4 c) T/3 d) T/2

257. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: In damped oscillations, the energy of the system is dissipated continuously.
Reason: For small damping, the oscillations remain approximately periodic.
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

258. The speed of sound through oxygen at T K is υ ms^{-1}. As the temperature becomes 2T and oxygen gas dissociated into atomic oxygen, the speed of sound:
a) remains the same b) becomes 2υ c) becomes $\sqrt{2}$v d) none of these

259. A string fixed at its both ends vibrates in 5 loops as shown in figure

The total number of nodes and anti nodes are respectively
a) 5,6 b) 6,5 c) 7,4 d) 4,7

260. Which of the following phenomenon is used by the musicians to tune their musical instruments?
a) Interference b) Diffraction c) Beats d) Polarisation

261. A 5 kg collar is attached to a spring of spring constant 500 N m^{-1}, It slides without friction over a horizontal rod. The collar is displaced from its equilibrium position by 10 cm and released. The time period of oscillation is:
a) $\frac{\pi}{5}s$ b) $\frac{\pi}{2}s$ c) πs d) 2π s

262. Plane simple harmonic progressive waves of wavelengths 120 cm and speed 34800 cm/sec are incident normally on a plane surface which is a perfect reflector of sound. Stationary waves are formed. The ratio of amplitudes of vibrations at points distant (i) 10 cm (ii) 30 cm from the reflector is:
a) 1:2 b) 1:0 c) 1:1 d) 1:4

263. A tuning fork when sounded together with a tuning fork of frequency 256 Hz emits two beats. On loading the tuning fork of frequency 256 Hz. the number of beats heard is one per second. The frequency of tuning fork is :
a) 257 Hz b) 258 Hz c) 256 Hz d) 254 Hz

264. A source and listener are both moving towards each other with speed v/10 where v is the speed of sound. If the frequency of the note emitted by the source is f, the frequency heard by the listener would be nearly:
a) 1.11 f b) 1.22 f c) f d) 1.27 f

265. For a particle executing SHM along x-axis, force acting onit , is given by:
a) -A k x b) A cos kx c) A exp (-k x) d) A k x

266. Assertion: The sound emitted by the source travels in all directions.
Reason: The relative velocity of sound with respect to the observer is the sum of velocity of sound and velocity of observer.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

267. Sound waves travel fastest in
a) solids b) liquids c) gases d) vacuum

268. A wave equation which gives the displacement along Y-direction is given: y = 10^4 sin (60t + 2x) . Where, x and y are in metre and t in sec. Among the following choose the correct statement.
a) It represents a wave propagating along positive x-axis with a velocity of 30 m/s.
b) It represents a wave propagating along negative x-axis with a velocity of 120 m/s.
c) It represents a wave propagating along negative x-axis with a velocity of 30 m/s.
d) It represents a wave propagating along negative x-axis with a velocity of 10^4 m/s.

269. Sound waves in air cannot be polarized because
a) their speed is small b) they require medium c) these are longitudinal
d) their speed is temperature dependent

270. Particle executing SHM is described by the displacement function x(t) = $A\cos(\omega t + \phi)$ If the initial (t = 0) position of the particle is πcms^{-1} , its initial velocity is 1t em S^{-1} and its angular frequency is π s^{-l}, then the amplitude of its motion is:
a) π cm b) 2 cm c) $\sqrt{2}$ cm d) 1 cm

271. A hospital uses an ultrasonic scanner to locate tumours in a tissue. The operating frequency of the scanner is 4.2 MHz. The speed of sound in a tissue is 1.7 km/s. The wavelength of sound in tissue is close to _______________ .
a) 4×10^{-4} m b) 8×10^{-4} m c) 4×10^{-3} m d) 8×10^{-3} m

272. The period of simple harmonic oscillator is 24 see and the initial phase is zero. The time at which the oscillating point would have attained half the amplitude is
a) 2 sec b) 2.4 sec c) 6 sec d) 12 sec

273. Assertion : The fundamental frequency of an open organ pipe increases as the temperature is increased.
Reason: As the temperature increases the velocity of sound increases more rapidly than length of pipe.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false.

274. The equation of a progressive wave can be given by y = 15 sin (660πt - 0.02πx) cm. The frequency of the wave is:

a) 330 Hz b) 342 Hz c) 365 Hz d) 660 Hz

275. Which one of the following does not represent a travelling wave?

a) $y = y_m f(x - vt)$ b) $y = y_m \sin k(x - vt)$ c) $y = y_m \log(x - vt)$ d) $y = f(x^2 - vt^2)$

276. A transverse wave consists of

a) only crests b) only troughs c) both crests and troughs

d) rarefactions and compressions

277. The equation of progressive wave is $y = 2\sin\pi(0.5x + 200t)$(x, y in cm). The amplitude and velocity of wave respectively are:

a) 2π cm, 100 cm/sec b) $\frac{2\pi}{3}cm,$ 0.5 cm/sec c) 2 cm, 400 cm/sec d) 0.2 cm, 200 cm/sec

278. Two waves represented by: $y_1 = a\sin\frac{2\pi}{\lambda}(vt - x)$ and $y_2 = a\cos\frac{2\pi}{\lambda}(vt - x),$ are superposed. The resultant wave has an amplitude equal to:

a) zero b) 2a c) a d) $a\sqrt{2}$

279. Frequency of variation of kinetic energy of a simple harmonic motion of frequency n is

a) 2n b) n c) $\frac{n}{2}$ d) 3n

280. Velocity of sound in a medium is v. If the density of the medium is doubled, what will be the new velocity of sound?

a) $\sqrt{2}v$ b) v c) $v/\sqrt{2}$ d) $2v$

281. In case of a forced oscillation, the resonance peak becomes very sharp when the

a) restoring force is small. b) damping force is small. c) quality factor is small

d) applied periodic force is small.

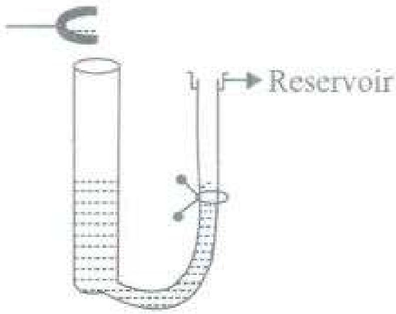
282. A tuning fork A of frequency 512 Hz produces 5 beats per second when sounded with another tuning fork B of unknown frequency. If B is loaded with wax the number of beats is again 5per second. The frequency of the tuning fork B before it was loaded is

a) 502 Hz b) 507 Hz c) 517 Hz d) 522 Hz

283. A band playing music at a frequency u is movmg towards a wall at a speed v_b' A motorist is following the band with a speed v_m. If v is the speed of sound, It I the expression for the beat frequency heard by the motorist is

a) $\frac{v + v_m}{v + v_b}v$ b) $\frac{v + v_m}{v - v_b}v$ c) $\frac{2v_b(v + v_m)}{v^2 - v_b^2}v$ d) $\frac{2v_m(v + v_b)}{v^2 - v_m^2}v$

284. A tuning fork vibrating with a frequency of 500 Hz is kept close to the open end of a tube filled with water, as shown in figure. The water level in the tube is gradually lowered. When the water



level is 17 cm below the open end, maximum intensity of sound is heard. If the room temperature is 20°C, the speed of sound in air at this temperature is

a) 330 m s^{-1} b) 340 m s^{-1} c) 350 m s^{-1} d) 360 m s^{-1}

285. A string is hanging from a rigid support. A transverse pulse is excited at its free end. The speed at which the pulse travels a distance x is proportional to:

a) x b) $\frac{1}{x}$ c) $\frac{1}{\sqrt{x}}$ d) x^2 e) $\sqrt{x}$

286. The displacement of a particle is represented by the equation $y = sin^3\omega t$ The motion is

a) non-periodic b) periodic but not simple harmonic c) simple harmonic with period

d) simple harmonic with period

287. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

Assertion: An earthquake will not cause uniform damage to all building in an affected area, even if they are built with the same strength and materials.

Reason : The one with its natural frequency close to the frequency of seismic wave is likely to be damaged less.

a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

288. Which one of the following statements is true?

a) The sound waves in air are longitudinal while the light waves are transverse

b) Both light and sound waves in air are longitudinal

c) Both light and sound waves can travel in vacuum

d) Both light and sound waves in air are hansverse

289. A sonometer wire 100 em long has a fundamental frequency of 330 Hz. The velocity of propagation of transverse waves on the wire is:

a) 330 ms^{-1} b) 660 ms^{-1} c) 900 ms^{-1} d) 115 ms^{-1}

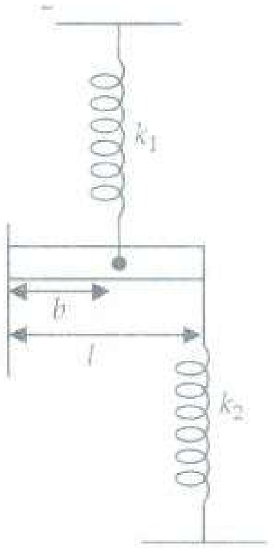
290. Match the Column I with Column II.

Column I		**Column II**	
(A)	Change in apparent frequency due to the relative motion between source and listener is	(p)	Beats
(B)	Intensity of sound varies with time in	(q)	Transverse wave
(C)	Sound waves in air are	(r)	Doppler's effect

(D)	Light waves are	(s)	Longitudinal wave

a) A - p, B - q, C - r, D - s b) A - q, B - r, C - s, D - P c) A - r, B - p, C - s, D - q
d) A - r, B - s, C - p, D - q

291. A rod of mass 11/ and length l is connected by two spring of spring constants k_l and "k_2' so that it is horizontal at equilibrium. What is the natural frequency of the system?



a) $\frac{1}{2\pi}\sqrt{\frac{k_1b^2+k_2l^2}{ml^2}}$ b) $\frac{1}{2\pi}\sqrt{\frac{2k_1b^2+k_2l^2}{ml^2}}$ c) $\frac{1}{2\pi}\sqrt{\frac{k_1b^2+k_2l^2}{2ml^2}}$ d) $\frac{1}{2\pi}\sqrt{\frac{3\left(k_1b^2+k_2l^2\right)}{ml^2}}$

292. A particle executing simple harmonic motion with an amplitude 5 cm and a time period 0.2 s. The velocity and acceleration of the particle when the displacement is 5 cm is:
a) 0.57πm s^{-1}, 0 m s^{-2} b) 0.5 m s^{-l}, -57π^2 m s^{-2} c) 0 m s^{-1}, -57π^2 m s^{-2}
d) 0.57πms^{-1}, -0.57π^2ms^{-2}

293. In the equation $y = 4\cos(2\pi x/50)\sin 100\pi t$, y represents the displacement of a particle at the distance x from the origin and at the time t.Then, a node occurs at the following distance:
a) 12.5 cm b) 50 cm c) 20 cm d) $(100/2\pi)cm$

294. The noise level for the threshold of pain (intensity 10^0 watt/m ^{2}) is:
a) 12 dB b) 120 dB c) 10^6 dB d) 10 dB

295. The acceleration due to gravity on the surface of the moon is 1.7 m s^{-2} . The time period of a simple pendulum on the moon if its time period on the earth is 3.5 s is (Given,g= 9.8 m s^{-2}).
a) 2.2 s b) 4.4 s c) 8.4 s d) 16.8 s

296. A vibratory motion is represented by

$$x = 2A\cos\omega t + A\cos\left(\omega t + \frac{\pi}{2}\right) + A\cos(\omega t + \pi) + \frac{A}{2}\cos\left(\omega t + \frac{3\pi}{2}\right)$$

The resultant amplitude of the motion is
a) $\frac{9A}{2}$ b) $\frac{\sqrt{5}A}{2}$ c) $\frac{5A}{2}$ d) 2A

297. Which of the following statements is incorrect?
a) Sound travels in straight lines. b) Sound travels as waves.
c) Sound is a form of energy. d) Sound travels faster in vacuum than in air.

298. The equation of a progressive wave is given by y = 5 sin(100πt -0.4ππx) where y and x are in m and t is in s.
(1) The amplitude of the wave is 5 m.
(2) The wavelength of the wave is 5 m.
(3) The frequency of the wave is 50 Hz.
(4) The velocity of the wave is 250 m S^{-1}.
Which of the following statements are correct?
a) (1), (2) and (3) b) (2) and (3) c) (1) and (4) d) All are correct

299. An air chamber of volu ne V has a neck of crosssectional area a into w' ICh a light ball of mass m just fits and can move up ind down without friction. The diameter of the ball is equal to that of the neck of the chamber. The ball is pressed down a little and released. If the bulk modulus of air is B, the time period of the oscillation of the ball is

a) $T = 2\pi\sqrt{\frac{Ba^2}{mV}}$ b) $T = 2\pi\sqrt{\frac{BV}{ma^2}}$ c) $T = 2\pi\sqrt{\frac{mB}{Va^2}}$ d) $T = 2\pi\sqrt{\frac{mV}{Ba^2}}$

300. Mark the correct statement.
a) In case of stationary waves maximum pressure change occurs at antinode.
b) Velocity of longitudinal waves in a medium is its physical characteristic.
c)
Due to propagation of longitudinal wave in air, maximum pressure change is equal to $2\pi na/\rho\upsilon$
d) None of the above

301. If C_o and C denote the sound velocity and root mean square velocity of molecules in a gas, then:

a) $C_0 = C$ b) $C_0 = C\left(\frac{\gamma}{3}\right)^{1/2}$ c) C_0 and C are not related d) $C_0 > C$

302. The time period of a simple pendulum is 2s. If its length is increased by 4 times, then its period becomes _____________ .
a) 16 s b) 12 s c) 8 s d) 4 s

303. If v_{rms} is the rms speed of molecules in a gas and v is the speed of sound waves in the gas, then the ratio $\frac{v_{rms}}{v}$

a) $\sqrt{\frac{3}{\gamma}}$ b) $\sqrt{\frac{\gamma}{3}}$ c) $\sqrt{3\gamma}$ d) $\frac{\sqrt{3}}{\gamma}$

304. The two nearest harmonics of a tube closed at one end and open at other end are 220 Hz and 260 Hz. What is the fundamental frequency of the system?
a) 20 Hz b) 30 Hz c) 40 Hz d) 10 Hz

305. The electric field of an electromagnetic wave in free space is given by

$\vec{E} = 10\cos\left(10^7 t + kx\right)\hat{j}V/m,$ where t and x are in seconds and metres respectively. It can be inferred that:
(1) the wavelength λ is 188.4 m
(2) the wave number k is 0.33 rad/m

(3) the wave amplitude is 10 V/m

(4) the wave is propagating along + X-direction

Which one of the following pairs of statements is correct?

a) (3) and (4) b) (1) and (2) c) (2) and (3) d) (1) and (3)

306. When sound waves travel from air to water which of these remains constant?

a) Velocity b) Freqaency c) Wavelength d) All of these

307. When two sound waves are superimposed, beats are produced when they have

a) Different amplitudes and phases b) Different velocities c) Different phases

d) Different frequencies

308. Two particles execute SHM of same amplitude and frequency on parallel lines. They pass one another when moving in opposite directions each time when their displacement is half of the amplitude. The phase difference between them is

a) 0 b) $\frac{2\pi}{3}$ c) π d) $\frac{\pi}{6}$

309. At a certain instant, a stationary transverse wave is found to have maximum kinetic energy. The appearance of string at that instant is:

a) sinusoidal shape with amplitude A/3 b) sinusoidal shape with amplitude A/2

c) sinusoidal shape with amplitude A d) straight line

310. Two identical sinusoidal waves each of amplitude 10 mm with a phase difference of 90° are travelling in the same direction in a string. The amplitude of the resultant wave is

a) 5 mm b) $10\sqrt{2}$ mm c) 15 mm d) 20 mm

311. A mass m is suspended from the two coupled springs connected in series. The force constant for springs are k_1 and k_2. The time period of the suspended mass will be:

a) $T = 2\pi\sqrt{\frac{m}{k_1-k_2}}$ b) $T = 2\pi\sqrt{\frac{mk_1k_2}{k_1+k_2}}$ c) $T = 2\pi\sqrt{\frac{m}{k_1+k_2}}$ d) $T = 2\pi\sqrt{\frac{m\left(k_1+k_2\right)}{k_1k_2}}$

312. A closed organ pipe and an open organ pipe of same length produce 2 beats/second while vibrating in their fundamental modes. The length of the open organ pipe is halved and that of closed pipe is doubled. Then, the number of beats produced per second while vibrating in the fundamental mode is

a) 2 b) 6 c) 8 d) 7

313. Time period of oscillation of a spring is 12 s one arth. What shall be the time period if it is taken to moon?

a) 6 s b) 12 s c) 36 s d) 72 s

314. A 10m long steel wire has mass 5 g. If the wire is under a tension of 80 N, the speed of transverse waves on the wire is

a) 100 m S^{-1} b) 200 m S^{-1} c) 400 m S^{-1} d) 500 m S^{-1}

315. A stretched string resonates with tuning fork of frequency 512 Hz when length of the string is 0.5 m. The length of the string required to vibrate resonantly with a tuning fork of frequency 256 Hz would be:

a) 0.25 m b) 0.5 m c) 1 m d) 2 m

316. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: The skill in swinging to greater heights lies in the synchronisation of the rhythm of pushing against the ground with the natural frequency of the swing.
Reason: The phenomenon behind this is resonance
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

317. A particle moves such that its acceleration a is given by a = - bx, where x is the displacement from equilibrium position and b is a constant. The period of oscillation is:
a) 2π$\sqrt{b}$ b) 2π/$\sqrt{b}$ c) 2π/b d) 2$\sqrt{\pi/b}$

318. When stationary waves are set up, pick out the correct statement from the following.
a)
All the particles in the medium are in the same phase of vibration at all times and distances
b)
The particles with an interval between two consecutive nodes are in phase, but the particles in two such consecutive intervals are of opposite phase
c)
The phase lag along the path of the wave increases as the distance from the source increases
d) Only antinodes are in same phase

319. When a wave travels in a medium the particles displacement is given by the equation; $y = 0.03\sin\pi(2t - 0.01x)$, where x and y are in metre and t in second. The wavelength of the wave is:
a) 200 m b) 100 m c) 20 m d) 10 m

320. The transverse wave represented by the equation
$y = 4\sin\frac{\pi}{6}\sin(3x - 15t)$ has:
a) amplitude =4p b) wavelength $= \frac{4\pi}{3}$ c) speed of propagation =5 d) period $= \frac{\pi}{15}$

321. Two tuning forks are in vibration and no beats are heard. One of the prongs of one tuning fork is loaded and then it is sounded with another tuning fork and four beats are heard. Now, the prongs of loaded tuning fork are cut slightly. Now, on sounding together they produce 4 beats. Initially, the ratio of the frequencies of the two tuning forks was:
a) 1:1 b) 4:1 c) 1:4 d) 1:2

322. On sounding tuning fork A with another tuning fork B of frequency 384 Hz, 6 beats are produced per second. After loading the prongs of A with some wax and then sounding it again with B, 4 beats are produced per second. What is the frequency of the tuning fork A?
a) 388 Hz b) 378 Hz c) 380 Hz d) 390 Hz

323. A particle starts simple harmonic motion from the mean position. Its amplitude is a and time period is T. What is its displacement when its speed is half of its maximum speed?

a) $\frac{\sqrt{2}}{3}a$ b) $\frac{\sqrt{3}}{2}a$ c) $\frac{2}{\sqrt{3}}a$ d) $\frac{a}{\sqrt{2}}$

324. Two open organs pipes of fundamental frequencies u_1 and u_2 are joined in series. The fundamental frequency of the new pipe so obtained will be

a) v_1+v_2 b) $\frac{v_1v_2}{(v_1+v_2)}$ c) $\frac{v_1v_2}{v_1-v_2}$ d) $\sqrt{(v_1^2+v_2^2)}$

325. The speed of sound in hydrogen at NTP is 1270 m/s. Then, the speed in a mixture of hydrogen and oxygen in the ratio 4: 1 by volume will be:

a) 317 m/s b) 635 m/s c) 830 m/s d) 950 m/s

326. Two vibrating tuning forks producing progressive waves given by:

$y_1 = 4\sin(500\pi t)$ and $y_2 = 2\sin(506\pi t)$ are held near the ear of a person. The person will hear:

a) 3 beats per second with intensity ratio between maxima and minima equal to 9

b) 3 beats per second with intensity ratio between maxima and minima equal to 2

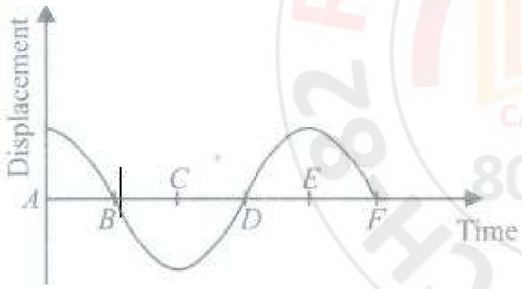
c) 6 beats per second with intensity ratio between maxima and minima equal to 2

d) 6 beats per second with intensity ratio between maxima and minima equal to 9

327. A line source emits a cylindrical wave. If the medium absorbs no energy, the amplitude will vary with distance r from the source as proportional to:

a) r^{-1} b) r^{-2} c) $r^{-1/2}$ d) $r^{1/2}$

328. Displacement versus time curve for a particle executing SHM is as shown in figure.



At what points the velocity of the particle is zero?

a) A, C, E b) B, D, F c) A, D, F d) C, E, F

329. With propagation of longitudinal waves through a medium, the quantity transmitted is

a) matter b) energy c) energy and matter d) energy, matter and momentum

330. The total energy of a simple harmonic oscillator is proportional to

a) amplitude b) square of amplitude c) frequency d) velocity

331. A pendulum has a string of length 99.39 cm. How much length of the pendulum must be shortened to keep the current time of the pendulum if it loses 4 s a day?

a) 0.0009 cm b) 0.009 cm c) 0.09 cm d) 0.9 cm

332. A wave equation is: y= 10^{-4} sin (60t + 2x), where, x and y are in metres and t is in sec. Which of the following statements is correct?

a) The wave travels with a velocity of 300 m/s in the negative direction of the x-axis

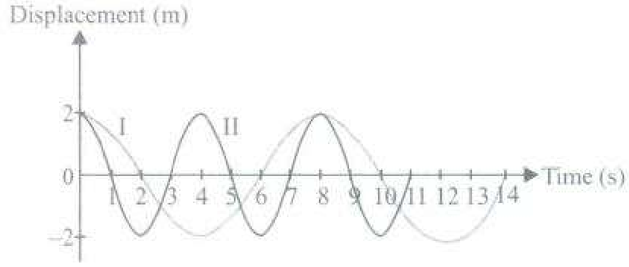
b) Its wavelength is π metre c) Its frequency is 50π hertz d) All of the above

333. Two harmonic waves having same ω and k are travelling on a stretched string in the positive direction of X-axis. The waves have same amplitude but differ in their initial phase. The net displacement of the wave is given by :

a) $y(x,t)=2a\sin\left(kx-\omega t+\frac{\phi}{2}\right)$ b) $y(x,t)=2a\cos\frac{\phi}{2}\sin\left(kx-\omega t+\frac{\phi}{2}\right)$ c) $y(x,t)=a\sin\left(kx-\omega t+\frac{\phi}{2}\right)$

d) $y(x,t)=2a\sin\frac{\phi}{2}\sin\left(kx-\omega t+\frac{\phi}{2}\right)$

334. Figure shows the displacement-time graphs of two simple harmonic motions I and II. From the graph it follows that



a) curve I has same frequency as that of curve II
b) curve I has frequency twice that of curve II. c) curve I has frequency half that of curve II.
d) curve I has frequency four times that of curve II.

335. The Doppler effect is applicable for
a) sound waves only b) light waves only c) both sound and light waves
d) none of these

336. The phase difference between oscillatory motion of two points separated by a distance of $\frac{\lambda}{2}$ is (where λ is the wavelength)
a) $\frac{\pi}{2}$ b) π c) $\frac{3\pi}{2}$ d) 2π

337. If the frequency of human heart is 1.25 Hz, the number of heart beats in 1minute is
a) 65 b) 75 c) 80 d) 90

338. Velocity of sound waves in air is 3.30 m/s. For a particular sound wave in air, path difference of 40 cm is equivalent to phase difference of 1.6p. The frequency of this wave is ______________ .
a) 165 Hz b) 150 Hz c) 660 Hz d) 330 Hz

339. If two tuning forks A and B are sounded together, they produce 4 beats per second. A is then slightly loaded with wax, they produce beats when sounded again. The frequency of A is 256 Hz. The frequency of B will be:
a) 250 Hz b) 252 Hz c) 260 Hz d) 262 Hz

340. The phase difference between two waves, represented by:
$y_1=10^{-6}\sin[100t+(x/50)+0.5]m$ $y_2=10^{-6}\cos[100t+(x/50)]m$. where x is expressed in metres and t is expressed in seconds, is approximately:
a) 1.07 rad b) 2.07 rad c) 0.5 rad d) 1.5 rad

341. The frequency of sinusoidal wave, 0.40 cos (2000t + 0.80) would be:
a) 1000p Hz b) 2000 Hz c) 20 Hz d) $\frac{1000}{\pi}$ Hz

342. A jet plane travels at Mach 2 at an altitude of 1600 m. How far past an observer will the plane be when the shock wave hits him?
a) 3200 m b) 3577 m c) 1600 m d) 2400 m

343. Beats are produced by two waves: $y_1 = a\sin 1000\pi t$ and $y_2 = a\sin 998\pi t$. The number of beats heard/sec is:
a) 1 b) 4 c) 0 d) 2

344. In the case of stationary waves all the particles of the medium between two nodes vibrate:
a) in phase but with different amplitudes and time periods
b) in phase and with same amplitude and time period
c) in phase with the same time period but different amplitudes
d) with the same time period but in different phases and with different amplitudes

345. If two sound waves:$y_1 = 0.3\sin 595\pi\left(t - \frac{x}{330}\right)$ and $y_2 = 0.5\sin 604\pi\left(t - \frac{x}{330}\right)$ are superposed. What will be (i) the frequency of the resultant wave (ii) the frequency at which the amplitude of resultant wave varies?
a) 600, 8 b) 300, 2 c) 300, 4 d) 600, 4

346. The stationary wave produced on a string is represented by the equation:
$y = 5\cos\left(\frac{\pi x}{3}\right)\sin 40\pi t$, where x and yare in em and t is in seconds. The distance between two consecutive nodes is:
a) 5 cm b) 3 cm c) π cm d) 40 cm

347. When a wave propagates through the medium, the constituents of the medium gets disturbed. The speed of the waves is:
a) directly proportional to restoring force set up in the medium when it is disturbed
b) inversely proportional to the mass density of the medium
c)
directly proportional to the product of the restoring force and the mass density of the medium
d) both (a) and (b)

348. Two waves of wavelength 50 m and 51 cm produce 12 beat/s. The speed of sound is ______________ .
a) 306 m/s b) 331 m/s c) 340 m/s d) 360 m/s

349. Two cars moving in opposite directions approach each other with speed of 22 m/s and 16.5 m/s respectively. The driver of the first car blows a horn having a frequency 400 Hz. The frequency heard by the driver of the second car is [velocity of sound 340m/s]
a) 361 Hz b) 411 Hz c) 448 Hz d) 350 Hz

350. Equations of motion in the same direction are given by:
$y_1 = 2a\sin(\omega t - kx)$ and $y_2 = 2a\sin(\omega t - kx - \theta)$. The amplitude of the medium particle will be:
a) $2a\cos\theta$ b) $\sqrt{2}a\cos\theta$ c) $4a\cos\theta/2$ d) $\sqrt{2}a\cos\theta/2$

351. A simple harmonic motion having an amplitude A and time period T is represented by the equation:
y = 5sin π (t+4)m

Then, the values of A (in m) and T (in see) are

A=5;T=2

a) A = 5; T = 2 b) A = 10; T = 1 c) A = 5; T=1 d) A = 10; T = 2

352. In a plane progressive harmonic wave particle speed is always less than the wave speed if:

a) amplitude of wave b) amplitude of wave c) amplitude of wave

d) amplitude of wave $> \lambda/\pi$

353. A wave travelling along the x-axis is described by the equation y (x, t) = 0.005 sin (αx - βt). If the wavelength and time period of the wave are 0.08 m and 2 s respectively, then α, β in appropriate units are

a) $\alpha = 25\pi$, $\beta = \pi$ b) $\alpha = \frac{0.08}{\pi}, \beta = \frac{2}{\pi}$ c) $\alpha = \frac{0.04}{\pi}, \beta = \frac{1}{\pi}$ d) $\alpha = 12.5, \beta = \frac{\pi}{2}$

354. A bat emits ultrasonic sound of frequency 100 kHz in air. If this sound meets a water surface, the wavelengths of the reflected and transmitted sound are (speed of sound in air = $340ms^{-1}$ and in water = $1500ms^{-1}$) :

a) 3.4 mm, 30 mm b) 6.8 mm, 15 mm c) 3.4 mm, 15 mm d) 6.8 mm, 30 mm

355. The transverse displacement of a string clamped at its both ends is given by y(x, t) = 0.06 sin $\left(\frac{2\pi}{3}x\right)$cos(120$\pi$t) where x and y are in m and tin s. The length of the string is 1.5 m and its mass is 3 x 10^{-2} kg. The tension in the string is

a) 324 N b) 648 N c) 832 N d) 972 N

356. Ultrasonic waves produced by a vibrating quartz crystal are

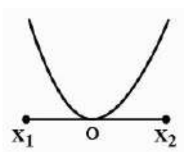
a) only longitudinal b) only transverse c) both longitudinal and transverse

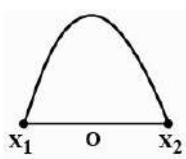
d) neither longitudinal nor transverse

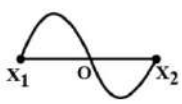
357. In a sinusoidal wave, the time required for a particular point, to move from maximum displacement to zero displacement is 0.170 s. The frequency of the wave is _______________ .

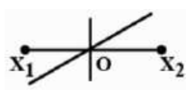
a) 1.47 Hz b) 0.36 Hz c) 0.73 Hz d) 2.94 Hz

358. A particle of mass m oscillates with simple harmonic motion between points x_1 and x_2, the equilibrium position being O. Its potential energy is plotted. It will be as given below in the graph.

a) 

b) 

c) 

d) 

359. A toothed wheel is rotating at 120 rpm and a postcard is placed against the teeth. How many teeth must it have to produce a note whose pitch is same as that of a tuning fork of frequency 256 per second?

a) 120 b) 128 c) 256 d) 256 x 120

360. The fundamental frequency of a closed organ pipe of length 20 cm is equal to the second overtone of an organ pipe open at both the ends. The length of organ pipe open at both the ends is :

a) 80 cm b) 100 cm c) 120 cm d) 140 cm

361. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: Every periodic motion is not simple harmonic motion.
Reason : The motion governed by the force law F = -kx is simple harmonic.
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

362. A wave is represented by the equation: $y = 0.1\sin(100\pi t - kx)$. If wave velocity is 100 m/s, its wave number is equal to:
a) 1 m^{-1} b) 2 m^{-1} c) πm^{-1} d) $2\pi m^{-1}$

363. A heavy rope is suspended from a rigid sur-port. A wave pulse is set up at the lower end; then:
a) the pulse will travel with uniform speed b) the pulse will travel with increasing speed
c) the pulse will travel with decreasing speed d) the pulse cannot travel through the rope

364. Spring of force constant k is cut into lengths of ratio 1 : 2 : 3. They are connected in series and the new force constant is k', Then they are connected in parallel and force constant is k". then k' : k" is:
a) 1:9 b) 1:11 c) 1:14 d) 1:6

365. Two sound waves of slightly different frequencies propagating in the same direction produce beats due to:
a) interference b) diffraction c) reflection d) refraction

366. Two waves produce displacements at a point given by: $y_1 = a\sin\omega t$ and $y_2 = a\sin\left(\omega t + \frac{\pi}{2}\right)$.
The resultant amplitude is:
a) 0 b) 2a c) $\sqrt{2}a$ d) $a/\sqrt{2}$

367. Assertion: A wave is motion of matter as a whole in a medium.
Reason: Wind is same as sound wave in air
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

368. The displacement x (in metres) of a particle performing simple harmonic motion is related to time t sec as x = 0.05 cos (4πt+π/4). The frequency of the motion will be:
a) 0.5 Hz b) 1.0 Hz c) 1.5 Hz d) 2.0 Hz

369. A block whose mass is 1kg is fastened to a spring. The spring has a spring constant of 100 Nm^{-1} The block is pulled to a distance x = 10 ern from its equilibrium position at x = 0 on a frictionless surface from rest at t = O. The kinetic energy and potential energy of the block when it is 5 em away from the mean position is
a) 0.0375 J, 0.125 J b) 0.125 J, 0.375 J c) 0.125 J, 0.125 J d) 0.375 J, 0.375 J

370. A note has a frequency 128 Hz. The frequency of a note two octaves higher than it is:
a) 256 Hz b) 64 Hz c) 32 Hz d) 384 Hz

371. At a point, beats frequency of n Hz is observed. It means:
a) medium particles, at that point, are vibrating with frequency n Hz
b) amplitude of vibrations changes simple harmonically with frequency n Hz at that point only
c) at that point, zero intensity is observed 2n times per second d) none of the above

372. Two waves of same frequency and intensity superimpose on each other in opposite phases. After the superposition, the intensity and frequency of waves will ______________ .
a) Increase b) Decrease c) Remain constant d) Become zero

373. What is the effect of humidity on sound waves when humidity increases?
a) Speed of sound waves increases b) Speed of sound waves decreases
c) Speed of sound waves remains same d) Speed of sound waves becomes zero

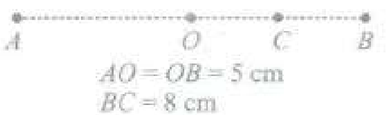
374. A simple harmonic progressive wave is represented by the equation: y=8sin2π(0.1x−2t) Where, x and yare in em and t is in seconds. At any instant the phase difference between two particles separated by 2.0 em in the X -direction is:
a) 18° b) 54° c) 36° d) 72°

375. Equation of a plane progressive wave is given by $y = 0.6sin2\pi\left(t - \frac{x}{2}\right)$ On reflection from a denser medium its amplitude becomes $\frac{2}{3}$ of the amplitude of the incident wave. The equation of the reflected wave is
a) $y = 0.6sin2\pi\left(1 + \frac{x}{2}\right)$ b) $y = -0.4sin2\pi\left(t + \frac{x}{2}\right)$ c) $y = 0.4sin2\pi\left(t + \frac{x}{2}\right)$ d) $y = -0.4sin2\pi\left(t - \frac{x}{2}\right)$

376. Sound waves travel at 350 m/s through a warm air and at 3500 m/s through brass. The wavelength of a 700 Hz acoustic wave as it enters brass from warm air ____________ .
a) Decreases by a factor 10 b) Increases by a factor 20 c) Increases by a factor 10
d) Decreases by a factor 20

377. A wave travels in a medium according to the equation of displacement given by :
$y(x, t) = 0.03\sin\pi(2t - 0.01x)$where y and x are in metre and t in second. The wavelength of the wave is:
a) 200 m b) 100 m c) 20 m d) 10 m

378. particle is in linear simple harmonic motion between two points A and B 10 crn apart (figure). Take the direction from A to B as the +ve direction. Which of the following statements is correct?



a) The sign of acceleration and force on the particle when it is at A is negative
b) The sign of acceleration and force on the particle when it is at B is positive

c)
The sign of velocity, acceleration and force on the particle when it is 3 cm away from A going towards B are positive.
d)
The sign of velocity, acceleration and force on the particle when it is 4 cm away from B going towards A are positive.

379. When two sound sources of the same amplitude but of slightly different frequencies v1 and v2 are sounded simultaneously, the sound one hears has a frequency equal to

a) $|v_1 - v_2|$ b) $\left[\frac{v_1+v_2}{2}\right]$ c) $\sqrt{v_1 v_2}$ d) $\left[v_1 + v_2\right]$

380. A hollow sphere is filled with water. It is hung by a long thread. As the water flows out of a hole at the bottom, the period of oscillation will:
a) first increase and then decrease b) first decrease and then increase
c) increase continuously d) decrease continuously

381. Which of the following equation represents a wave?
a) $y = a\sin\omega t$ b) $y = a\cos kx$ c) $y = a\sin(\omega t - bx + c)$ d) $y = a\sin(\omega t - kx)$

382. Which one of the following is not a periodic motion?
a) Rotation of the earth about its axis.
b) A freely suspended bar magnet displaced from its N-S direction and released
c) Motion of hands of a clock d) An arrow released from a bow.

383. A plane sound wave is travelling in a medium. With reference to a frame A, its equation is $y = a\cos(\omega t - kx)$. With reference to a frame B, moving with a constant velocity v in the direction of propagation of the wave, equation of the wave will be:
a) $y = a\cos[(\omega + kv)t - kx]$ b) $y = -a\cos[(\omega - kv)t - kx]$ c) $y = a\cos[(\omega - kv)t - kx]$
d) $y = a\cos[(\omega + kv)t + kx]$

384. Three sound waves of equal amplitudes have frequencies (n-1), n, (n+1). They superimpose to give beats. The number of beats produced per second will be:
a) 1 b) 4 c) 3 d) 2

385. A hospital uses an ultrasonic scanner to locate tumours in a tissue. The operating frequency of the scanner is 3.2 MHz. The speed of sound in a tissue is 1.6 km S^{-1}. The wavelength of sound in the tissue is
a) 0.25 mm b) 0.5 mm c) 0.75 mm d) 1mm

386. A wave is propagating along x-axis and another wave is propagating along y-axis. If they superimpose each other, the resultant wave will be:
a) circular b) parabolic c) straight line d) elliptical

387. To show that a simple pendulum executing a simple harmonic motion it is necessary to assume that
a) length of the pendulum is small. b) mass of the pendulum is small
c) acceleration due to gravity is small. d) amplitude of the oscillation is small

388. The speed of a wave in a certain medium is 960 m/sec. If 3600 waves pass over a certain point of the medium in 1 minute, the wavelength is :

a) 2 meters b) 4 meters c) 8 meters d) 16 meters

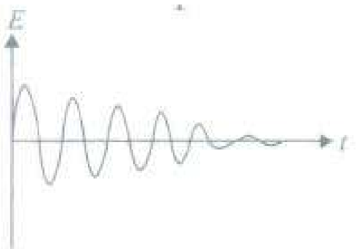
389. A cylindrical resonance tube open at both ends, has a fundamental frequency f, in air. If half of the length is dipped vertically in water, the fundamental frequency of the air column will be ________________ .

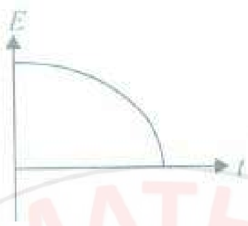
a) 2f b) $\frac{3f}{2}$ c) f d) $\frac{f}{2}$

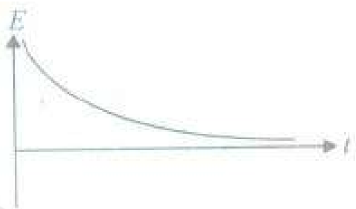
390. Waves of displacement amplitude A and angular frequency ω travel in air with the same velocity. Which of the following waves has the highest intensity?

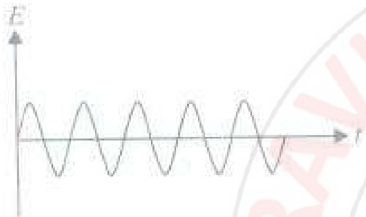
a) A = 10×10^{-4} m, ω= 500 s^{-1} b) A = 2×10^{-4} m, ω= 2000 s^{-1} c) A = 2×10^{-4} m, ω= 115 s^{-1}
d) A = 20×10^{-4} m, ω= 200 s^{-1}

391. Which of the following energy-time graphs represents damped harmonic oscillator?

a) 

b) 

c) 

d) 

392. A vehicle, with a horn of frequency n is moving with a velocity of 30 m/s in a direction perpendicular to the straight line joining the observer and the vehicle. The observer perceives the sound to have a frequency n + n_1. Then (If the sound velocity in air is 300 m/s)

a) $n_1 = 10n$ b) $n_1 = 0$ c) $n_1 = 0.1n$ d) $n_1 = -0.1n$

393. Assertion: Intensity of sound wave does not change when the listener moves towards or away from stationary source.

Reason: The motion of listener causes the apparent change in wavelength.

a)
If both assertion and reason are true but reason is not the correct explanation of assertion.

b) If assertion is true but reason is false. c) If both assertion and reason are false.

d) If both assertion and reason are true and reason is the correct explanation of assertion.

394. A source and an observer move away from each other, with a velocity of 10 m /s with respect to ground. If the observer finds the frequency of sound coming from the source as 1950 Hz, then original frequency of source is (velocity of sound in air =340 m/s)

a) 1950 Hz b) 1838.5 Hz c) 2132 Hz d) 2486 Hz

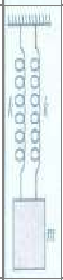
395. Two Simple Harmonic Motions of angular frequency 100 and 1000 rad s^{-1} have the same displacement amplitude. The ratio of their maximum accelerations is ::

a) $1:10^4$ b) 1:10 c) $1:10^2$ d) $1:10^3$

396. Two tuning forks have frequencies 380 and 384 hertz respectively. When they are sounded together, they produce 4 beats. After hearing the maximum sound, how long will it take to hear the minimum sound

a) 1/2 sec b) 1/4 sec c) 1/8 sec d) 1/16 sec

397. Match the Column I with Column II

Column I		Column II	
(A)		(p)	$T = 2\pi\sqrt{\frac{m(k_1+k_2)}{k_1k_2}}$
(B)		(q)	$T = 2\pi\sqrt{\frac{2m}{k}}$
(C)		(r)	$T = 2\pi\sqrt{\frac{m}{2k}}$
(D)		(s)	$T = 2\pi\sqrt{\frac{m}{k_1+k_2}}$

a) A - p, B - q, C - s, D - r b) A - s, B - r, C - p, D - q c) A - r, B - p, C - s, D - q
d) A - p, B - r, C - q, D - s

398. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

Assertion: The motion of the earth around the sun is periodic but not oscillatory.

Reason: Oscillatory motion is necessarily periodic but periodic motion is not necessarily oscillatory.

a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false

399. When a string fixed at its both ends vibrates in 1 loop, 2 loops, 3 loops and 4 loops, the frequencies are in the ratio

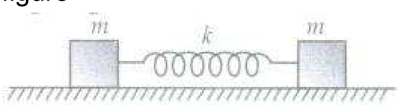
a) 1: 1 : 1 : 1 b) 1: 2 : 3 : 4 c) 4: 3 : 2 : 1 d) 1 : 4 : 9 : 16

400. A particle is executing a simple of harmonic motion amplitude a. Its potential energy is maximum when the displacement from the position of the maximum kinetic energy is:

a) 0 b) +a c) $\pm a/2$ d) $-a/2$

Ravi Maths Tuition Centre

Time : 1 Mins OSCILLATIONS' ANS WAVES 1 Marks : 1113

1. Mark the correct statement.
   a) In case of stationary waves, maximum pressure change occurs at antinodes
   b) In case of stationary waves, maximum pressure change occurs at nodes
   c)
   In case of stationary waves, amplitude of pressure change is same at all the nodes and antinodes
   d) In case of stationary waves, no pressure change takes place
2. Which of the following is not a transverse wave?
   a) X-rays b) γ-rays c) Visible light wave d) Sound wave in a gas
3. If we study the vibration of a pipe open at both ends, then which of the following statements is not true?
   a) Odd harmonics of the fundamental frequency will be generated
   b) All harmonics of the fundamental frequency will be generated
   c) Pressure change will be maximum at both ends d) Antinode will be at open end
4. A policeman blows a whistle with a frequency of 500 Hz. A car approaches him with a velocity of 15 m S^{-1}. The change in frequency as heard by the driver of the car as he passes the policeman is (Given, speed of sound in air is 300 m S^{-1})
   a) 25 Hz b) 50 Hz c) 100 Hz d) 150 Hz
5. A particle executing simple harmonic motion with time period T. The time period with which its kinetic energy oscillates is:
   a) T b) 2T c) 4T d) $\frac{T}{2}$
6. The equation of a wave traveling on a string is $y = 4\sin\left[\frac{\pi}{2}\left(8t - \frac{x}{8}\right)\right]$, where x, y are in cm and t in second. The velocity of the wave.is:
   a) 64cm Is, in - X-direction b) 32cm Is , in - X -direction c) 32cm/s, in + X-direction
   d) 64 cm/s , in + X -direction
7. Two blocks each of mass m is connected to the spring of spring constant k as shown in the figure
   

   If the blocks are displaced slightly in opposite directions and released, they will execute simple harmonic motion. The time period of oscillation is
   a) $2\pi\sqrt{\frac{m}{k}}$ b) $2\pi\sqrt{\frac{m}{2k}}$ c) $2\pi\sqrt{\frac{m}{4k}}$ d) $2\pi\sqrt{\frac{2m}{k}}$
8. Ten tuning forks are arranged in increasing order of their frequencies in such a way that any two nearest tuning forks produce 4 beats per second. The highest frequency is twice that of the lowest. Possible highest and lowest frequencies are:
   a) 80 and 40 b) 100 and 50 c) 44 and 22 d) 72 and 36
9. Which of the following wave functions does not represent a travelling wave?

a) y = tan $(x - vt)^2$ b) y = log(x + vt) c) $y=\frac{1}{x+vt}$ d) All of these

10. Two sources of sound placed close to each other, are emitting progressive waves given by $y_1 = 4\sin 600\pi t$ and $y_2 = 5\sin 608\pi t$. An observer located near these two sources of sound will hear:
a) 8 beats per second with intensity ratio 81: 1 between waxing and waning.
b) 4 beats per second with intensity ratio 81: 1 between waxing and waning.
c) 4 beats per second with intensity ratio 25: 16 between waxing and waning.
d) 8 beats per second with intensity ratio 25: 16 between waxing and waning.

11. Which of the following relationships between the acceleration a and the displacement x of a particle executing simple harmonic motion?
a) a= $2X^2$ b) a = - $2X^2$ c) a=2x d) a=-2x

12. A block of mass m is hanging vertically by spring of spring constant k. If the mass is made to oscillate vertically, its total energy is
a) maximum at the extreme position b) maximum at the mean position
c) minimum at the mean position d) same at all positions

13. The equation of a wave on a string of linear mass density 0.04 kg m^{-1} is given by: y = 0.02 (m) $\sin\left[2\pi\left(\frac{t}{0.04(s)} - \frac{x}{0.50(m)}\right)\right]$ The tension in the string is:
a) 4.0 N b) 12.5 N c) 0.5 N d) 6.25 N

14. The equation of the stationary wave is: $y = 2A\sin\left(\frac{2\pi ct}{\lambda}\right)\cos\left(\frac{2\pi x}{\lambda}\right)$. Which of the following statements is wrong?
a) The unit of ct is same as that of λ b) The unit of x is same as that of λ
c) The unit of $2\pi c/\lambda$ is same as that of $2\pi x/\lambda t$ d) The unit of c/λ is same as that of x/λ

15. Velocity of sound is measured in hydrogen and oxygen gases at a given temperature. The ratio of the two velocities will be:
a) 1:4 b) 4:1 c) 1:1 d) 32:1

16. When pressure increased by 1 atmosphere and temperature increases by 1^0C, the velocity of sound
a) decreases by 0.61 ms^{-1} b) increases by 61 ms^{-1} c) decreases by 61 m s^{-1}
d) increases by 0.61 m s^{-1}

17. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: The amplitude of oscillation can never be infinite.
Reason : The energy of oscillator is continuously dissipated
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

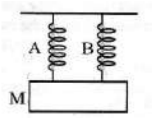
18. A transverse wave propagating along x-axis is represented by $y(x,t) = 8.0\sin\left(0.5\pi x - 4\pi t - \frac{\pi}{4}\right)$ where x is in metres and t in seconds. The speed of the wave is _____________ .
a) $0.5\mathrm{p m/s}$ b) $\frac{\pi}{4}$ m/s c) 8 m/s d) $4\mathrm{p m/s}$

19. Consider ten identical sources of sound all giving the same frequency but having phase angles which are random. If the average intensity of each source is I_0, the average of resultant intensity I due to all these ten sources will be:
a) I=100 I_0 b) I=10 I_0 c) I= I_0 d) $I = \sqrt{10} I_0$

20. From a wave equation $y = 0.5\sin\frac{2\pi}{3.2}(64t - x)$, the frequency of the wave is ______________ .
a) 5 Hz b) 15 Hz c) 20 Hz d) 25 Hz

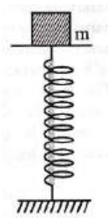
21. A source of sound gives 5 beats per second when sounded with another source of frequency 100 per second. The second harmonic of the source, together with a source of frequency 205 per second, gives 5 beats per second. What is the frequency of the source?
a) 95 sec^{-1} b) 100 sec^{-1} c) 105 sec^{-1} d) 205 sec^{-1}

22. A body of mass M, executes vertical SHM with periods t_1, and t_2, when separately attached to spring A and spring B respectively. The period of SHM, when the body executes SHM. as shown in the figure is t_0. Then,



a) $t_0^{-1} = t_1^{-1} + t_2^{-1}$ b) $t_0 = t_1 + t_2$ c) $t_0^2 = t_1^2 + t_2^2$ d) $t_0^{-2} = t_1^{-2} + t_2^{-2}$

23. A mass of 2.0 kg is put on a flat pan attached to a vertical spring fixed on the ground as shown in the figure. The mass of the spring and the pan is negligible. When pressed slightly and released the mass executes a simple harmonic motion. The spring constant is 200 N/m. What should be the minimum amplitude of the motion so that the mass gets detached from the pan (take g = 10 m/s^2)?



a) 10.0 m b) Any value less than 12.0 cm c) 4.0 cm d) 8.0 sm

24. Four independent waves are represented by the following equations:
$X_1 = a_1\sin\omega t...(1);\quad X_2 = a_1\sin\ 2\omega t...(2);\quad X_3 = a_1\sin\omega_1 t...(3)\quad and\quad X_4 = a_1\sin\ (\omega t + \delta)...(4)$
Interference is possible between waves represented by equations:
a) 3 and 4 b) 1 and 2 c) 2 and 3 d) 1 and 4

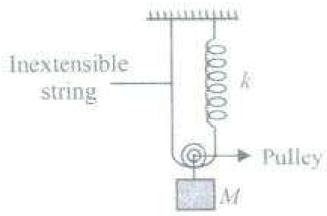
25. The piston in the cylinder head of a locomotive has a stroke of 6 m. If the piston executing simple harmonic motion with an angular frequency of 200 rad min^{-1}, its maximum speed is:
a) 5 m s^{-1} b) 10 m s^{-l} c) 15 m s^{-1} d) 20 m s^{-1}

26. A particle executing SHM according to the equation $x = 5\cos\left(2\pi t + \frac{\pi}{4}\right)$ in units. The displacement and acceleration of the particle at t = 1.5 s is
a) -3.0 m, 100 m s^{-2} b) +2.54 m, 200 m s^{-2} c) -3.54 m, 140 m s^{-2} d) +3.55 m, 120 ms^{-2}

27. The superposition takes place between two waves of frequency f and amplitude a. The total intensity is directly proportional to :
a) a b) 2a c) $2a^2$ d) $4a^2$

28. The intensity of a plane progressive wave of frequency 1000 Hz is 10^{-10} watt per metre ^{2}. Given that the speed of sound is 330 m/s and density of air is 1.293kg/m^3, then the maximum change in pressure (in N/ m^2) is:
a) 3×10^{-4} b) 3×10^{-5} c) 3×10^{-3} d) 3×10^{-2}

29. The time period of mass M when displaced from its equilibrium position and then released for the system as shown in figure is



a) $2\pi\sqrt{\frac{M}{k}}$ b) $2\pi\sqrt{\frac{M}{2k}}$ c) $2\pi\sqrt{\frac{M}{4l}}$ d) $2\pi\sqrt{\frac{2M}{k}}$

30. A block of mass m is attached to a spring of spring constant k is free to oscillate with angular velocity ω in a horizontal plane without friction or clamping. It is pulled to a distance X_o and pushed towards the centre with a velocity v_0 at time t = O.The amplitude of oscillations in terms of ω , X_o and v_0 is:

a) $\sqrt{\frac{v_0^2}{\omega^2} - x_0^2}$ b) $\sqrt{\omega^2 v_0^2 + x_0^2}$ c) $\sqrt{\frac{x_0^2}{\omega^2} - v_0^2}$ d) $\sqrt{\frac{v_0^2}{\omega^2} - x_0^2}$

31. Two particles are oscillating along two close parallel straight lines side by side, with the same frequency and amplitudes. They pass each other, moving in opposite directions when their displacement is half of the amplitude. The mean positions of the two particles lie on a straight line perpendicular to the paths of the two particles. The phase difference is:
a) 0 b) 2π/3 c) P d) P/6

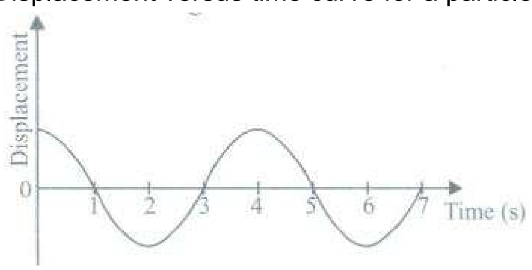
32. A wire is stretched between two rigid supports vibrates in its fundamental mode with a frequency of 50 Hz. The mass of the wire is 30 g and its linear density is 4 x 10-2 kg m S-I. The speed of the transverse wave at the string is
a) $25ms^{-1}$ b) $50ms^{-1}$ c) $75ms^{-1}$ d) $100ms^{-1}$

33. The displacement of a particle is given by x = 3 sin (5πt)+ 4 cos (5πt) The amplitude of particle is :
a) 3 b) 4 c) 5 d) 7

34. A body of mass m is situated in a potential field $U(x) = U_0(1 - cos\alpha x)$ where U_o and α are constants. The time period of small oscillations is

a) $2\pi\sqrt{\frac{m}{U_0\alpha}}$ b) $2\pi\sqrt{\frac{m}{U_0\alpha^2}}$ c) $2\pi\sqrt{\frac{m}{2U_0\alpha}}$ d) $2\pi\sqrt{\frac{2m}{U_0\alpha^2}}$

35. Displacement versus time curve for a particle SHM is as shown in the figure.



Which of the following statements is correct?
a) Phase of the oscillator is same at t = 0 s and t = 2 s.
b) Phase of the oscillator is same at t = 2 s and t = 5 s.
c) Phase of the oscillator is same at t = 1 s and t = 7 s
d) Phase of the oscillator is same at t = 1 s and t = 5 s.

36. The equation of motion of a particle is $x = a\cos\left(\alpha t^2\right)$. The motion is:

a) periodic but not oscillatory. b) periodic and oscillatory. c) oscillatory but not periodic
d) neither periodic nor oscillatory

37. The path difference between the two waves:
$y_1 = a_1 \sin(\omega t - kx)$ and $y_2 = a_2 \cos(\omega t - kx + \phi)$, *is*:
a) $(\lambda/2\pi)\phi$ b) $\lambda\left(\frac{\phi + (\pi/2)}{2\pi}\right)$ c) $\frac{2\pi}{\lambda}\left(\phi - \frac{\pi}{2}\right)$ d) $\left(\frac{2\pi}{\lambda}\right)\phi$

38. The equation of a travelling wave is, $y = 60\cos(1800t - 6x)$. Where y is in microns, t in seconds and x in metres. The ratio of maximum particle velocity to velocity of wave propagation is:
a) 3.6 b) 3.6x 10^{-6} c) 3.6x 10^{-11} d) 3.6x 10^{-4}

39. A person feels 2.5% difference of frequency of a motor-car horn. If the motor-car is moving to the person and the velocity of sound is 320 m/see, then the velocity of car will be :
a) 8 m/s (approx.) b) 800 m/s c) 7 m/s d) 6 m/s (approx)

40. Two pipes are each 50 cm in length. One of them is closed at one end while the other is open at both ends. The speed of sound in air is 340 m S^{-1}. The frequency at which both the pipes can resonate is
a) 680 Hz b) 510 Hz c) 85 Hz d) none of these

41. Assertion: On reflection from a rigid boundary there takes place a complete reversal of phase.
Reason: On reflection from a denser medium, both the particle velocity and wave velocity are reversed in sign.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

42. A stretched wire emits a fundamental note of 256 Hz. Keeping the stretching force constant and reducing the length of wire by 10 cm, the frequency becomes 320 Hz, the original length of the wire is:
a) 100 cm b) 50 cm c) 400 cm d) 200 cm

43. Mechanical waves on the surface of a liquid are:
a) transverse b) longitudinal c) torsional d) both transverse and longitudinal (or ripples)

44. A particle executing SHM. The phase difference between velocity and displacement is:
a) 0 b) $\frac{\pi}{2}$ c) π d) 2π

45. When two waves of almost equal frequencies V_1 and v_2 reach at a point simultaneously, the time interval between successive maxima is
a) v_1+v_2 b) v_1-v_2 c) $\frac{1}{v_1+v_2}$ d) $\frac{1}{v_1-v_2}$

46. A disc of radius R = 10 em oscillates as a physical pendulum about an axis perpendicular to the plane of the disc at a distance r from Its centre .If $r = \frac{R}{4}$ the approximate period of oscillation is (Takeg= 10 m s^{-2})
a) 0.84s b) 0.94s c) 1.26s d) 1.42s

47. The equation of a wave is represented by:
$y = 10^{-4}\sin\left[100t - \frac{x}{10}\right]$. The velocity of the wave will be ______________ .
a) 100 m/s b) 250 m/s c) 750 m/s d) 1000 m/s

48. A glass tube of 1.0 m length is filled with water. The water can be drained out slowly at the bottom of the tube. If a vibrating tuning fork of frequency 500 Hz is brought at the upper end of the tube and the velocity of sound is 330 m S-I, then the total number of resonances obtained will be
a) 4 b) 3 c) 2 d) 1

49. Light can travel in vacuum but not sound, because:
a) speed of sound is very much slower than light
b) light waves are electromagnetic in nature c) sound waves are electromagnetic in nature
d) light waves are not electromagnetic in nature

50. Sound waves of wavelength λ travelling in a medium with a speed of vms' enter 111 to another medium where its speed is 21' ms^{-1}. Wavelength of sound waves in the second medium is
a) λ b) $\frac{\lambda}{2}$ c) 2λ d) 4λ

51. The speed of transverse wave on a stretched string is
a) directly proportional to the tension in the string
b) directly proportional to the square root of the tension c) inversely proportional to tension
d) inversely proportional to square root of tension

52. An earthquake generates both transverse (5) and longitudinal (P) sound waves in the earth. The speed of 5 waves is about 4 km S^{-1} and that of P waves is about 8 km S^{-1}. A seismograph records P and 5 waves from an earthquake. The first P wave arrives 4 min before the first 5 wave. The epic entre of the earthquake is located at a distance of about
a) 192 km b) 384 m c) 1920 km d) 384 km

53. If the amplitude of sound is doubled and the frequency reduced to one-fourth, the intensity of sound at the same point will:
a) Increase by a factor of 2 b) Decrease by a factor of 2 c) Decrease by a factor of 4
d) Remains unchanged

54. The second overtone of an open organ pipe has the same frequency as the first overtone of a closed pipe L metre long. The length of the open pipe will be:
a) L b) 2L c) L/2 d) 4L

55. Two organ pipes give 4 beats when sounded together at 27^{0}C. Calculate the number of beats at 127^{0}C:
a) 4.6 beats/sec b) 3.9 beats/sec c) 4 beats/sec d) none of these

56. In case of force oscillations of a body
a) driving force is constant throughout. b) driving force is to be applied only momentarily
c) driving force has to be periodic and continuous d) driving force is not required.

57. A block of mass 200 g executing SHM under the influence of a spring of spring constant k = 90 N m^{-1} and a damping constant b = 40 g s^{-1}.The time elapsed for its amplitude to drop to half of its initial value is (Given, In (1/2) = -0.693).
a) 2.5 s b) 3.5 s c) 4.5 s d) 7.5 s

58. A string of 7m length has a mass of 0.035 kg. If tension in the string is 60.5 N, then speed of a wave on the string is ______________ .
a) 77 m/s b) 102 m/s c) 110 m/s d) 165 m/s

59. Equations of a stationary and a travelling waves are as follows:
y_1 = a sin kx cosωt and $y_2 = a\sin(\omega t - kx)$. The phase difference between two points
$x_1 = \frac{\pi}{3k}$ and $x_2 = \frac{3\pi}{2k}$ and ϕ_1 and ϕ_2 respectively for the two waves. The ratio $(\phi_1/\phi_2)$is:
a) 1 b) $\frac{5}{6}$ c) $\frac{3}{4}$ d) $\frac{6}{7}$

60. The displacement of a particle varies with time according to the relation y = a sin ωt + b cos ωt.
a) The motion is oscillatory but not SHM. b) The motion is SHM with amplitude a + b.
c) The motion is SHM with amplitude a^2+b^2 d) The motion is SHM with amplitude $\sqrt{a^2 + b^2}$

61. A student sees a jet plane flying from east to west. When the jet is seen just above his head, the sound of jet appears to reach him making angle 60° with the horizontal from east. If the velocity of sound is V, then that of the jet plane is:

a) $2v$ b) $\left(\sqrt{3}/2\right)v$ c) $\left(2/\sqrt{3}\right)v$ d) $v/2$

62. The shape of the wave at any fixed instant, say t = t_o is given by:
a) function of x only b) function of t only c) a function which represents sine wave
d) both (a) and (c)

63. The speed of a wave in a medium is 760 m/s.If 3600 waves are passing through a point in the medium in 2 min, then their wavelength is ________________ .
a) 13.8 m b) 25.3 m c) 41.5 m d) 57.2 m

64. A man stands between two parallel cliffs (not in middle). When he claps his hands, he hears two echoes one after 1 second and the other after 2 seconds. If the velocity of sound in air is 330 m s^{-1} the width of the valley is:
a) 330 m b) 495 m c) 660 m d) 990 m

65. Which of the following waves does not travel in vacuum?
a) Seismic waves b) X-rays c) Light d) Radio waves

66. Two simple harmonic motions are represented by the equations.

$$y_1 10\sin\frac{\pi}{4}(12t+1), y_2 5\left(\sin 3pt + \sqrt{3}\cos 3pt\right)$$

The ratio of their amplitudes is
a) 1: 1 b) 1: 2 c) 3: 2 d) 2: 3

67. A travelling wave is partly reflected and partly transmitted from a rigid boundary. Let a_i, a_r and a_t be the amplitudes of incident wave, reflected wave and transmitted wave and I_i, I_r and I_t be the corresponding intensities. Then, choose the correct alternative:

a) $\frac{I_i}{I_r}=\left(\frac{a_i}{a_r}\right)^2$ b) $\frac{I_i}{I_t}=\left(\frac{a_i}{a_t}\right)^2$ c) $\frac{I_r}{I_t}=\left(\frac{a_r}{a_t}\right)^2$ d) all of these

68. A blast gives a sound of intensity 0.8 W/m^2 and frequency 1kHz. If the density of air is 1.3 kg/m^3 and speed of sound in air is 330 m/s, the amplitude of the sound wave is approximately:
a) 5 x 10^{-6} m b) 9.7 x 10^{-6} m c) 15 x 10^{-6} m d) 20 x 10^{-6} m

69. The phase difference between the instantaneous velocity and acceleration of a particle executing simple harmonic motion is:
a) p b) 0707p c) zero d) 0.5p

70. When beats are produced by two progressive waves of nearly the same frequency, which one of the following is correct?
a)
The particles vibrate simple harmonically, with the frequency equal to the difference in the component frequencies
b)
The amplitude of vibrations at any point changes simple harmonically with a frequency equal to difference in the frequencies of the two waves
c) The frequency of the beats depends on the position, where the observer is
d) The frequency of the beat changes as the time progresses
e) The particle's vibration frequency and amplitude frequency are equal

71. When beats are produced by two progressive waves of the same amplitude and of nearly the same frequency, the ratio maximum loudness to the loudness of one of the waves will be n, where n is:
a) 3 b) 1 c) 4 d) 2

72. The period of oscillation of a mass M suspended from a spring of negligible mass is 7. If along with it another mass M is also suspended, the period of oscillation will now be:
a) T b) T$\sqrt{2}$ c) 2T d) $\sqrt{2}$T

73. A whistle of frequency 385 Hz rotates in a horizontal circle of radius 50 cm at an angular speed of 20 radians s^{-1}. The lowest frequency heard by a listener a long distance away at rest with respect to the centre of the circle, (given velocity of sound equal to 340 ms^{-1}), is ____________ .

a) 396 Hz b) 363 Hz c) 374 Hz d) 385 Hz

74. Two men stand a certain distance apart beside a long metal fence on a still day; one man places his ear against the fence while the other gives the fence a sharp knock with a hammer. Two sounds separated by a time interval of 0.5 second are heard by the first man. If the velocity of sound in air is 330 m s^{-1} and in the metal is 5280 m s^{-1}, how far apart are the men?

a) 352 m b) 330 m c) 165 m d) 176 m

75. Which of the following statements is true for wave motion?

a) Mechanical transverse waves can propagate through all mediums

b) Longitudinal waves can propagate through solids only.

c) Mechanical transverse waves can propagate through solids only

d) Longitudinal waves can propagate through vacuum.

76. Which of the following statements is incorrect for a stationary wave?

a)
Every particle has a fixed amplitude which is different from the amplitude of its nearest particle.

b) All the particles cross their mean position at the same time.

c) All the particles are oscillating with same amplitude.

d) There is no net transfer of energy across any plane.

77. A racing car moving towards a cliff sounds its horn. The driver observes that the sound reflected from the cliff has a pitch one octave higher than the actual sound of the horn. If v is the velocity of sound, then the velocity of the car is:

a) $\frac{v}{2}$ b) $\frac{v}{\sqrt{2}}$ c) $\frac{v}{4}$ d) $\frac{v}{3}$

78. When two progressive waves of intensity I_1 and I_2 but slightly different frequencies superpose, the resultant intensity fluctuates between:

a) $\left(\sqrt{I_1}+\sqrt{I_2}\right)^2$ and $\left(\sqrt{I_1}-\sqrt{I_2}\right)^2$ b) $\left(\sqrt{I_1}+\sqrt{I_2}\right)$ and $\left(\sqrt{I_1}-\sqrt{I_2}\right)$ c) $\left(I_1+I_2\right)$ and $\sqrt{I_1-I_2}$

d) $\frac{I_1}{I_2}$ and $\frac{I_2}{I_1}$

79. Two sources of sound placed close to each other are emitting progressive waves given by y_1 = 4 sin 600 pt and y_2 = 5 sin 608 pt. An observer located near these two sources of sound will hear:

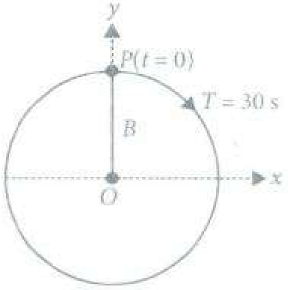
a) 4 beats per second with intensity ratio 25= 16 between waxing and waning.

b) 8 beats per second with intensity ratio 25: 16 between waxing and waning

c) 8 beats per second with intensity ratio 81: 1 between waxing and waning

d) 4 beats per second with intensity ratio 81: 1 between waxing and waning

80. Figure shows the circular motion of a particle. The radius of the circle, the period, sense of revolution and the initial position are indicated on the figure. The simple harmonic motion of the x-projection of the radius vector of the rotating particle P is



a) $x(t) = B\sin\left(\frac{2\pi}{30}t\right)$ b) $x(t) = B\cos\left(\frac{\pi}{15}t\right)$ c) $x(t) = B\sin\left(\frac{\pi}{15}t+\frac{\pi}{2}\right)$ d) $x(t) = B\cos\left(\frac{\pi}{15}t+\frac{\pi}{2}\right)$

81. The composition of two simple harmonic motions of equal periods at right angles to each other and with a phase difference of π results in the displacement of the particle along:
a) figures of eight b) straight line c) ellipse d) circle

82. When a string is divided into three segments of length l_1, l_2 and l_3 the fundamental frequencies of these three segments are v_1, v_2 and v_3 respectively. The original fundamental frequency (v) of the string is:
a) $\sqrt{v} = \sqrt{v_1} + \sqrt{v_2} + \sqrt{v_3}$ b) $v = v_1 + v_2 + v_3$ c) $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2} + \frac{1}{v_3}$ d) $\frac{1}{\sqrt{v}} = \frac{1}{\sqrt{v_1}} + \frac{1}{\sqrt{v_2}} + \frac{1}{\sqrt{v_3}}$

83. A simple pendulum has a metal bob, which is negatively charged. If it is allowed to oscillate above a positively charged metallic plate, then its time period will
a) increase b) decrease c) become zero d) remain the same

84. A body is executing SHM. When the displacement from the mean position is 4 cm and 5 cm, the corresponding velocities of the body is 10 cm/s and 8 cm/s. Then, the time period of the body is:
a) 2πsec b) $\frac{\pi}{2}$sec c) πsec d) $\frac{3\pi}{2}$sec

85. In a transverse wave, the particles of the medium
a) vibrate in a direction perpendicular to the direction of the propagation.
b) vibrate in a direction parallel to the direction of of the propagation. c) move in circle.
d) move in ellipse

86. Ultrasonic, infrasonic and audio waves travel through a medium with speed V_u ,V_i and Va respectively; then:
a) V_u ,V_i and V_a are nearly equal b) $V_u \geq V_a \geq V_i$ c) $V_u \leq V_a \leq V_i$ d) $V_a \leq V_u$ and $V_u \approx V_i$

87. A train, standing in a station yard, blows a whistle of frequency 400 Hz in still air. The wind starts blowing in the direction from the yard to the station with a speed of 10m S^{-1}. Which of the following statements is correct?
(Speed of sound in still air is 340 m S^{-1})
a) The frequency of sound as heard by an observer standing on the platform is 400 Hz.
b) The speed of sound for the observer standing on the platform is 330 m S^{-1}.
c) The frequency of sound as heard by the observer standing on the platform will increase.
d) The frequency of sound as heard by the observer standing on the platform will decrease.

88. There is a body having mass m and performing S.H.M. with amplitude a. There is a restoring force F = -kx. The total energy of body depends upon
a) k, x b) k, a c) k, a, x d) k, a, v

89. Velocity of sound in vacuum is
a) zero b) 330 m S^{-1} c) 360 m S^{-1} d) 660 m S^{-1}

90. If the maximum velocity and acceleration of a particle executing SHM are equal in magnitude, the time period will be
a) 1.57 sec b) 1.57 sec c) 6.28 sec d) 12.56 sec

91. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: Simple harmonic motion is the projection of uniform circular motion on the diameter of the circle in which the latter motion occurs.
Reason : Simple harmonic motion is a uniform motion
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false.

92. Two waves are represented by the equations
Y1 = asin(ωt + kx + 0.57) m and
Y2 = acos(ωt + kx) m,

where x is in metres and t is in seconds. The phase difference between them is

a) 1.0 radian b) 1.25 radian c) 1.57 radian d) 0.57 radian

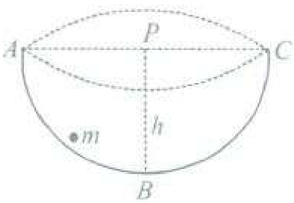
93. A particle oscillating under a force $\vec{F} = -k\vec{x} - b\vec{v}$ is a (k and b are constants)

a) simple harmonic oscillator b) linear oscillator c) damped oscillator d) forced oscillator

94. Consider a pair of identical pendulums, which oscillate with equal amplitude independently such that when one pendulum is at its extreme position making an angle of 20 to the right with the vertical, the other pendulum makes an angle of 10 to the left of the vertical. The phase difference between the pendulums is

a) $\frac{\pi}{2}$ b) $\frac{2}{3}\pi$ c) $\frac{3}{2}\pi$ d) π

95. A sphere of mass m makes SHM in a hemispherical bowl ABC and it moves from A to e and back to A via ABC, so that PB = 17. If acceleration due to gravity is g the speed of the ball when it just crosses the point B is



a) 2gh b) mgh c) $\sqrt{2gh}$ d) $\frac{gh}{2}$

96. If a simple harmonic oscillator has got a displacement of 0.02 m and acceleration equal to 2.0 m/s^2 at any time, the angular frequency of the oscillator is equal to ______________ .

a) 10 rad/s b) 0.1 rad/s c) 100 rad/s d) 1 rad/s

97. A vibrating tuning fork of frequency u is placed near the open end of a long cylindrical tube. The tube has a side opening and is also fitted with a movable reflecting piston. As the piston is moved through 8.75 cm, the intensity of sound changes from a maximum to minimum. If the speed of sound is 350 m s^{-1}, then υ is

a) 500 Hz b) 1000 Hz c) 2000 Hz d) 4000 Hz

98. A string of mass 2.5 kg is under a tension of 200 N. The length of the stretched string is 20 m. If the transverse jerk is struck at one end of the string, the disturbance will reach the other end in

a) one second b) 0.5 second c) 2 second d) data given is insufficient.

99. The transverse displacement of a string clamped at its both ends is given by y(x, t) = 2sin

$$\left(\frac{2\pi}{3}x\right)cos(100\pi t).$$

where x and yare in cm and t is in s. Which of the following statements is correct?

a)

All the points on the string between two consecutive nodes vibrate with same frequency, phase and amplitude.

b)

All the points on the string between two consecutive nodes vibrate with same frequency and phase but different amplitude,

c)
All the points on the string between two consecutive nodes vibrate with different frequency and phase but same amplitude.
d)
All the points on the string between two consecutive nodes vibrate with different frequency, phase and amplitude.

100. A particle is acted simultaneously by mutually perpendicular simple harmonic motions x = a cos ω t and y = a sin ωt. The trajectory of motion of the particle will be
a) an ellipse b) a parabola c) a circle d) a straight line.

101. Of the following gases, velocity of sound at 30° C will be least through:
a) N_2 b) O_2 c) SO_2 d) CO_2

102. A particle, with restoring force proportional to displacement and resisting force proportional to velocity is subjected to a force F sin wt. If the amplitude of the particle is maximum for $w = w_1$ and the energy of the particle is maximum for $w = w_2$, then:
a) $w_1 = w_0$ and $w_2{}^1w_0$ b) $w_1 = w_0$ and $w_2 = w_0$ c) $w_1{}^1w_0$ and $w_2 = w_0$ d) $w_1{}^10$ and $w_2{}^1w_0$

103. Which of the following is not the standard form of a sine wave?
a) $y = A\sin 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right)$ b) $y = A\sin(vt - kx)$ c) $y = A\sin\omega\left(t - \frac{x}{v}\right)$ d) $y = A\sin k(vt - x)$

104. A particle executes simple harmonic oscillation with an amplitude a. The period of oscillation is 7. The minimum time taken by the particle to travel half of the amplitude from the equilibrium position is:
a) T/8 b) T/12 c) T/2 d) T/4

105. A car is moving towards a high cliff The car driver sounds a horn of frequency f. The reflected sound heard by the driver has frequency 2f. If v be the velocity of sound, then the velocity of the car, in the same velocity units, will be:
a) v/2 b) $v/\sqrt{2}$ c) v/3 d) v/4

106. A source of sound of frequency 600 Hz is placed inside water. The speed of sound in water is 1500 m/s and in air it is 300 m/s. The frequency of sound recorded by an observer who is standing in air is:
a) 200 Hz b) 3000 Hz c) 120 Hz d) 600 Hz

107. A sound source is moving towards a stationary observer with 1/10 of the speed of sound. The ratio of apparent to real frequency is :
a) 10/9 b) 11/10 c) $(11/10)^2$ d) $(9/10)^2$

108. 41 tuning forks are arranged such that every fork gives 5 beats with the next. The last fork has a frequency that is double of the first. The frequency of the first fork is:
a) 200 b) 400 c) 205 d) 210

109. $y = a\cos(kx + \omega t)$superposes on another wave giving a stationary wave having node at x = 0.What is the equation of the other wave?
a) $a\cos(kx + \omega t)$ b) $a\cos(kx - \omega t)$ c) $-a\cos(kx + \omega t)$ d) $-a\sin(kx + \omega t)$

110. If the resultant amplitude due to superposition of two waves changes periodically with time as well as in position, then it is a case of:
a) interference b) beats c) stationary waves d) Lissajous' figures

111. The amplitude of a wave is given by: $A = \frac{c}{(a+b-c)}$. Resonance will occur when:
a) b=-c/2 b) b=-a/2 c) b=0,a=c d) none of these

112. Oxygen is 16 times heavier than hydrogen. The equal volumes of hydrogen and oxygen are mixed. The ratio of speed of sound in the mixture to that in hydrogen is:
a) $\sqrt{8}$ b) $\sqrt{\frac{1}{8}}$ c) $\sqrt{\frac{2}{17}}$ d) $\sqrt{\frac{32}{17}}$

113. A sound wave has frequency 500 Hz and velocity 360 m/sec. What is the distance between two particles having phase difference of 60^0?
a) 0.7 cm b) 12.0 cm c) 70 cm d) 120.0 cm

114. In a progressive wave along X-direction, at a particular location, the particles of the medium are executing:
a) oscillatory motion b) rectilinear motion c) rotational motion d) none of these

115. Assertion: In a sound wave, a displacement node is a pressure antinode and vice versa.
Reason: Displacement node is a point of minimum displacement.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

116. A mass m is suspended from a string of length l and force constant k. The frequency of vibration of the mass is f_1. The spring is cut in to two equal parts and the same mass is suspended from one of the parts. The new frequency of vibration of mass is f_2 Which of the following reaction between the frequencies is correct.
a) $f_1 = \sqrt{2}\, f_2$ b) $f_1 = f_2$ c) $f_1 = 2f_2$ d) $f_2 = \sqrt{2} f_1$

117. Two waves are represented by: $y_1 = 4\sin 404\pi t$ and $y_2 = 3\sin 404\pi t$. Then:
a) beat frequency is 4 Hz and the ratio of maximum to minimum intensity is 49 : 1
b) beat frequency is 2 Hz and the ratio of maximum to minimum intensity is 49 : 1
c) beat frequency is 2 Hz and the ratio of maximum to minimum intensity is 1 : 49
d) beat frequency is 4 Hz and the ratio of maximum to minimum intensity is 1 : 49

118. An echo repeats 2 syllables. If the speed of sound is 330 m s^{-1}, then the distance of the reflecting surface is:
a) 16.5 m b) 33.0 m c) 66.0 m d) 99.0 m

119. In a certain oscillatory system, the amplitude of motion is 5 m and the time period is 4 s. The time taken by the particle for passing between points which are at distances of 4 m and 2 m from the centre and on the same side of it will be
a) 0.30 s b) 0.32 s c) 0.33 s d) 0.35 s

120. Two trains move towards each other with the same speed. The speed of sound is 340 m/s. If the height of the tone of the whistle of one of them heard on the other changes 9/8 times, then the speed of each train should be:
a) 20 m/s b) 2 m/s c) 200 m/s d) 2000 m/s

121. The damping force on an oscillator is directly proportional to the velocity. The units of the constant of proportionality are:
a) $kgms^{-1}$ b) $kgms^{-2}$ c) kgs^{-1} d) kgs

122. Find the temperature at which the fundamental frequency of an organ pipe is independent of small variation in temperature in terms of the coefficient of linear expansion (ex) of the material of the tube.
a) 1/5 b) 1/3 c) 1/2 d) 1/4

123. Which of the following statement is wrong?
a) Changes in air temperature have no effect on the speed of sound
b) Changes in air temperature have effect on the speed of sound
c) The speed of sound in water is lower than in air d) Both 'a' and 'c'

124. A simple pendulum of length L and having a bob of mass 111 is suspended in a car. The car is moving on.1 circular track of radius R with a uniform speed v. If the pendulum makes small oscillations in a radial direction about its equilibnum position, its time pen d of oscillation is

a) $T = 2\pi\sqrt{\frac{L}{g}-c}$ b) $T = 2\pi\sqrt{\frac{L}{\sqrt{g^2+\frac{v^4}{R^2}}}}$ c) $T = 2\pi\sqrt{\frac{L}{\sqrt{g^2\frac{v^2}{R}}}}$ d) $T = 2\pi\sqrt{\frac{L}{g^2-\frac{v^4}{R^2}}}$

125. The Halley's comet appears after every
a) 72 years b) 74 years c) 76 years d) 78 years

126. A siren can be made from a rotating flat disc, which has regularly spaced holes punched through it along a circle concentric with the axis of rotation. An air nozzle is directed against the disc. Each time a hole passes the nozzle, a puff of air is released to generate a wave pulse. Sound of what frequency will be produced by disc containing 72 holes and rotating at 1800 rev/min?
a) 72 x 1800Hz b) 72 x 1800 x 60Hz c) 2160 Hz d) 72 Hz

127. The propagation constant of a wave is also called its
a) wavelength b) frequency c) wave number d) angular wave number

128. In an SHM, x is the displacement and a is the acceleration at time t. The plot of a against x for one complete oscillation will be
a) a straight line b) a circle c) an ellipse d) a sinusoidal curve

129. The velocity of sound is generally greater in solids than in gases because
a) the density of solids is high, but the elasticity is low
b) the density of solids is high., but the elasticity of solids is very high
c) both the density and elasticity of solids are low
d) the density of solids is low but the elasticity is high

130. The time period of a simple pendulum on the surface of the earth is 4 s. Its time period on the surface of the moon is
a) 4 s b) 8 s c) 10 s d) 12 s

131. The time period of a mass suspended from a spring is T. If the spring is cut into four equal parts and the same mass is suspended from one of the parts, then the new time period will be:
a) 2T b) $\frac{T}{4}$ c) 2 d) $\frac{T}{2}$

132. I here are 26 tuning forks arranged in the decreasing order of their frequencies. Each tuning fork gives 3 beats with the next. The first one is octave of the last. What IS the frequency of 18th tuning fork?
a) 100 Hz b) 99 Hz c) 96 Hz d) 103 Hz

133. The displacement of a particle is represented by the equation $y = 3cos\left(\frac{\pi}{4} - 2\omega t\right)$.The motion of the particle is
a) simple harmonic with period $\frac{2\pi}{\omega}$ b) simple harmonic with period $\frac{\pi}{\omega}$
c) periodic but not simple harmonic d) non-periodic.

134. The kinetic energy of a particle executing SHM is 16 J when it is in its mean position. If the amplitude of oscillation is 25 cm and mass of the particle is 5.12 kg, the time period of its oscillation is:
a) (π/5)sec b) 2πsec c) 20πsec d) 5πsec

135. In a stationary wave:
a) energy is uniformly distributed
b) energy is maximum at nodes and minimum at antinodes
c) energy is minimum at nodes and maximum at antinodes
d) alternating maxima and minima of energy are produced at nodes and antinodes

136. Which of the following expressions does not represent SHM?
a) A cos ωt b) A sin ωt c) sin ωt + B cosωt d) A sin ^{2} ωt

137. A number of tuning forks are arranged in the order of increasing frequency and any two successive tuning forks produce 4 beats per second, when sounded together. If the last tuning fork has a frequency octave higher than that of the first tuning fork and the frequency of the first tuning fork is 256 Hz, then the number of tuning forks is:
a) 63 b) 64 c) 65 d) 66

138. A mass m is vertically suspended from a spring of negligible mass, the system oscillates with a frequency n. What will be the frequency of the system, if amass 4m is suspended from the same spring?
a) $\frac{n}{4}$ b) 4n c) $\frac{n}{2}$ d) 2n

139. When a longitudinal wave propagates through a medium, the particles of the medium execute simple harmonic oscillations about their mean positions. These oscillations of a particle are characterised by an invariant:
a) kinetic energy b) potential energy c) sum of kinetic energy and potential energy
d) difference between kinetic energy and potential energy

140. Which of the following statements is correct for stationary waves?
a) Nodes and antinodes are formed in case of stationary transverse wave only.
b)
In case of longitudinal stationary wave, compressions and rarefactions are obtained in place of nodes and antinodes respectively
c)
Suppose two plane waves, one longitudinal and the other transverse having same frequency and amplitude are travelling in a medium in opposite directions with the same speed, by superposition of these waves, stationary waves cannot be obtained.
d) None of the above.

141. At a fixed instant, say t = t_0, the argument of the sine function in y(x, t) is:
a) having constant + kx b) having constant - kx c) $kx - \omega t_0 + \phi$ d) both (a) and (c)

142. Speed of sound waves in a fluid is
a) directly proportional to the square root of bulk modulus of the medium.
b) inversely proportional to the bulk modulus of the medium.
c) directly proportional to the density of the medium.
d) inversely proportional to the density of the medium.

143. Two simple harmonic motions with the same frequency act on a particle at right angles i.e., along X-axis and Y-axis. If the two amplitudes are equal and the phase difference is p/2, the resultant motion will be _______________ .
a) a circle b) an ellipse with the major axis along Y-axis
c) an ellipse with the major axis along X-axis d) a straight line inclined at 45^o to the X-axis

144. If the string is very large compared to the size of the pulse, then which of the given statements is correct?
a) The pulse will reach the other end and gets reflected from the wall
b) The pulse will damp out before it reaches the other end
c) The pulse will get reflected from the wall to the other end and then damp out gradually
d) Both (a) and (b)

145. The displacement of a particle executing simple harmonic motion is given by

$x = 3\sin\left(2\pi t + \frac{\pi}{4}\right)$ where x is in metres and t is in seconds. The amplitude and maximum speed of the particle is

a) 3m,2π ms^{-1} b) 3m,4π ms^{-1} c) 3 m, 6πm s^{-1} d) 3 m, $8\pi ms^{-1}$

146. A wave travelling in the +ve x-direction having displacement along y-direction as 1m, wavelength 2π m and frequency of 1/π Hz is represented by :

a) y=sin(2πx+2πt) b) y=sin(x-2t) c) y=sin(2πx-2πt) d) y=sin(10πx-20πt)

147. Two waves are said to be coherent, if they have _____________ .

a) Same phase but different amplitude b) Same frequency but different amplitude

c) Same frequency, phase and amplitude d) Different frequency, phase and amplitude

148. Two solid bars are having Young's modulus Y_1 and Y_2 in the ratio (Y_1 / Y_2) = 4. If the bars are made up of the material with same density, then the ratio of the speed of longitudinal waves in the solid bars, i.e., (v_1/v_2) is:

a) 2 b) 1 c) 3 d) 4

149. Two points on a travelling wave having frequency 500 Hz and velocity 300 m/s are 60° out of phase, then the minimum distance between the two points is:

a) 0.2 b) 0.1 c) 0.5 d) 0.4

150. A tuning fork of frequency 440 Hz resonates with a tube closed at one end of length 1.8 cm and diameter 5 cm in fundamental mode. The velocity of sound in air is:

a) 336 m S^{-1} b) 343 m S^{-1} c) 300 m S^{-1} d) 350 m S^{-1}

151. The speed of sound in air at a given temperature is 350 m/s. An engine blows whistle at a frequency of 1200 cps. It is approaching the observer with velocity 50 m/s. The apparent frequency in eps heard by the observer will be :

a) 600 b) 1050 c) 1400 d) 2400

152. Two waves are given by: $y_1 = \cos(4t - 2x)$ and $y_2 = \sin\left(4t - 2x + \frac{\pi}{4}\right)$. The phase difference between the two waves is:

a) $\frac{\pi}{4}$ b) $-\frac{\pi}{4}$ c) $\frac{3\pi}{4}$ d) $\frac{\pi}{2}$ e) $\frac{3\pi}{2}$

153. The equation $y = a\sin 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right)$ of a simple harmonic wave gives us:

a) the displacement of all particles of the medium at a particular instant of time only

b) the displacement of a single particle at any time

c)
the displacement of all the particles of the medium at a particular instant of time as well as the displacement of a single particle at any time

d) the behaviour of the medium as a whole

154. A string of mass 3 kg is under tension of 400 N. The length of the stretched string is 25 cm. If the transverse jerk is stuck at one end of the string how long does the disturbance take to reach the other end?

a) 0.043 s b) 0.055 s c) 0.034 s d) 0.065 s

155. A progressive wave is represented by
y = 5 sin(10πt - 2πx) where x and y are in m and t is in s. The maximum particle velocity is

a) 100π m S^{-1} b) 200π m S^{-1} c) 400π m S^{-1} d) 500π m S^{-1}

156. When stationary waves are produced in a medium, which physical characteristics change at antinodes?

a) Density only b) Pressure only c) Density and pressure

d) Neither density nor pressure

157. An astronaut cannot hear his companion at the surface of the moon because:

a) produced frequencies are above the audio frequencies

b) there is no medium for sound propagation

c) temperature is too low during night and high during day

d) there are too many craters on the surface of the moon

158. A stone is dropped into a pond from the top of the tower of height h. If v is the speed of sound in air, then the sound of splash will be heard at the top of the tower after a time:

a) $\sqrt{\frac{2h}{g}} + \frac{h}{v}$ b) $\sqrt{\frac{2h}{g}} - \frac{h}{v}$ c) $\sqrt{\frac{2h}{g}}$ d) $\sqrt{\frac{2h}{g}} + \frac{2h}{v}$

159. Assertion: When a source of sound passes us, whether it be a car horn or a train whistle, the pitch we hear goes from high to low.

Reason: According to Doppler's effect, there is apparent change in the frequency of sound observed due to relative motion between the observer and the source of sound.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

160. Three travelling waves in same direction are superimposed. The equations of wave are y_1=A_o

$y_1 = A_o sin(kx - \omega t)$,$y_2 = 3\sqrt{2}A_0 sin(kx - \omega t + \phi)$ and $y_3 = 4A_o cos(kx - \omega t)$. If $0 \le \phi \le \pi/2$

and the phase difference between resultant wave and first wave is $\pi/4$,then ϕ is

a) $\frac{\pi}{6}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{12}$ d) none of these

161. It is found that an increase in pressure of 100 KP a causes a certain volume of water to decrease by 5 x 10^{-3} percent of its original volume. Then, the speed of sound in water is about:

a) 330 m/s b) 1400 m/s c) 2400 m/s d) 660 m/s

162. Transverse elastic waves can propagate:

a) both in a gas and a metal b) in a gas but not in a metal c) in a metal but not in a gas

d) neither in a gas nor in a metal

163. The number of possible natural oscillations of air column in a pipe closed at one end of length 85 cm whose frequencies lie below 1250 Hz are: (velocity of sound = 340m/s)

a) 4 b) 5 c) 7 d) 6

164. The following equations represent progressive transverse waves:

$z_1 = A\cos(\omega t - kx)$; $z_2 = A\cos(\omega t + kx)$; $z_3 = A\cos(\omega t - ky)$ and $z_4 = A\cos(2\omega t - 2ky)$. A stationary wave will be formed by superposing:

a) z_1 and z_2 b) z_1 and z_4 c) z_2 and z_3 d) z_3 and z_4

165. Equation of progressive wave is given by

$$y = 4\sin\left[\pi\left(\frac{t}{5} - \frac{x}{9}\right) + \frac{x}{6}\right]$$

Then, which of the following is correct?

a) $v = 5$ cm b) $\lambda = 18$ cm c) $a = 0.04$ cm d) $f = 50$ Hz

166. A transverse harmonic wave on a string is described by y(x, t) = 3sin $\left(36t + 0.018x + \frac{\pi}{4}\right)$

where x and yare in cm and t is in s. Which of the following statements is incorrect?

a) The wave is travelling in negative x-direction b) The amplitude of the wave is 3 cm.

c) The speed of the wave is 20 m S^{-1}. d) The frequency of the wave is $\frac{9}{\pi}$Hz.

167. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

Assertion: In forced oscillations, the steady state motion of the particle is simple harmonic.

Reason : The frequency of particle after the free oscillations die out, is the natural frequency of the particle.

a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false d) If both assertion and reason are false

168. A tuning fork of frequency 512 Hz makes 4 beats per second with the vibrating string of a piano. The beat frequency decreases to 2 beats per sec when the tension in the piano string increased. The frequency of the piano string before increasing the tension was ____________ .

a) 510 Hz b) 514 Hz c) 516 Hz d) 508 Hz

169. In stationary waves, antinodes are the points where

a) Minimum displacement and minimum pressure change occur

b) Minimum displacement and maximum pressure change occur

c) Maximum displacement and maximum pressure change occur

d) Maximum displacement and minimum pressure change occur

170. At the nodes of a longitudinal stationary wave:

a) the amplitude of oscillation is maximum b) the density variation is zero

c) the pressure variation is maximum d) the velocity amplitude is maximum

171. The following equations represent transverse waves:

$z_1 = A\cos(kx - \omega t); z_1 = A\cos(kx + \omega t)$ and $z_3 = A\cos(kx - \omega t)$, then the combination of waves which can produce stationary wave is:

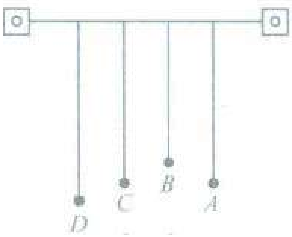
a) z_1 and z_2 b) z_1 and z_3 c) z_2 and z_2 d) z_1, z_1 and z_3

172. The displacement of a particle executing periodic motion is given by:

$y = 4\cos^2(t/2)\sin(1000\quad t)$. This expression may be considered to be a result of superposition of:

a) two waves b) three waves c) four waves d) five waves

173. Four pendulums A, B, C and D are suspended from the same elastic support as shown in figure. A and C are of the same length, while B is smaller than A and D is D C larger than A. If A is given a transverse displacement,



a) D will vibrate with maximum amplitude b) C will vibrate with maximum amplitude

c) B will vibrate with maximum amplitude d) All the four will oscillate with equal amplitude

174. The relation between acceleration and displacement of four particles are given below Which one of the particles is executing simple harmonic motion?

a) $a_x = +2x$ b) $a_x = +2X^2$ c) $a_x = -2X^2$ d) $a_x = -2x$

175. Which one of the following is a simple harmonic motion?

a) Ball bouncing between two rigid vertical walls

b) Particle moving in a circle with uniform speed

c) Wave moving through a string fixed at both ends d) Earth spinning about its own axis.

176. Compressional wave pulses are sent to the bottom of sea from a ship and the echo is heard after 2 s. If bulk modulus of elasticity of water is 2 x 10^9 N/m^2 and mean temperature is 4°C, the depth of the sea will be:
a) 1014 m b) 1414 m c) 2828 m d) none of these

177. Two point isotropic sound sources A and B emitting waves of equal frequency with equal power are located in a medium, some distance apart. A long line AB:
a) a stationary wave is established between A and B
b)
though stationary wave is not formed but nodes and antinodes are formed between A and B
c) superposition of two waves is impossible between A and B d) none of the above

178. In a simple harmonic motion, when the displacement is one-half the amplitude, what fraction of the total energy is kinetic?
a) Zero b) $\frac{1}{4}$ c) $\frac{1}{2}$ d) $\frac{3}{4}$

179. A train standing at the outer signal of a railway station blows a whistle of frequency 400 Hz in still air. The train begins to move with a speed of 30 m S^{-1} towards the platform. The frequency of the sound heard by an observer standing on the platform is (Speed of sound in air = 330 m S^{-1})
a) 420 Hz b) 430 Hz c) 440 Hz d) 450 Hz

180. In a plane progressive wave given by: y = 25cos(2πt − πx), the amplitude and frequency are respectively:
a) 25, 100 b) 25, 1 c) 25, 2 d) 50π, 2

181. An auditorium has volume $10^5 m^3$ and surface area of absorption 2 x 10^4 m^2 . Its average absorption coefficient is 0.2. The reverberation time of the auditorium (in seconds) is:
a) 6.5 b) 5.5 c) 4.25 d) 3.25

182. The phenomenon of echo is an example of:
a) reflection b) refraction c) beats d) resonance

183. A block of mass M is attached to the lower end of a vertical spring. The spring is hung from a ceiling and has force constant value k. The mass is released from rest with the spring initially unstretched. The maximum extension produced in the length of the spring will be:
a) 2 Mg/k b) 4 Mg/k c) Mg/2k d) Mg/k

184. Beats are produced with the help of two sound waves on amplitude 3 and 5 units. The ratio of maximum to minimum intensity in the beats is :
a) 2:1 b) 5:3 c) 4:1 d) 16:1

185. A speeding motorcyclist sees traffic jam ahead of him. He slows down to 36 km/hour. He finds that traffic has eased and a car moving ahead of him at 18 km/hour is honking at a frequency of 1392 Hz. If the speed of sound is 343 m/s, the frequency of the honk as heard by him will be:
a) 1332 Hz b) 1372 Hz c) 1412 Hz d) 1454 Hz

186. The net displacement of the waves is given by the principle of superposition as

$y(x,t) = A(\phi)\sin\left(kx - \omega t + \frac{\phi}{2}\right)$ which of the following statements is correct for the resultant wave?

(I) The resultant wave y(x, t)is a harmonic wave travelling in the positive direction of x-axis as the constituent waves.
(II) The resultant wave has different frequency and wavelength than the constituent waves.
(III) Initial phase angle is $\frac{\phi}{2}$. Choose the correct option from those given below:
a) I and III b) only II c) II and III d) I ,II and III

187. A sings with a frequency (n) and B sings with a frequency (1/8) that of A. If the energy remains the same and the amplitude of A is a then amplitude of B is:
a) a b) 2a c) 8a d) 16a

188. The length of the wire between two ends of a sonometer is 100 cm. What should be the positions of two bridges below the wire so that the three segments of the wire have their fundamental frequencies in the ratio of 1: 3: 5?
a) $\frac{1500}{23}$ cm, $\frac{2000}{23}$ cm b) $\frac{1500}{23}$ cm, $\frac{500}{23}$ cm c) $\frac{1500}{23}$ cm, $\frac{300}{23}$ cm d) $\frac{300}{23}$ cm, $\frac{1500}{23}$ cm

189. Two wires are in unison. If the tension in one of the wires is increased by 2%, 5 beats are produced per second. The initial frequency of each wire is:
a) 200 Hz b) 400 Hz c) 500 Hz d) 1000 Hz

190. A tuning fork gives 4 beats with 50 cm length of a sonometer wire. If the length of the wire is shortened by 1 cm , the number of beats is still the same. The frequency of the fork is:
a) 404 Hz b) 400 Hz c) 396 Hz d) 384 Hz

191. A pipe 30 cm long, is open at both ends. Which harmonic mode of the pipe resonates a 1.1 kHz source? (Speed of sound in air = 330 m S^{-1})
a) First b) Second c) Third d) Fourth

192. Simple harmonic motion is the projection of uniform circular motion on
a) x-axis b) y-axis c) reference circle d) any diameter of reference circle

193. A simple pendulum executing SHM with a period of 6 s between two extreme positions Band e about a point O. If the length of the arc Be is 10 cm, how long will the pendulum take the move from position eto a position D towards 0 exactly midway between e and O?
a) 0.5s b) 1s c) 1.5s d) 3s

194. A wave has SHM (Simple Harmonic Motion) whose period is 4s while another wave which also possesses SHM has its period 3s. If both are combined, then the resultant wave will have the period equal to ______________ .
a) 4 s b) 5 s c) 12 s d) 3 s

195. A source of sound of frequency 90 vibration/sec is approaching a stationary observer with a speed equal to 1/10 the speed of sound. What will be the frequency heard by the observer
a) 80 vibration/sec b) 90 vibration/sec c) 100 vibration/sec d) 120 vibration/sec

196. Water waves produced by a motor boat sailing in water are
a) neither longitudinal nor transverse b) both longitudinal and transverse
c) only longitudinal d) only transverse.

197. Motion of an oscillating liquid in a U tube is:
a) periodic but not simple harmonic. b) non-periodic.
c) simple harmonic and time period is independent of the density of the liquid.
d) simple harmonic and time period is directly proportional to the density of the liquid.

198. Two waves of wavelength 2 m and 2.02 m respectively, moving with the same velocity, superpose to produce 2 beats per second. The velocity of the waves is:
a) 400.0 m/s b) 404.0 m/s c) 402.0 m/s d) 406.0 m/s

199. Two tuning forks of frequencies 256 and 258 vibrations/sec are sounded together. Then, the time interval between two consecutive maxima heard by an observer is:
a) 2 sec b) 0.5 sec c) 250 sec d) 252 sec

200. Two particles execute SHM of same amplitude and same time period, about same mean position but with a phase difference between them. At an instant $x = +\frac{A}{3}$.The phase difference between them is

a) $2\cos^{-1}\left(\frac{1}{5}\right)$ b) $2\sin^{-1}\left(\frac{1}{5}\right)$ c) $2\cos^{-1}\left(\frac{1}{3}\right)$ d) $2\sin^{-1}\left(\frac{1}{5}\right)$

201. If V_m is the velocity of sound in moist air, V_d is the velocity of sound in dry air, under identical conditions of pressure and temperature:

a) $V_m > V_d$ b) V_m c) $V_m = V_d$ d) $V_m V_d = 1$

202. Which of the following statement is correct?

a)
A stationary wave appears to be stationary but transfer of energy from one particle to another continues to take place

b)
If a transverse stationary wave of frequency n is formed in a medium, then frequency for variation of shear strain at a point will be equal to 2n

c)
Magnitude of strain is maximum at anti node because medium particles at antinodes have maximum possible

d) None of the above

203. A particle of mass m oscillates along x-axis according to equation $= a\sin\omega t$. The nature of the graph between momentum and displacement of the particle is:

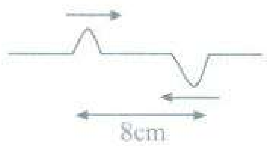
a) Straight line passing through origin b) Circle c) Hyperbola d) Ellipse

204. For the wave $y = 20\sin 2\pi\left(\frac{x}{4} + \frac{t}{2}\right)$, the correct one is:(when xis in metre and t in sec)

a) amplitude is 20 m and frequency is 2 b) wavelength is 20 m and frequency is 1

c) frequency is 112 and wavelength is 20 cm d) $\omega = 2\pi$ and $k = \pi/2$

205. Two pulses in a stretched string whose centres are initially 8 cm apart are moving towards each other as shown in the figure. The speed of each pulse is 2 cm/s. After 2 second, the total energy of the pulses will be



a) zero b) purely kinetic c) purely potential d) partly kinetic and partly potential

206. The stationary wave $y = 2a\sin kx\cos\omega t$, in a stretched string is the result of superposition of $y_1 = a\sin(kx - \omega t)$ and:

a) $y_2 = a\cos(kx + \omega t)$ b) $y_2 = a\sin(kx + \omega t)$ c) $y_2 = a\cos(kx - \omega t)$ d) $y_2 = a\sin(kx - \omega t)$

207. A source of unknown frequency gives 4 beats/s, when sounded with a source of known frequency 250 Hz, the second harmonic of the source of unknown frequency gives five beats per second, when sounded with a source of frequency 513 Hz, the unknown frequency is :

a) 260 Hz b) 254 Hz c) 246 Hz d) 240 Hz

208. A particle executes linear simple harmonic motion with an amplitude of 3 cm. When the particle is at 2 cm from the mean position, the magnitude of its velocity is equal to that of its acceleration. Then its time period in seconds is:

a) $\sqrt{5}/2\pi$ b) $4\pi/\sqrt{5}$ c) $2\pi/\sqrt{5}$ d) $\sqrt{5}/\pi$

209. In a stationary wave there is:

a) neither energy current nor energy density

b) no energy current but there is energy density c) energy current but no energy density

d) both energy current and energy density

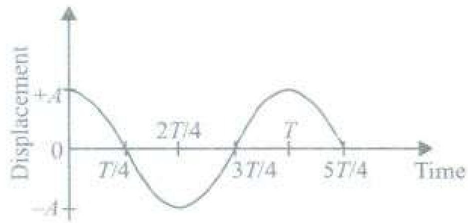
210. A wave of length 2 m is superposed on its reflected wave to form a stationary wave. A node is located at x = 3 m; the next node will be located at x equal to:

a) 3.25 m b) 3.50 m c) 3.75 m d) 4 m

211. The equation of a wave travelling in a string can be written as y = 3 cos π (100t - x), its wavelength is
a) 100 cm b) 2 cm c) 5 cm d) None of these

212. The equation of a wave is; $y = 5\sin\left(\frac{t}{0.04} - \frac{x}{4}\right)$, where x is in ern and t in seconds. The maximum velocity of the wave will be:
a) 1 ms^{-1} b) 2 ms^{-1} c) 1.5 ms^{-1} d) 1.25 ms^{-1}

213. The displacement -time graph for a particle executing SHM is as shown in figure.



Which of the following statements is correct?

a) The velocity of the particle is maximum at $t = \frac{3}{4}T$

b) The velocity of the particle is maximum at $t = \frac{T}{2}$

c) The acceleration of the particle is maximum at $t = \frac{T}{2}$

d) The acceleration of the particle is maximum at $t = \frac{3}{4}T$

214. A particle executes simple harmonic motion between x=-A and x=+A.The time taken for it to go from 0 A/2 is T_1 and to go from A/2 to A is T_2. Then
a) $T_1 < T_2$ b) $T_1 > T_2$ c) $T_l = T_2$ d) $T_1 = 2T_2$

215. A sound is produced by plucking a string in a musical instrument, then
a) the frequency of the wave in the string is equal to the frequency of the sound produced.
b) the wave in the string is progressive.
c) the tension in the string varies from point to point.
d) the velocity of wave in the string is equal to the velocity of sound in the string.

216. An observer moves towards a stationary source of sound with a speed 1/5th of the speed of sound. The wavelength and frequency of the sound emitted are 1 and f respectively. The apparent frequency and wavelength recorded by the observer are respectively.
a) 0.8f, 0.81 b) 1.2*f*, 1.21 c) 1.2*f*, 1 d) *f*, 1.21

217. The potential energy of a simple harmonic oscillator when the particle is half way to its end point is:
(where E is the total energy)
a) $\frac{1}{2}E$ b) $\frac{2}{3}E$ c) $\frac{1}{8}E$ d) $\frac{1}{4}E$

218. When a pulse or train of pulse travels along the length of the string (in X-direction), the elements of the string:
a) oscillate about their mean position as the pulse or wave passes through it
b) oscillate normal to the direction of wave motion along the string (i.e., along Y-direction)
c) oscillate along the direction of propagation of wave d) both (a) and (b)

219. A stone thrown into still water, creates a circular wave pattern moving radially outwards. If r is the distance measured from the centre of the pattern, the amplitude of the wave varies as:

a) $r^{-1/2}$ b) r^{-1} c) r^{-2} d) $r^{-3/2}$

220. The fundamental note produced by a closed organ pipe is of frequency u. The fundamental note produced by an open organ pipe of same length will be of frequency

a) $\frac{v}{2}$ b) v c) 2v d) 4v

221. A simple pendulum is made of a body which is a hollow sphere containing mercury suspended by means of a wire. If a little mercury is drained off, the period of pendulum will:

a) remain unchanged b) increase c) decrease d) become erratic

222. Assertion: The basic of Laplace correction was that, exchange of heat between the region of compression and rarefaction in air is not possible.

Reason: Air is a bad conductor of heat and velocity of sound in air is large.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

223. A transverse wave is travelling in a string. Equation of the wave:

a) is not equal to the shape of the string at an instant t

b) is general equation for displacement of a particle of the string

c) is an equation for displacement of the particle of one end only

d) must be sinusoidal equation

224. A man standing between two cliffs, claps his hands and starts hearing a series of echoes at intervals of one second. If speed of sound in air is 340 m/s, then distance between the cliffs is:

a) 340 m b) 680 m c) 1020 m d) 1360 m

225. A resonating air column shows resonance with a tuning fork of frequency 256 Hz at column lengths 33.4 cm and 101.8cm. The speed of sound in air is

a) 300 m S^{-1} b) 250 m S^{-1} c) 390 m S^{-1} d) 350 m S^{-1}

226. The time period of simple harmonic motion depends upon

a) amplitude b) energy c) phase constant d) mass

227. An organ pipe of cross-sectional area 100 cm? resonates with a tuning fork of frequency 1000 Hz in fundamental tone. The minimum volume of water to be drained so the pipe again resonates with the same tuning fork is (Take velocity of wave = 320 m S^{-1})

a) 800 cm^3 b) 1200 cm^3 c) 1600 cm^3 d) 2000 cm^3

228. A source of sound producing wavelength 50 cm is moving away from a stationary observer with $\left(\frac{1}{5}\right)^{th}$ speed of sound. Then what is the wavelength of sound received by the observer?

a) 55 cm b) 40 cm c) 60 cm d) 70 cm

229. Elevation of a cloud is 60° above the horizon. A thunder is heard 6 see after the lightning is observed. The speed of sound is 340 m s^{-1}. The vertical height of the cloud is:

a) 6 x 340 m b) 6 x 340 x cos 60^0m c) 6 x 340 x sin 60° m d) 6 x 340 x tan 60° m

230. A rocket is moving at a speed of 220 m S^{-1} towards a stationary target, emits a sound of frequency 1000 Hz. Some of the sound reaching the target gets reflected back to the rocket as an echo. The frequency of the echo as detected by the rocket is

(Take velocity of sound = 330 m S^{-1})

a) 3500 Hz b) 4000 Hz c) 5000 Hz d) 3000 Hz

231. The path difference between the two waves $y_1 = a_1 \sin(\omega t - 2\pi x/\lambda)$ and $y_2 = a_2 \cos(\omega t - 2\pi x/\lambda + \phi)$ is :

a) $\lambda/2\pi\phi$ b) $(\lambda/2\pi)(\phi+\pi/2)$ c) $(2\pi/\lambda)(\phi-\pi/2)$ d) $(2\pi/\lambda)(\phi)$

232. A wave travelling along positive x-axis is given by: $y = A\sin(\omega t - kx)$. If it is reflected from rigid boundary such that 80% amplitude is reflected, then equation of reflected wave is:
a) $y = A\sin(\omega t + kx)$ b) $y = -8.0A\sin(\omega t + kx)$ c) $y = 0.8A\sin(\omega t + kx)$ d) $y = A\sin(\omega t + 0.8kx)$

233. Which of the following is not a characteristics of simple harmonic motion?
a) The motion is periodic b) The motion is along a straight line about the mean position.
c) The oscillations are responsible for the energy conversion
d) The acceleration of the particle is directed towards the extreme position .

234. The equation of a plane progressive wave is: $y = 0.09\sin 8\pi\left(t - \frac{x}{20}\right)$. When it is reflected at rigid support, its amplitude becomes (2/3)rd of its previous value. The equation of the reflected wave is:
a) $y = 0.09\sin 8\pi\left(t - \frac{x}{20}\right)$ b) $y = 0.06\sin 8\pi\left(t - \frac{x}{20}\right)$ c) $y = 0.06\sin 8\pi\left(t + \frac{x}{20}\right)$
d) $y = -0.06\sin 8\pi\left(t + \frac{x}{20}\right)$

235. A transverse wave is passing through a medium. The maximum speed of the vibrating particle occurs when the displacement of the particle from the mean position is:
a) zero b) half of the amplitude c) equal to the amplitude d) none of these

236. The relation between frequency υ, wavelength λ and velocity of propagation of a wave v is
a) $\upsilon = \frac{\lambda}{v}$ b) $\upsilon = \lambda v$ c) $\upsilon = \frac{v}{\lambda}$ d) None of these

237. Two identical sounds S_1 and S_2 reach at a point P in phase. The resultant loudness at point P is n dB higher than the loudness of S_1, The value of n is:
a) 2 b) 4 c) 5 d) 6

238. Assertion: The speed of sound in solids is maximum though their density is large.
Reason: The coefficient of elasticity of solids is large.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

239. A simple harmonic wave train of amplitude 2 cm and time period 0:01 sec is travelling with a velocity of 10 m/sec in the positive X -direction. The displacement of the particle from the mean position, the particle velocity and particle acceleration at x = 150cm from the origin and at t = 3sec are:
a) 0,0,0 b) 0,400π cm/sec, 0 c) 0,0,400π cm/sec^2 d) 400π cm,0,0

240. The ratio of the velocity of sound in hydrogen $\left(\gamma = \frac{7}{5}\right)$ to that in helium $\left(\gamma = \frac{5}{3}\right)$ at the same temperature is
a) $\sqrt{\frac{5}{42}}$ b) $\sqrt{\frac{5}{21}}$ c) $\frac{\sqrt{42}}{5}$ d) $\frac{\sqrt{21}}{5}$

241. The speed of sound in a mixture of I mole of helium and 2 moles of oxygen at 27° C is:
a) 400 m/s b) 800 m/s c) 1200 m/s d) 600 m/s

242. Two waves are propagating along a taut string that coincides with the x-axis. The first wave has the wave function; $y_1 = A\cos[k(x - vt)]$ and the second has the wave function;
$y_2 = A\cos[k(x + vt) + \phi]$:
a) for constructive interference at x= 0,$\phi = \pi$ b) for constructive interference at x= 0,$\phi = 3\pi$
c) for destructive interference at x= 0,$\phi = \pi$ d) for destructive interference at x = 0,$\phi = 2\pi$

243. The phase difference between displacement and acceleration of a particle in a simple harmonic motion is:

a) Zero b) π rad c) $\frac{3\pi}{2}rad$ d) $\frac{\pi}{2}rad$

244. Which of the following statements is correct?

a) The distance between any two consecutive antinodes or no nodes is $\frac{\lambda}{4}$.

b) The distance between a node and adjoining is c) In the open end is an node.

d) In the closed end is an antinode.

245. When a wave travels in a medium, the particle displacement is given by: $y = a\sin 2\pi(bt - cx)$, where a, b and e are constants. The maximum particle velocity will be twice the wave velocity if:

a) $c = \frac{1}{\pi a}$ b) $c = \pi a$ c) b = ac d) $b = \frac{1}{ac}$ e) a = bc

246. A train moving at a speed of 220 m/s towards a stationary object, emits a sound of frequency 1000 Hz. Some of the sound reaching the object gets reflected back to the train as echo. The frequency of the echo as detected by the driver of the train is (speed of sound in air is 330 m/s) :

a) 4000 Hz b) 5000 Hz c) 3000 Hz d) 3500 Hz

247. A simple harmonic oscillator has an amplitude a and time period T. The time required by it to travel from $x = a$ to $x = \frac{a}{2}$ is ________________ .

a) $\frac{T}{6}$ b) $\frac{T}{4}$ c) $\frac{T}{3}$ d) $\frac{T}{2}$

248. A sine wave has an amplitude A and wavelength λ. The ratio of particle velocity and the wave velocity is:$(2\pi A = \lambda)$

a) ≤ 1 b) =1 c) ≥ 1 d) none of these

249. At resonance, the amplitude of forced oscillations is

a) minimum b) maximum c) zero d) none of these

250. In stationary wave, node is the point having:

a) maximum density b) maximum displacement c) minimum density d) maximum strain

251. Two sound waves having a phase difference of 60° have a path difference of:

a) 2λ b) λ/2 c) λ/6 d) λ/3

252. Define Mach Number.

a) It is the ratio of the stress to strain b) It is the ratio of the strain to stress

c) It is the ratio of the velocity of an object to the velocity of sound

d) It is the ratio of the velocity of sound to the velocity of an object

253. Two waves: $y = 0.25\sin 316t$, $y = 0.25\sin 310t$ are travelling in same direction. The number of beats produced per second will be:

a) 6 b) 3 c) $3/\pi$ d) 3π

254. Which one of the following statements is true for the speed v and the acceleration a of a particle executing simple harmonic motion?

a) When v is maximum. a is zero b) When vis maximum, a is maximum

c) Value of a is zero, whatever may be the value of v d) When v is zero. a is zero

255. An ideal gas enclosed in a vertical cylindrical container supports a freely moving piston of mass M. The piston and the cylinder have equal cross sectional area A. When the piston is in equilibrium, the volume of the gas is Va and its pressure is P_o' The piston is slightly displaced from the equilibrium position and released. Assuming that the system is completely isolated from its surrounding, the piston executes a simple harmonic motion with frequency

a) $\frac{1}{2\pi}\sqrt{\frac{MV_0}{A\lambda P_0}}$ b) $\frac{1}{2\pi}\frac{A\gamma P_0}{V_0 M}$ c) $\frac{1}{2\pi}\frac{V_0 M P_0}{A^2\gamma}$ d) $\frac{1}{2\pi}\sqrt{\frac{A^2\gamma P_0}{MV_0}}$

256. The length of a seconds pendulum on the surface of earth is 1m. Its length on the surface of the moon is

a) $\frac{1}{6}m$ b) 1m c) $\frac{1}{36}m$ d) 36 m

257. Natural length of the spring is 40 cm and its spring constant is 4000 N m^{-1}. A mass of 20 kg is hung from it. The extension produced in the spring is (Giveng= 9.8 ms^{-2})

a) 4.9 cm b) 0.49 cm c) 9.4 cm d) 0.94 cm

258. A rectangular block of mass 111 and area of crosssection A floats in a liquid of density p. If it is given a small vertical displacement from equilibrium it undergoes oscillation with a time period T. Then

a) $T \propto \frac{1}{\sqrt{m}}$ b) $T \propto \sqrt{\rho}$ c) $T \propto \frac{1}{\sqrt{A}}$ d) $T \propto \frac{1}{\rho}$

259. The circular motion of a particle with constant speed is

a) periodic and simple harmonic. b) simple harmonic but not periodic.

c) neither periodic nor simple harmonic d) periodic but not simple harmonic.

260. Two sound waves of equal intensity I produce beats. The maximum intensity of sound produced in beats will be:

a) I b) 4 I c) 2 I d) $\frac{I}{2}$

261. The displacement of a particle along the x-axis is given by x = a sin2 ωt. The motion of the particle corresponds to:

a) Simple harmonic motion of frequency ω/p

b) Simple harmonic motion of frequency 3ω/2π c) Non-simple harmonic motion

d) Simple harmonic motion of frequency ω/2π

262. Which of the following statements is incorrect during propagation of a plane progressive mechanical wave?

a) All the particles are vibrating in the same phase. b) Amplitude of all the particles is equal

c) Particles of the medium executes SHM

d) Wave velocity depends upon the nature of the medium.

263. A travelling wave represented by y (x, t) = asin(kx - ωt) is superimposed on another wave represented by y(x, t) = asin(kx + ωt). The resultant is:

a) standing wave having nodes at x =$x = \left(n + \frac{1}{2}\right)\frac{\lambda}{2}$; n - 0,1,2, ...

b) standing wave having nodes at x =$\frac{n\lambda}{2}$n= 0,1,2, ... c) wave travelling along + x direction.

d) wave travelling along - x direction.

264. A thin plane membrane separates hydrogen at 7° C from hydrogen at 47° C, both being at the same pressure. If a collimated sound beam travelling from the cooler gas makes an angle of incidence of 30° at the membrane, the angle of refraction is:

a) $\sin^{-1}\sqrt{\frac{7}{32}}$ b) $\sin^{-1}\sqrt{\frac{2}{7}}$ c) $\sin^{-1}\sqrt{\frac{4}{7}}$ d) $\sin^{-1}\sqrt{\frac{7}{4}}$

265. A tuning fork is set into vibrations and then it is held with its stem resting on a table. How will duration of its vibrations be affected?

a) It will vibrate for same duration b) It will vibrate for a longer duration

c) It will vibrate for a shorter duration

d) The duration will increase or decrease depending upon the dimensions of the table

266. A second harmonic has to be generated in a string of length L stretched between two rigid supports. The point where the string has to be plucked and touched are

a) plucked at $\frac{L}{4}$ and touch at $\frac{L}{2}$ b) plucked at $\frac{L}{4}$ and touch at c) plucked at $\frac{L}{2}$ and touch at $\frac{L}{2}$
d) plucked at $\frac{L}{2}$ and touch at $\frac{3L}{4}$

267. Change in temperature of the medium changes
a) frequency of sound waves b) amplitude of sound waves
c) wavelength of sound waves. d) loudness of sound waves

268. Which of the following waves is used in sonography?
a) Radio waves b) X-rays c) Ultrasonic waves d) Gamma rays

269. Which of the following properties of a wave is independent of others?
a) Velocity b) Frequency c) Amplitude d) Wavelength

270. Two sine waves travel in the same direction in a medium. The amplitude of each waves is A and phase difference between the two waves is 120°. The resultant amplitude will be:
a) A b) 2A c) 4A d) $\sqrt{2}A$

271. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: A block of small mass m attached to a stiff spring will have large oscillation frequency
Reason : Stiff springs have high value of spring constant.
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false d) If both assertion and reason are false

272. It takes 2.0 seconds for a sound wave to travel between two fixed points when the day temperature is 10^0C. If the temperature rises to 30° C the sound wave travels between the same fixed points in:
a) 1.9 sec b) 2.0 sec c) 2.1 sec d) 2.2 sec

273. The potential energy of a long spring when stretched by 2 cm is U. If the spring is stretched by 8 cm. the potential energy stored in it is:
a) 8 U b) 16 U c) U/4 d) 4 U

274. Two vibrating tuning forks produce progressive waves given by:
$y_1 = 4\sin(500\pi t)$ and $y_2 = 2\sin(506\pi t)$, They are held near the ear of a person. If the number of beats heard per second be B and the ratio of maximum to minimum intensity be A, then:
a) B =3 and A =2 b) B =3 and A =9 c) B = 6 and A = 2 d) B = 6 and A = 9

275. A sound wave of frequency 500 Hz covers a distance of 1000 m in 5 second between points X and Y. The number of waves between X and Y are:
a) 500 b) 1000 c) 2500 d) 5000

276. Two SHMs with same amplitude and time period when acting together in perpendicular directions with a phase difference of ππ/2 give rise to:
a) elliptical motion b) circular motion c) straight motion d) none of these

277. The equation of a wave moving on a string is $y = 8\sin 2\pi(0.01x - 2.00t)$, where y and x are in ems and t in second. The amplitude of the wave is:
a) 200 cm b) 100 cm c) 50 cm d) 8 cm

278. The equation for a wave propagating with a velocity of 330 m/s and having a frequency of 110Hz and amplitude 0.05 m is:
a) $y = 0.05\sin 2\pi\left[100t + \frac{x}{3}\right]$ b) $y = 0.05\sin 2\pi\left[100t - \frac{x}{3}\right]$ c) $y = 0.05\sin 2\pi\left[100t \pm \frac{x}{3}\right]$
d) $y = 0.05\sin[100t - 330x]$

279. A body of mass m is attached to the lower end of a spring whose upper end is fixed. The spring has negligible mass. When the mass m is slightly pulled down and released, it oscillates with a time period of 3 s. When the mass m is increased by 1 kg, the time period of oscillations

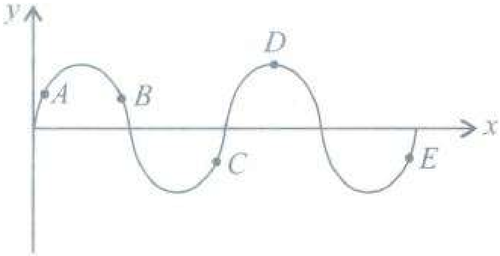
becomes 5s. The value of m in kg is

a) 3/4 b) 4/3 c) 16/9 d) 9/16

280. Two waves are approaching each other with a velocity of 20 m/s and frequency n. The dist nodes is _______________ .

a) $\frac{20}{n}$ b) $\frac{10}{n}$ c) $\frac{5}{n}$ d) $\frac{n}{10}$

281. Figure shows a sinusoidal wave at a given instant.



Which points are in phase?

a) A, B b) B, C c) B, D d) C, E

282. Phase difference between two particles of a medium lying between two consecutive nodes is:

a) zero b) π/4 c) π/2 d) π

283. The driver of a car travelling with speed 30 m/sec towards a hill sounds a horn of frequency 600 Hz. If the velocity of sound in air is 330 m/s, the frequency of reflected sound as heard by driver is:

a) 555.5 Hz b) 720 Hz c) 500 Hz d) 550 Hz

284. A sound wave travelling with a velocity υ in a medium A reaches a point on the interface of medium A and medium B. If the velocity in the medium B be 2υ , the angle of incidence for total internal reflection of the wave will be:

a) >15° b) >30° c) >45° d) >90°

285. A sound wave is passing through air column in the form of compressions and rarefactions. In consecutive compressions and rarefactions:

a) density of the air in a region changes

b) velocity of the particles of air is perpendicular to wave velocity c) density is constant

d) none of the above

286. A particle is executing SHM with amplitude A and has maximum velocity V_o. Its speed at displacement A/2 wili be:

a) $(\sqrt{3})V_0/2$ b) $V_0/2$ c) V_o d) $V_o/4$

287. The frequency of a tuning fork is 256 Hz. The velocity of sound in air is 344 ms $^{-1}$. The distance travelled (in meters) by the sound during the time in which the tuning fork completes 32 vibrations is:

a) 21 b) 43 c) 86 d) 129

288. A simple pendulum suspended from the roof of a lift oscillates with frequency u when the lift is at rest. If the lift falls freely under gravity, its frequency of oscillation becomes

a) zero b) υ c) 2υ d) infinite

289. To demonstrate the phenomenon of beats, we need:

a) two sources which emit radiation of nearly the same frequency

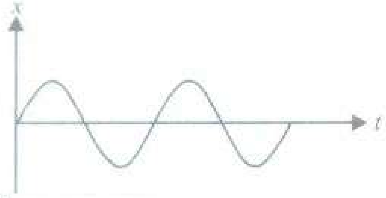
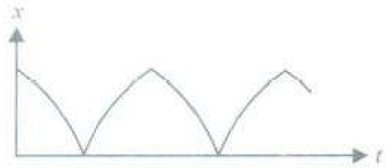
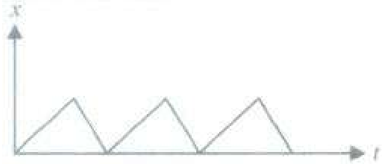
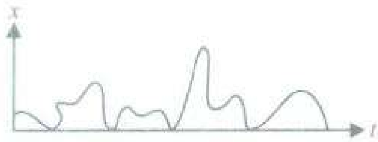
b) two sources which emit radiation of exactly the same frequency

c)

two sources which emit radiation of exactly the same frequency and have a definite phase relationship

d) two sources which emit radiation of exactly the same wavelength

290. Which of the following x- t graphs does not represent periodic motion?

a) 
b) 
c) 
d) 

291. A train approaching a railway platform with a speed of 20 m S^{-1} starts blowing the whistle. Speed of sound in air is 340 m S^{-1}. If the frequency of the emitted sound from the whistle is 640 Hz, the frequency of sound as heard by person standing on the platform is
a) 600 Hz b) 640 Hz c) 680 Hz d) 720 Hz

292. The equation of a wave is: $x = 5\sin\left(\frac{t}{0.04} - \frac{x}{4}\right)cm.$ Find the maximum velocity of the particles of the medium:
a) 1 m/s b) 1.5 m/s c) 1.25 m/s d) 2 m/s

293. A vibrating tuning fork generates a wave given by: $y = 0.1\ \sin\pi(0.1x - 2t),$ where x and y are in metre and t in second. The distance travelled by the wave while the fork completes 30 vibrations is:
a) 600 m b) 20 m c) 30 m d) 200 m

294. A steel rod 100 cm long is clamped at its mid-point. The fundamental frequency of longitudinal vibrations of the rod is given to be 2.53 kHz. What is the speed of sound in steel?
a) 5.06 km/s b) 6.06 km/s c) 7.06 km/s d) 8.06 km/s

295. Each of the two strings of length 51.6 cm and 49.1 cm are tensioned separately by 20 N force. Mass per unit length of both the strings is same and equal to 1 g/m. When both the strings vibrate simultaneously the number of beats is:
a) 7 b) 8 c) 3 d) 5

296. Two sinusoidal plane waves of the same frequency having intensities I_0 and $4I_0$ are travelling in the same direction. The resultant intensity at a point at which waves meet with a phase difference of zero radian is:
a) I_0 b) $5I_0$ c) $9I_0$ d) $3I_0$

297. The equation for the displacement of a stretched string is given by: $y = 4\sin 2\left(\frac{t}{0.02} - \frac{x}{100}\right).$
Where, y and x are in em and t in Sec. The (i) frequency (ii) velocity of the wave (iii) maximum particle velocity are:
a) 50 Hz, 50 m/s, 20π m/s b) 50 Hz, 20 m/s, 50 m/s c) 50 Hz, 50 m/s, 20π m/s
d) 50 Hz, 50 m/s, 4π m/s

298. In a guitar, two strings A and B made of same materiat are slightly out the tune and produce beats of frequency 6 Hz. When tension in B is slightly decreased, the beat frequency increases to 7 Hz. If the frequency of A is 530 Hz, the original frequency of B will be:
a) 537 Hz b) 523 Hz c) 524 Hz d) 536 Hz

299. Four simple harmonic vibrations:
$y_1 = 8\cos\omega t; y_2 = 4\cos\left(\omega t + \frac{\pi}{2}\right); y_3 = 2\cos(\omega t + \pi); y_4 = \cos\left(\omega t + \frac{3\pi}{2}\right),$ are superposed on each other. The resulting amplitude and phase are respectively:
a) $\sqrt{45} and \quad \tan^{-1}(1/2)$ b) $\sqrt{45} and \quad \tan^{-1}(1/3)$ c) $\sqrt{75} and \quad \tan^{-1}(1/2)$ d) $\sqrt{75} and \quad \tan^{-1}(1/3)$

300. A particle is executing SHM along a straight line. Its velocities at.distances x_1 and x_2 from the mean position are V_1 and V_2, respectively. Its time period is:

a) $2\pi\sqrt{(x_1^2+x_2^2)/(V_1^2+V_2^2)}$ b) $2\pi\sqrt{(x_2^2-x_1^2)/(V_1^2+V_2^2)}$ c) $2\pi\sqrt{(x_2^2-x_1^2)/(V_1^2-V_2^2)}$

d) $2\pi\sqrt{(V_1^2+V_2^2)/(x_1^2-x_2^2)}$

301. A small piece of cork in a ripple tank oscillates up and down as ripples pass it. If the ripples travelling at 0.3 m/s have a wavelength of 1.5π cm and the cork vibrates with an amplitude of 5 mm, the maximum velocity of the cork is:

a) 20 cm/sec b) 20 m/sec c) 0.02 m/sec d) 200 cm/sec

302. A tuning fork A produces 4 beats per second with another tuning fork B of frequency 320 Hz. On filing one of the prongs of A, 4 beats per second are again heard when sounded with the same fork B. Then, the frequency of the fork A before filing is:

a) 328 Hz b) 316 Hz c) 324 Hz d) 320 Hz

303. The equation of a simple harmonic wave is given by Y = 5 sin $\frac{\pi}{2}$ (l00 t - x), where x and yare in metre and time is in second. The time period of the wave (in seconds) will be

a) 0.04 b) 0.01 c) 1 d) 5

304. The efficiency of an ideal heat engine working between the freezing point and boiling point of water, is

a) 6.25% b) 20% c) 26.8% d) 12.5%

305. A pipe 17 cm long is closed at one end. Which harmonic mode of the pipe resonates a 1.5 kHz source? (Speed of sound in air = 340 m S^{-1})

a) First b) Third c) Fifth d) Seventh

306. P and Q are two wires whose fundamental frequencies are 256 Hz and 382 Hz respectively. How many beats in two seconds will be heard by the third harmonic of A and second harmonic of B?

a) 4 b) 8 c) 16 d) zero

307. A linear harmonic oscillator of force constant 2 x 10^6 N/m and amplitude 0.01 m has a total mechanical energy of 160J. Its ___________ .

a) maximum potential energy is 160 J b) maximum potential energy is 100 J

c) maximum potential energy is zero d) minimum potential energy is 100 J

308. Decibel is the unit of:

a) intensity of light b) X-ray radiation capacity c) sound loudness d) energy of radiation

309. A stretched string of length l, fixed at both ends can sustain stationary waves of wavelength λ given by

a) $\lambda=n^2/2l$ b) $\lambda=l^2/2n$ c) $\lambda=2l/n$ d) $\lambda=2ln$

Ravi Maths Tuition Centre

Time : 1 Mins | **ELECTROSTATICS' CURRENT ELECTRICITY 1** | **Marks : 1542**

1. A capacitor of capacity C_1 is charged upto V volt and then connected to an uncharged capacitor of capacity C_2. Then final potential difference across each will be:
   a) $C_2V/(C_1+C_2)$ b) $(1+C_2/C_1) \times V$ c) $C_1V/(C_1+C_2)$ d) $(1-C_2/C_1) \times V$
2. Which of the following statements is/ are true about the principle of Van de Graaff generator?
   a) The action of sharp points.
   b)
   The charge given to a hollow conductor is transferred to outer surface and is distributed uniformly over it.
   c) It is used for accelerating uncharged particle d) Both (a) and (b) are true.
3. The electric field in a certain region is acting radially outward and is given by E = Ar. A charge contained in a sphere of radius '*a*' centred at the origin of the field, will be given by:
   a) $4\pi\varepsilon_0 Aa^3$ b) $\varepsilon_0 Aa^3$ c) $4\pi\varepsilon_0 Aa$ d) $\varepsilon_0 a^2$
4. A capacitor is charged by a battery. The battery is removed and another identical uncharged capacitor is connected in parallel. The total electrostatic energy of resulting system:
   a) decreases by a factor of 2 b) remains the same c) increases by a factor of 2
   d) increases by a factor of 4
5. The top of the atmosphere is about 400 kV with respect to the surface of earth, corresponding to an electric field that decreases with altitude. Near the surface of earth the field is about 100 V m^{-1}, but still don't get an electric shock, as we set out of our houses in to open because (assume the house is free from electric field)
   a) our body is a perfect insulator b) our body and ground form an equipotential surface
   c) the original equipotential surfaces of open air remain same d) none of these
6. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
   Assertion: Charge on all the condensers connected in series is the same.
   Reason : Capacitance of capacitor is directly proportional to charge on it.
   a) If both assertion and reason are true and reason is the correct explanation of assertion.
   b) If both assertion and reason are true but reason is not the correct explanation of assertion
   c) If assertion is true but reason is false d) If both assertion and reason are false
7. A point Q lies on the perpendicular bisector of an electrical dipole of dipole moment p. If the distance of Q from the dipole is r (much larger than the size of the dipole), then electric field at Q is proportional to:

a) p^{-1} and r^{-2} b) p and r^{-2} c) p^{-1} and r^{-2} d) p and r^{-3}

8. A capacitor of capacitance 700 pF is charged by 100 V battery. The electrostatic energy stored by the capacitor is

   a) 2.5×10^{-8} J b) 3.5×10^{-6} J c) 2.5×10^{-4} J d) 3.5×10^{-4} J

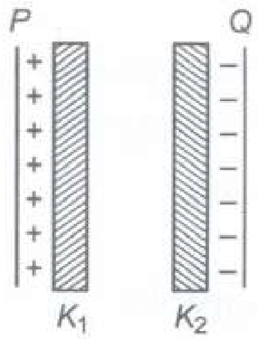
9. 1volt is equivalent to

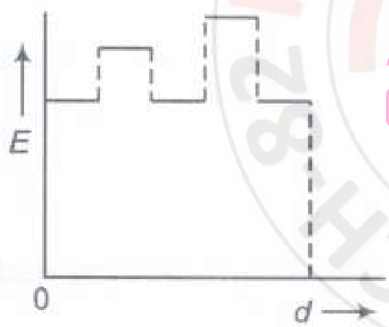
   a) $\frac{newton}{second}$ b) $\frac{newton}{coulomb}$ c) $\frac{joule}{coulomb}$ d) $\frac{joule}{second}$

10. Two charged spheres of radii 10 cm and 15 cm are connected by a thin wire. No current will flow, if they have:

    a) The same charge on each b) The same potential c) The same energy
    d) The same field on their surfaces

11. Two thin dielectric slabs of dielectric constants K_1 and K_2 ($K_1 < K_2$) are inserted between plates of a parallel plate capacitor, as shown in the figure. The variation of electric field 'E' between the plates with distance 'd' as measured from plate P is correctly shown by:



a)


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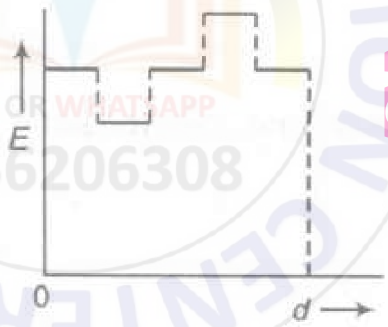
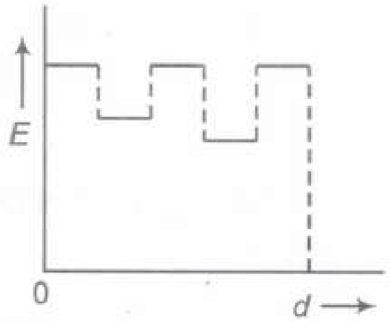
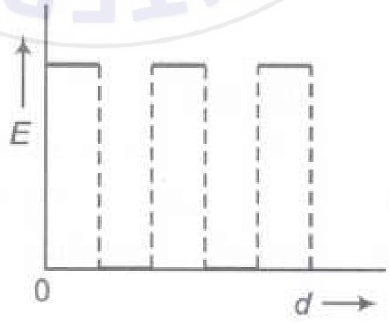


c)


d)


12. Who established the fact of animal electricity?

    a) Van de Graaff b) Count Alessandro Volta c) Gustav Robert Kirchhoff
    d) Hans Christian Oersted

13. A parallel plate capacitor with air between the plates has a capacitance of 10 pF. The capacitance, if the distance between the plates is reduced by half and the space between them is filled with a substance of dielectric constant 4 is

    a) 80 pF b) 96 pF c) 100 pF d) 120 pF

14. A charge +q is placed at the origin O of x-y axes as shown in the figure. The work done in taking a charge Q from A to B along the straight line AB is
 a) $\frac{qQ}{4\pi\varepsilon_o}\left(\frac{a-b}{ab}\right)$ b) $\frac{qQ}{4\pi\varepsilon_o}\left(\frac{b-a}{ab}\right)$ c) $\frac{qQ}{4\pi\varepsilon_o}\left(\frac{b}{a^2}-\frac{1}{b}\right)$ d) $\frac{qQ}{4\pi\varepsilon_o}\left(\frac{a}{b^2}-\frac{1}{b}\right)$

15. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as
 Assertion: Two adjacent conductors of unequal dimensions, carrying the same positive charge have a potential difference between them.
 Reason: The potential of a conductor depends upon the charge given to it.
 a) If both assertion and reason are true and reason is the correct explanation of assertion.
 b) If both assertion and reason are true but reason is not the correct explanation of assertion
 c) If assertion is true but reason is false. d) If assertion is true but reason is false.

16. What is the angle between electric field and equipotential surface?
 a) 90° always b) 0° always c) 0° to 90° d) 0° to 180°

17. The electric potential at a point in free space due to a charge Q coulomb is Q x 10^{11} volts. The electric field at that point is:
 a) $12\pi\varepsilon_0$ Q x 10^{22} volt/m b) $4\pi\varepsilon_0$ Q x 10^{22} volt/m c) $12\pi\varepsilon_0$ Q x 10^{20} volt/m
 d) $4\pi\varepsilon_0$ Q x 10^{20} volt/m

18. If a unit positive charge is taken from one point to another over an equipotential surface, then:
 a) Work is done on the charge b) Work is done by the charge c) Work done is constant
 d) No work is done

19. A parallel plate capacitor having area A and separated by distance d is filled by copper plate of thickness b. The new capacity is
 a) $\frac{\varepsilon_o A}{d+\frac{b}{2}}$ b) $\frac{\varepsilon_o A}{2d}$ c) $\frac{\varepsilon_o A}{d-b}$ d) $\frac{2\varepsilon_o A}{d+\frac{b}{2}}$

20. Dielectric constant for a metal is
 a) zero b) infinite c) 1 d) 10

21. When air is replaced by a dielectric medium of constant K, the maximum force of attraction between two charges separated by a distance
 a) increases K times b) remains unchanged c) decreases K times
 d) increases K^{-1} times

22. A capacitor is charged by using a battery which is then disconnected. A dielectric slab is then slipped between the plates, which results in:
 a) Reduction of charge on the plates and increase of potential difference across the plates
 b)
 Increase in the potential difference across the plate, reduction in stored energy, but no change In the charge on the plates
 c)
 Decrease in the potential difference across the plates, reduction in the stored energy, but no change in the charge on the plates
 d) None of the above

23. The potential at a point due to a charge of 5 x 10^{-7} C located 10 cm away is
 a) 3.5 x 10^5 V b) 3.5 x 10^4 V c) 4.5 x 10^4 V d) 4.5 x 10^5 V

24. The capacity of a parallel plate condenser is 10 μF, when the distance between its plates is 8 cm, If the distance between the plates is reduced to 4 cm, then the capacity of this parallel plate condenser will be:
 a) 5 μF b) 10 μF c) 20 μF d) 40 μF
25. The energy stored in a condenser of capacity C which has been raised to a potential V is given by:
 a) (1/2) CV b) (1/2) CV^2 c) CV d) (1/2)VC
26. Three concentric spherical shells have radii a, b and c (a < b < c) and have surface charge densities σ, - σ and σ respectively. If V_A, V_B and V_C denote the potentials of the three shells, then for c = a + b, we have:
 a) $V_C = V_B \neq V_A$ b) $V_C \neq V_B \neq V_A$ c) $V_C = V_B = V_A$ d) $V_A = V_C \neq V_B$
27. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
 Assertion: Electric field is discontinuous across the surface of a spherical charged shell.
 Reason: Electric potential is continuous across the surface of a spherical charged shell.
 a) If both assertion and reason are true and reason is the correct explanation of assertion.
 b) If both assertion and reason are true but reason is not the correct explanation of assertion
 c) If assertion is true but reason is false. d) If both assertion and reason are false
28. The electric intensity due to a dipole of length 10 em and having a charge of 500 μC, at a point on the axis at a distance 20 cm from one of the charges in air, is:
 a) 6.25×10^7 N/C b) 9.28×10^7 N/C c) 13.1×11^{11} N/C d) 20.5×10^7 N/C
29. If a conductor has a potential V≠0 and there are no charges anywhere else outside, then
 a) there must be charges on the surface or inside itself.
 b) there cannot be any charge in the body of the conductor.
 c) there must be charges only on the surface. d) both (a) and (b) are correct.
30. A parallel plate capacitor is connected across a 2 V battery and charged. The battery is then disconnected and a glass slab is introduced between plates. Which of the following pairs of quantities decreases?
 a) Charge and potential difference b) Potential difference and energy stored.
 c) Energy stored and capacitance. d) Capacitance and charge
31. The potential at a point distant x (measured in μm) due to some charges situated on the x-axis is given by $V_{(x)} = \dfrac{20}{x^2 - 4}$. The electric field at x = 4 μm is given by:
 a) $\frac{5}{3} V \mu m^{-1}$ and in positive x direction b) $\frac{10}{9} V \mu m^{-1}$ and in negative x diirection
 c) $\frac{10}{9} V \mu m^{-1}$ and in positive x direction d) $\frac{5}{3} V \mu m^{-1}$and in negative x diirection
32. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
 Assertion : Capacity of parallel plate condenser remains unaffected on introducing a

insulating slab between the plates.

Reason : Electric field intensity between the plates increases on introducing the insulating slab

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false

33. A parallel plate capacitor has two square plates with equal and opposite charges. The surface charge densities on the plates are $+\sigma$ and $-\sigma$ respectively. In the region between the plates the magnitude of the electric field is

a) $\frac{\sigma}{2\varepsilon_o}$ b) $\frac{\sigma}{\varepsilon_o}$ c) 0 d) none of these

34. A parallel plate air capacitor of capacitance C is connected to a cell of emf V and then disconnected from it. A dielectric slab of dielectric constant K, which can just fill the air gap of the capacitor, is now inserted in it Which of the following is incorrect?

a) The change in energy stored is $1/2\ CV^2\ (1/K - 1)$

b) The charge on the capacitor is not conserved

c) The potential difference between the plates decreases K times.

d) The energy stored in the capacitor decreases K times.

35. When a proton is accelerated through 1 V, then its kinetic energy will be:

a) 1840 eV b) 13.6 eV c) 1 eV d) 0.54 eV

36. A metallic sphere of radius 18 cm has been given a charge of 5×10^{-6} C. The energy of the charged conductor is

a) 0.2 J b) 0.6 J c) 1.2 J d) 2.4 J

37. 2μF capacitance has potential difference across its two terminals 200 volts. It is disconnected from battery and then another uncharged capacitance is connected in parallel to it, then P.D. becomes 20 volts. Then the capacity of another capacitance will be:

a) 2 μF b) 4 μF c) 18 μF d) 10 μF

38. Metallic sphere of radius R is charged to potential V. Then charge q is proportional to

a) V b) R c) both V and R d) none of these

39. The capacity of a parallel plate capacitor with no dielectric substance but with a separation of 0.4 cm is 2 μF. The separation is reduced to half and it is filled with a dielectric substance of value 2.8. The final capacity of the capacitor is:

a) 11.2 μF b) 15.6 μF c) 19.2 μF d) 22.4 μF

40. Three capacitors each of capacity 4μF are to be connected in such a way that the effective capacitance is 6μF. This can be done by:

a) Connecting them in parallel b) Connecting two in series and one in parallel

c) Connecting two in parallel and one in series d) Connecting all of them in series

41. A parallel plate condenser has a capacitance 50 μF in air and 110 μF when immersed in an oil. The dielectric constant 'K' of the oil is:

a) 0.45 b) 0.55 c) 1.10 d) 2.20

42. The condensers of capacity C_1 and C_2 are connected in parallel, then the equivalent capacitance is:

a) $C_1 + C_2$ b) $C_1C_2/C_1 + C_2$ c) C_1/C_2 d) C_2/C_1

43. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: Increasing the charge on the plates of acapacitor means increasing the capacitance.
Reason : Capacitance is directly proportional to charge
a) If both assertion and reason are true and reason is the correct explanation of assertion
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

44. Two charged conducting spheres of radii a and b are connected to each other by a wire. The ratio of electric fields at the surfaces of two spheres is
a) $\frac{a}{b}$ b) $\frac{b}{a}$ c) $\frac{a^2}{b^2}$ d) $\frac{b^2}{a^2}$

45. 8 drops of mercury of equal radii possessing equal charges combine to form a big drop. Then the capacitance of bigger drop compared to each individual small drop is:
a) 8 times b) 4 times c) 2 times d) 32 times

46. In a Van de Graaff type generator, a spherical metal shell is to be 15 x 10^6 V electrode. The dielectric strength of the gas surrounding the electrode is 5 x 10^7 V m^{-1}. The minimum radius of the spherical shell required is:
a) 1 m b) 2 m c) 1.5 m d) 3 m

47. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: Polar molecules have permanent dipole moment.
Reason : In polar molecule, the centres of positive and negative charges coincide even when there is no external field.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

48. A capacitor of 20 μF is charged to 500 volts and connected in parallel with another capacitor of 10 μF and charged to 200 volts. The common potential is:
a) 200 volts b) 300 volts c) 400 volts d) 500 volts

49. Minimum number of capacitors each of 8μF and 250 V used to make a composite capacitor of 16 μF and 1000 V are
a) 8 b) 32 c) 16 d) 24

50. A parallel plate condenser with oil between the plates (dielectric constant of oil K = 2) has a capacitance C. If the oil is removed, then capacitance of the capacitor becomes:
a) $\sqrt{2}C$ b) 2C c) C/$\sqrt{2}$ d) C/2

51. In case of a Van de Graaff generator, the breakdown field of air is
a) 2 x 10^8 V m^{-1} b) 3 x 10^6 V m^{-1} c) 2 x 10^{-8} V m^{-1} d) 3 x 10^4 V m^{-1}

52. Two metal spheres, one of radius R and the other of radius 2R, both have same surface charge density σ . If they are brought in contact and separated, then the new surface charge densities on each of the sphere are respectively
a) $\frac{5}{2}\sigma, \frac{5}{4}\sigma$ b) $\frac{5}{3}\sigma, \frac{5}{6}\sigma$ c) $\frac{3}{5}\sigma, \frac{6}{5}\sigma$ d) $\frac{2}{3}\sigma, \frac{1}{2}\sigma$

53. An electric dipole is kept in non - uniform electric field. It experiences
   a) A force and a torque b) A force but not a torque c) A torque but not a force
   d) Neither a force nor a torque
54. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
   Assertion: In the absence of an external electric field, the dipole moment per unit volume of a polardielectric is zero.
   Reason : The dipoles of a polar dielectric are randomly oriented.
   a) If both assertion and reason are true and reason is the correct explanation of assertion
   b) If both assertion and reason are true but reason is not the correct explanation of assertion
   c) If assertion is true but reason is false d) If both assertion and reason are false
55. In a charged capacitor, the energy resides:
   a) The positive charges b) Both the positive and negative charges
   c) The field between the plates d) Around the edge of the capacitor plates
56. Point charges +4q,-q and +4q are kept on the x-axis at points x = 0, x = a and x = 2a respectively, then
   a) Only q is in stable equilibrium b) None of the charges are in equilibrium
   c) All the charges are in unstable equilibrium d) All the charges are in stable equilibrium
57. A charge of 40μC is given to a capacitor having capacitance C = 10μF. The stored energy in ergs is:
   a) 80×10^{-6} b) 800 c) 80 d) 8000
58. Van de Graaff generator is used to
   a) store electrical energy b) build up high voltages of few million volts
   c) decelerate charged particle like electrons d) both (a) and (b) are correct
59. The electric field intensity at a point P due to point charge q kept at point Q is 24 N C^{-1} and the electric potential at point P due to same charge is 12 J c^{-1}. The order of magnitude of charge q is:
   a) 10^{-6} C b) 10^{-7}C c) 10^{-10} C d) 10^{-9} C
60. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
   Assertion: If distance between the parallel plates of a capacitor is halved, then its capacitance is doubled.
   Reason: The capacitance depends on the introduced dielectric.
   a) If both assertion and reason are true and reason is the correct explanation of assertion
   b) If both assertion and reason are true but reason is not the correct explanation of assertion
   c) If assertion is true but reason is false. d) If both assertion and reason are false
61. A charge Q is placed at the corner of a cube. The electric flux through all the six faces of the cube is:
   a) $Q/3\ \varepsilon_0$ b) $Q/6\ \varepsilon_0$ c) $Q/8\ \varepsilon_0$ d) Q/ε_0
62. On rotating a point charge having a charge q around a charge Q in a circle of radius r. The work done will be:
   a) $q \times 2\pi r$ b) $q \times 2\pi Qr$ c) Zero d) $Q/2\varepsilon_0 r$

63. In the question number 4, work done in bringing a charge of 4×10^{-9} C from infinity to that point is
a) 2.4×10^{-4} J b) 1.8×10^{-4} J c) 3.2×10^{-5} J d) 4.1×10^{-5} J

64. The capacity of a parallel plate condenser is C. Its capacity when the separation between the plates is halved will be:
a) 4C b) 2C c) C/2 d) C/4

65. Two small spheres each carrying a charge q are placed r metre apart. If one of the spheres is taken around the other one in a circular path of radius r, the work done will be equal to:
a) Force between them x r b) Force between them x 2πr c) Force between them / 2πr
d) Zero

66. A parallel plate capacitor is filled by a dielectric whose relative permittivity varies with the applied voltage (V) as $\varepsilon = \alpha V$ where $\alpha = 2\ V^{-1}$. A similar capacitor with no dielectric is charged to V_o = 78 V. It is then connected to the uncharged capacitor with the dielectric. Final voltage on the capacitor is
a) 2 V b) 3 V c) 5 V d) 6 V

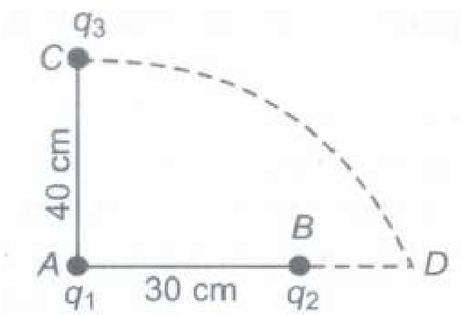
67. A parallel plate capacitor is made by stacking n equally spaced plates connected alternately. If the capacitance between any two plates is C then the resultant capacitance is:
a) C b) nC c) (n - 1)C d) (n + 1)C

68. A parallel plate capacitor of capacitance 5 μF and plate separation 6 cm is connected to a 1 V battery and charged. A dielectric of dielectric constant 4 and thickness 4 cm is introduced between the plates of the capacitor. The additional charge that flows into the capacitor from the battery is
a) 2μC b) 3μC c) 5μC d) 10μC

69. A charge Q is enclosed by a Gaussian spherical surface of radius R. If the radius is doubled, then the outward electric flux will:
a) increase four times b) be reduced to half c) remain the same d) be doubled

70. A 16 pF capacitor is connected to 70 V supply. The amount of electric energy stored in the capacitor is
a) 4.5×10^{-12} J b) 5.1×10^{-8} J c) 2.5×10^{-12} J d) 3.2×10^{-8} J

71. Two charges q_1 and q_2 are placed 30 cm apart, shown in the figure. A third charge q_3 is moved along the arc of a circle of radius 40 cm from C to D. The change in the potential energy of the system is $q_3/4\pi\varepsilon_0$ x k, where k is:



a) $8q_2$ b) $8q_1$ c) $6q_2$ d) $6q_1$

72. Three capacitors each of capacitance C and of breakdown voltage V are joined in series. The capacitance and breakdown voltage of the combination will be:

a) 3C, V/3 b) C/3, 3V c) 3C, 3V d) C/3, V/3

73. A charge q is placed at the centre of the line joining two equal charges Q. The system of the three charges will be in equilibrium, if q is equal to:

a) $-\frac{Q}{2}$ b) $-\frac{Q}{4}$ c) $\frac{Q}{4}$ d) $\frac{Q}{2}$

74. An electric dipole when placed in a uniform electric field E will have minimum potential energy, if the positive direction of dipole moment makes the following angle with E:

a) π b) $\pi/2$ c) Zero d) $3\pi/2$

75. A molecule of a substance has a permanent electric dipole moment of magnitude 10^{-30} cm. A mole of this substance is polarised by applying a strong electrostatic field of magnitude 10^7 V m^{-1}. The direction of field is changed by an angle 60°. The heat released by the substance in aligning its dipole along the new direction of the field is:

a) -6J b) -3J c) 3J d) 6J

76. The work done in bringing a unit positive charge from infinite distance to a point at distance x from a positive charge Q is W. Then the potential ϕ at that point is

a) $\frac{WQ}{x}$ b) W c) $\frac{W}{x}$ d) WQ

77. Which among the following is an example of polar molecule?

a) O_2 b) H_2 c) N_2 d) HCl

78. Two positive ions, each carrying a charge q, are separated by a distance d. If F is the force of repulsion between the ions, the number of electrons missing from each ion will be (e being the charge on an electron):

a) $4\pi\varepsilon_0 Fd^2/e^2$ b) $\sqrt{4\pi\varepsilon_0 Fe^2/d^2}$ c) $\sqrt{4\pi\varepsilon_0 Fd^2/e^2}$ d) $4\pi\varepsilon_0 Fd^2/q^2$

79. A particle of mass m and charge q is placed at rest in a uniform electric field E and then released. The kinetic energy attained by the particle after moving a distance y is:

a) qEy^2 b) qE^2y c) qEy d) q^2Ey

80. Which of the following statements is false for a perfect conductor?

a) The surface of the conductor is an equipotential surface.

b) The electric field just outside the surface of a conductor is perpendicular to the surface.

c)
The charge carried by a conductor is always uniformly distributed over the surface of the conductor.

d) None of these

81. The distance between H^+ and Cl^- ions in HCl molecules is 1.38 $\mathring{A}$. The potential due to this dipole at a distance of 10 $\mathring{A}$ on the axis of dipole is

a) 2.1 V b) 1.8 V c) 0.2 V d) 1.2 V

82. Two spherical conductors each of capacity Care charged to potential Y and - Y. These are then connected by means of a fine wire. The loss of energy is

a) zero b) $\frac{1}{2}CV^2$ c) CV^2 d) 2 CV^2

83. Choose the correct statement.

a) Polar molecules have permanent electric dipole moment.
b) CO_2 molecule is a polar molecule. c) H_2O is a non-polar molecule
d) The dipole field at large distances falls of as $\frac{1}{r^2}$.

84. Consider a parallel plate capacitor with plates 20 cm by 20 cm and separated by 2 mm. The dielectric constant of the material between the plates is 5. The plates are connected to a voltage source of 500 V. The energy density of the field between the plates will be close to:
a) 2.65 J/m^3 b) 1.95 J/m^3 c) 1.38 J/m^3 d) 0.69 J/m^3.

85. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: The potential difference between the two conductors of a capacitor is small.
Reason: A **c**apacitor is so configured that it confines the electric field lines within a small region of space
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

86. An electric dipole is placed at an angle of 30^0 with an electric field intensity 2.0 X 10^5 N/C. It experiences a torque equal to 4 N m. The charge on the dipole, if the dipole length is 2 cm, is:
a) 8 mC b) 2 mC c) 5 mC d) 7 μC

87. An electric dipole of length 20 cm having ±3 x 10^{-3} C charge placed at 60° with respect to a uniform electric field experiences a torque of magnitude 6 N m. The potential energy of the dipole is
a) $-2\sqrt{3}J$ b) $5\sqrt{3}J$ c) $-3\sqrt{2}J$ d) $3\sqrt{5}J$

88. A parallel plate condenser has a uniform electric field E(V/m) in the space between the plates. If the distance between the plates is d(m) and area of each plate is A(m^2) the energy (joules) stored in the condenser is:
a) E^2Ad/ε_0 b) $(1/2)\varepsilon_0E^2$ c) ε_0EAd d) $(1/2)\varepsilon_0E^2Ad$

89. Two identical capacitors are joined in parallel, charged to a potential V and then separated and then connected in series i.e. the positive plate of one is connected to negative of the other:
a) The charges on the free plates connected together are destroyed
b) The charges on the free plates are enhanced
c) The energy stored in the system increases
d) The potential difference in the free plates becomes 2V

90. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: In a series combination of capacitors, charge on each capacitor is same.
Reason: In such a combination, voltage across each capacitor is same.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

91. Electric field strength due to a point charge of 5 μC at a distance of 80 cm from the charge is:
a) 8 x 10^4 N/C b) 7 x 10^4 N/C c) 5 x 10^4 N/C d) 4 x 10^4 N/C

92. Three condensers each of capacitance 2 F are put in series. The resultant capacitance is:

a) 6 F b) 3/2 F c) 2/3 F d) 5 F

93. A slab of material of dielectric constant K has the same area A as the plates of a parallel plate capacitor, and has thickness$\left(\frac{3}{4}d\right)$, where d is the separation of the plates. The change in capacitance when the slab is inserted between the plates is

a) $C = \frac{\varepsilon_o A}{d}\left(\frac{K+3}{4K}\right)$ b) $C = \frac{\varepsilon_o A}{d}\left(\frac{2K}{K+3}\right)$ c) $C = \frac{\varepsilon_o A}{d}\left(\frac{K}{K+3}\right)$ d) $C = \frac{\varepsilon_o A}{d}\left(\frac{4K}{K+3}\right)$

94. An electric dipole is placed at the centre of a hollow conducting sphere. Which of the following is correct?

a) Electric field is zero at every point of the sphere

b) Electric field is not zero anywhere on the sphere

c) The flux of electric field is not zero through the sphere d) All of these

95. A parallel plate capacitor without any dielectric within its plates, has a capacitance C, and is connected to a battery of emf Y. The battery is disconnected and the plates of the capacitor are pulled apart until the separation between the plates is doubled. What is the work done by the agent pulling the plates apart, in this process?

a) $\frac{1}{2}CV^2$ b) $\frac{3}{2}CV^2$ c) $-\frac{3}{2}CV^2$ d) CV^2

96. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as

Assertion: The electric field inside a cavity is always zero.

Reason: Charges reside only on the outer surface of a conductor with cavity.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If both assertion and reason are true but reason is not the correct explanation of assertion

d) If both assertion and reason are false

97. In a regular polygon of n sides, each corner is at a distance r from the centre. Identical charges are placed at (n - 1) corners. At the centre, the magnitude of intensity is E and the potential is V. The ratio VIE is:

a) rn b) r(n - 1) c) (n - 1)/r d) r(n - 1)/n

98. A test charge is moved from lower potential point to a higher potential point. The potential energy of test charge will

a) remain the same b) increase c) decrease d) become zero

99. A bullet of mass 2 gm is having a charge of 2μC. Through what potential difference must it be accelerated, starting from rest, to acquire a speed of 10m/s.

a) 5 kV b) 50 kV c) 5 V d) 50 V

100. The insulated spheres of radii R_l and R_2 having charges Q_1 and Q_2 respectively are connected to each other. There is:

a) No change in the energy of the system b) An increase in the energy of the system

c) Always a decrease in the energy of the system

d) A decrease in the energy of the system unless $Q_1R_2 = Q_2R_1$

101. Three capacitors of capacitances 3μF, 9μF and 18μF are connected once in series and another time in parallel. The ratio of equivalent capacitance in the two cases (C_s/C_p) will be:

a) 1: 15 b) 15: 1 c) 1: 1 d) 1: 3

102. In a region the potential is represented by V(*x, y, z*) = 6*x* - 8*xy* - 8*y* + 6*yz*, where V is in volts and *x, y, z* are in meters. The electric force experienced by a charge of 2 coulomb situated at point (1, 1, 1) is:
a) $6\sqrt{5}N$ b) 30 N c) 24 N d) $4\sqrt{35}N$

103. In the question number 66, the charge on capacitors C_1 and C_4 are:
a) 4 x 10^{-3} C, 12 x 10^{-3} C b) 6 x 10^{-3} C, 12 x 10^{-3} C c) 2 x 10^{-3} C, 4 x 10^{-3} C
d) 3 x 10^{-3} C, 2 x 10^{-3} C

104. A parallel plate capacitor is made by placing n equally spaced plates connected alternatively. If the capacitance between any two adjacent plates is C then the resultant capacitance is
a) nC b) $\frac{C}{n}$ c) (n+1)C d) (n-1)C

105. Which of the following statement is true?
a) Electrostatic force is a conservative force.
b)
Potential at a point is the work done per unit charge in bringing a charge from any point to infinity.
c) Electrostatic force is non-conservative. d) Potential is the product of charge and work.

106. An electric dipole has the magnitude of its charge as q and its dipole moment is p. It is placed in a uniform electric field E. If its dipole moment is along the direction of the field, the force on it and its potential energy are respectively:
a) 2q·E and minimum b) q·E and p·E c) Zero and minimum d) q·E and maximum

107. A conducting sphere of radius R is given a charge Q. The electric potential and the electric field at the centre of the sphere respectively are:
a) Zero and $Q/4\pi\varepsilon_0R^2$ b) $Q/4\pi\varepsilon_0R$ and Zero c) $Q/4\pi\varepsilon_0R$ and $Q/4\pi\varepsilon_0R^2$
d) Both are zero.

108. Two points A and B are located in diametrically opposite directions of a point charge of +2 μC at distances 2 m and 1 m respectively from it. The potential difference between A and B is:
a) 3 x 10^3V b) 6 x 10^4V c) -9 x 10^3V d) -3 x 10^3V

109. A simple pendulum of period T has a metal bob which is negatively charged. If it is allowed to oscillate above a positively charged metal plate, its period will:
a) Remains equal to T b) Less than T c) Greater than T d) Infinite

110. Two insulated metallic spheres of 3 μF and 5 μF capacitances are charged to 300 V and 500 V respectively. The energy loss, when they are connected by a wire is:
a) 0.012 J b) 0.0218 J c) 0.0375 J d) 3.75 J

111. If two conducting spheres are separately charged and then brought in contact:
a) The total energy of the two spheres is conserved
b) The total charge on the two spheres is conserved
c) Both the total energy and charge are conserved
d) The final potential is always the mean of the original potentials of the two spheres

112. The electrostatic force between the metal plates of an isolated parallel plate capacitor C having a charge Q and area A, is:

a) Proportional to the square root of the distance between the plates
b) Linearly proportional to the distance between the plates
c) Independent of the distance between the plates
d) Inversely proportional to the distance between the plates

113. When air in a capacitor is replaced by a medium of dielectric constant K, the capacity:
a) Decreases K times b) Increases K times c) Increases K^2 times d) Remains constant

114. 1000 small water drops each of radius r and charge q coalesce together to form one spherical drop. The potential of the big drop is larger than that of the smaller drop by a factor of
a) 1000 b) 100 c) 10 d) 1

115. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: For a point charge, concentric spheres centered at a location of the charge are equipotential surfaces.
Reason: An equipotential surface is a surface over which potential has zero value.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

116. Four equal charges q each are placed at four corners of a square of side a each. Work done in carrying a charge -q from its centre to infinity is
a) zero b) $\frac{\sqrt{2}q^2}{\pi\varepsilon_o a}$ c) $\frac{\sqrt{2}q}{\pi\varepsilon_o a}$ d) $\frac{q^2}{\pi\varepsilon_o a}$

117. A system consists of two charges 4 μC and -3 μC with no external field placed at (-5 cm, 0, 0) and (5 cm, 0, 0) respectively. The amount of work required to separate the two charges infinitely away from each other is
a) -1.1 J b) 2 J c) 2.5 J d) 3 J

118. If identical charges (-q) are placed at each corner of a cube of side b, then electric potential energy of charge (+q) which is placed at centre of the cube will be:
a) $8\sqrt{2}q^2/4\pi\varepsilon_0 b$ b) $-8\sqrt{2}q^2/4\pi\varepsilon_0 b$ c) $-4\sqrt{2}q^2/4\pi\varepsilon_0 b$ d) $-4q^2\sqrt{3}\pi\varepsilon_0 b$

119. Consider two conducting spheres of radii R_1 and R_2 with $R_1 > R_2$. If the two are at the same potential, and the larger sphere has more charge than the smaller sphere, then
a) the charge density of smaller sphere is less than that of larger sphere.
b) the charge density of smaller sphere is more than that of larger sphere.
c) both spheres may have same charge density. d) none of these.

120. If dielectric constant and dielectric strength be denoted by K and X respectively, then a material suitable for use as a dielectric in a capacitor must have
a) high K and high X b) high K and low X c) low K and high X d) low K and low X

121. Equipotential surfaces
a) are closer in regions of large electric fields compared to regions of lower electric fields
b) will be more crowded near sharp edges of a conductor c) will always be equally spaced
d) both (a) and (b) are correct

122. An electron and a proton are in a uniform electric field, the ratio of their accelerations will be:
a) Zero b) Unity c) The ratio of the masses of proton and electron
d) The ratio of the masses of electron and proton

123. When one electron is taken towards the other electron, then the electric potential energy of the system
a) Decreases b) Increases c) Remains unchanged d) Becomes zero

124. Cathode rays travelling from east to west enter into region of electric field directed towards north to south in the plane of paper. The deflection of cathode rays is towards:
a) East b) South c) West d) North

125. The electric potential at the surface of an atomic nucleus (Z = 50) of radius 9.0 x 10^{-13} cm is
a) 80 volts b) 8 x 10^6 volts c) 9 volts d) 9 x 10^5 volts

126. The electric field inside a spherical shell of uniform surface charge density is:
a) Zero b) Constant, less than zero
c) Directly proportional to the distance from the centre d) None of the above

127. A hollow insulated conducting sphere is given a positive charge of 10μC. What will be the electric field at the centre of the sphere if its radius is 2 meters:
a) Zero b) 5μCm^{-2} c) 20μCm^{-2} d) 8μCm^{-2}

128. A cylindrical capacitor has two co-axial cylinders of length 20 cm and radii 1.5 cm and 1.6 cm. The outer cylinder is earthed and inner cylinder is given a charge of 4 μC. The capacitance of the system is (neglect end effects)
a) 2.8 x 10^{-8}F b) 4.2 x 10^{-14}F c) 1.7 x 10^{-10}F d) 3.4 x 10^{-12}F

129. A parallel plate condenser with a dielectric constant K between the plates has a capacity C and is charged to a potential Y volt. The dielectric slab is slowly removed from, between the plates and then reinserted. The net work done by the system in this process is
a) zero b) $\frac{1}{2}(K-1)CV^2$ c) $\frac{CV^2(K-I)}{K}$ d) (K -I)CV^2

130. The acceleration of an electron in an electric field of magnitude 50 V/cm, if e/m value of the electron is 1.76 x 10^{11} C/kg, is:
a) 8.8 x 10^{14} m/sec^2 b) 6.2 x $I0^{13}$ m/sec^2 c) 5.4 x 10^{12} m/sec^2 d) Zero

131. The capacity of parallel plate condenser depends on:
a) The type of metal used b) The thickness of plates
c) The potential applied across the plates d) The separation between the plates

132. Three capacitors of capacitance 3 μF, 10 μF and 15 μF are connected in series to a voltage source of 100 V. The charge on 15 μF is:
a) 50 μC b) 100 μC c) 200 μC d) 280 μC

133. The electric potential at a point on the axis of an electric dipole depends on the distance r of the point from the dipole as:
a) ∝ 1/r b) ∝ 1/r^2 c) ∝ r d) ∝ 1/r^3

134. There is an electric field E in X-direction. If the work done on moving a charge 0.2 C through a distance of 2 m along a line making an angle 60^0 with the X-axis is 4.0, what is the value of E:
a) $\sqrt{3}$ N/C b) 4 N/C c) 5 N/C d) 20 N/C

135. Two metallic spheres of radii 1 cm and 3 em are given charges of -1 x 10^{-2} C and 5 x 10^{-2} C, respectively. If these are connected by a conducting wire, the final charge on the bigger sphere is:
a) 3 X 10^{-2} C b) 4 X 10^{-2} C c) 1 X 10^{-2} C d) 2 X 10^{-2} C

136. If the distance between parallel plates of a capacitor is halved and dielectric constant is doubled then the capacitance:
a) Decreases two times b) Increases two times c) Increases four times
d) Remain the same

137. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: Dielectric polarisation means formation of positive and negative charges inside the dielectric.
Reason: Free electrons are formed in this process
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

138. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: Capacity of a parallel plate capacitor increases when distance between the plates is decreased.
Reason: Capacitance of capacitor is inversely proportional to distance between them.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

139. Two tiny spheres carrying charges 1.8 μC and 2.8 μC are located at 40 cm apart. The potential at the mid-point of the line joining the two charges is
a) 3.8×10^4 V b) 2.1×10^5 V c) 4.3×10^4 V d) 3.6×10^5 V

140. Suppose the charge of a proton and an electron differ slightly. One of them is - e, the other is (e + e). If the net f electrostatic force and gravitational force between two hydrogen atoms placed at a distance d (much greater than atomic size) apart is zero, then Δe is of the order of: [Given mass of hydrogen m_h = 1.67 X 10^{-27} kg]
a) 10^{-23} C b) 10^{-37} C c) 10^{-47} C d) 10^{-20} C

141. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: Work done in moving a charge between any two points in an electric field is independent of the path followed by the charge, between these points.
Reason : Electrostatic force is a non conservative force.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false.

142. The work done to move a unit charge along an equipotential surface from P to Q
a) must be defined as $-\int_P^Q \vec{E}.\overrightarrow{dl}$ b) is zero c) can have a non-zero value
d) both (a) and (b) are correct

143. A parallel plate capacitor has a uniform electric field E in the space between the plates. If the distance between the plates is d and area of each plate is A, the energy stored in the capacitor is:

a) $E^2 Ad/\varepsilon_0$ b) $(1/2)\ \varepsilon_0 E^2 Ad$ c) $\varepsilon_0 EAd$ d) $(1/2)\ \varepsilon_0 E^2$

144. Which of the following statements is true about the relation between electric field and potential?

a) Electric field is in the direction in which the potential decreases steepest

b)

Magnitude of electric field is given by the change in the magnitude of potential per unit displacement normal to the equipotential surface at that point.

c) In the region of strong electric field, equipotential surfaces are far apart.

d) Both the statements (a) and (b) are correct.

145. The distance between the two charges +q and -q of a dipole is r. On the axial line at a distance d from the centre of dipole, the intensity is proportional to:

a) q/d^2 b) qr/d^2 c) q/d^3 d) qr/d^3

146. A capacitor is charged through a potential difference of 200 V, when 0.1 C charge is stored in it. The amount of energy released by it, when it is discharged is:

a) 5 J b) 10 J c) 20 J d) 2.5 J

147. Two spheres of radius a and b respectively are charged and joined by a wire. The ratio of electric field of the spheres is:

a) a/b b) b/a c) a^2/b^2 d) b^2/a

148. The magnitude of electric field E in the annular region of a charged cylindrical capacitor

a) is the same throughout b) is higher near the outer cylinder than near the inner cylinder

c) varies as $\frac{1}{r^2}$ where r is the distance from the axis

d) varies as $\frac{1}{r^3}$ where r is the distance from the axis

149. An electric dipole of moment $\vec{p}$ is placed in a uniform electric field $\vec{E}$. Then

(i) the torque on the dipole is $\vec{p} \times \vec{E}$.

(ii) the potential energy of the system is $\vec{p}.\vec{E}$.

(iii) the resultant force on the dipole is zero.

Choose the correct option.

a) (i), (ii) and (iii) are correct b) (i) and (iii) are correct and (ii) is wrong c) only (i) is correct

d) (i) and (ii) are correct and (iii) is wrong

150. A capacitor has some dielectric between its plates, and the capacitor is connected to a de source. The battery is now disconnected and then the dielectric is removed, then

a) capacitance will increase b) energy stored will decrease c) electric field will increase.

d) voltage will decrease

151. Two insulated charged spheres of radii 20 cm and 25 cm respectively and having an equal charge Q are connected by a copper wire, then they are separated:

a) Both the spheres will have the same charge Q

b) Charge on the 20 cm sphere will be greater than that on the 25 cm sphere

c) Charge on the 25 cm sphere will be greater than that on the 20 cm sphere

d) Charge on each of the sphere will be 2Q

152. Consider a uniform electric field in the z-direction. The potential is a constant

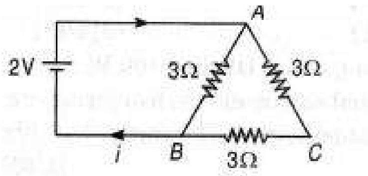
a) for any x for a given z b) for any y for a given z c) on the x-y plane for a given z
d) all of these

153. A condenser of capacity 50μF is charged to 10 volts. Its energy is equal to:
a) 2.5×10^{-3} joule b) 2.5×10^{-4} joule c) 5×10^{-2} joule d) 1.2×10^{-8} joule

154. A series combination of n_1 capacitors, each of value C_1 is charged by a source of potential difference 4V. When another parallel combination of n_2 capacitors, each of value C_2, is charged by a source of potential difference V, it has the same (total) energy stored in it, as the first combination has. The value of C_2, in terms C_1, is then:
a) $2 C_1 / n_1n_2$ b) $16 \times n_2 / n_1 \times C_1$ c) $2 \times n_2 / n_1 \times C_1$ d) $16 C_1 / (n_1 x n_2)$

155. The energy of a charged capacitor is given by the expression (q = charge on the conductor and C = its capacity):
a) $q^2/2C$ b) q^2/C c) $2qC$ d) $q/2C^2$

156. The current in the following circuit is _______.



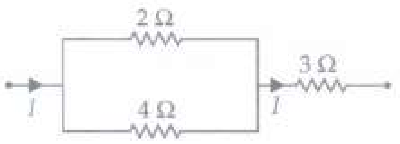
a) 1A b) $\frac{2}{3}A$ c) $\frac{2}{9}A$ d) $\frac{1}{8}A$

157. If voltage across a bulb rated 220 V, 100 W drops by 2.5 % of its rated value, the percentage of the rated value by which the power would decrease is
a) 20% b) 2.5% c) 5% d) 10%

158. In India, electricity is supplied for domestic use at 220 V. It is supplied at 110 V in USA. If the resistance of a 60 W bulb for use in India is R, the resistance of a 60 W bulb for use in USA will be ___________.
a) R/2 b) R c) 2R d) R/4

159. Consider the following two statements:
(i) Kirchhoff's junction law follows from the conservation of charge.
(ii) Kirchhoff's loop law follows from the conservation of energy.
Which of the following is correct?
a) Both (i) and (ii) are wrong b) (i) is correct and (ii) is wrong
c) (i) is wrong and (ii) is correct d) Both (i) and (ii) are correct

160. In the circuit shown in figure heat developed across 2 Ω, 4 Ω and 3 Ω resistances are in the ratio of



a) 2: 4 : 3 b) 8: 4: 12 c) 4: 8 : 27 d) 8: 4 : 27

161. Range of resistivity for metals is
a) 10^{-6} Ω m to 10^{-4} Ω m b) 10^{-7} Ω m to 10^{-5} Ω m c) 10^{-8} Ω m to 10^{-6} Ω m
d) 10^{-9} Ω m to 10^{-7} Ω m

162. If the resistance of a conductor is 5W at 50°C and 7Ω at 100°C, then the mean temperature coefficient of resistance (of the material) is _______.

a) 0.01/°C b) 0.04/°C c) 0.06/°C d) 0.08/°C

163. n resistors each of resistance R first combine to give maximum effective resistance and then combine to give minimum effective resistance. The ratio of the maximum to minimum resistance is

a) n b) n^2 c) n^2-1 d) n^3

164. Two cells of emf's approximately 5 V and 10 V are to be accurately compared using a potentiometer of length 400 cm.

a) The battery that runs the potentiometer should have voltage of 8 V.

b)

The battery of potentiometer can have a voltage of 15V and R adjusted so that the potential drop across the wire slightly exceeds 10V

c) The first portion of 50 cm of wire itself should have a potential drop of 10V.

d) Potentiometer is usually used for comparing resistances and not voltages.

165. You are given several identical resistance each of value R=10 Ω and each capable of carrying a maximum current of one ampere. It is required to make a suitable combination of these resistance of 5 Ω which can carry a current of 4 ampere. The minimum number of resistance of the type R that will be required for this job is :

a) 4 b) 10 c) 8 d) 20

166. The internal resistance of a cell of emf 2V is 0.1Ω. It's connected to a resistance of 3.9 Ω. The voltage across the cell will be :

a) 0.5 volt b) 1.9 volt c) 1.95 volt d) 2 volt

167. Two cells ε_1 and ε_2 connected in opposition to each other as shown in figure. The cell ε_1 is of emf 9 V and internal resistance 3 Ω the cell ε_2 is of emf 7 V and internal resistance 7 Ω. The potential difference between the points A and B is

a) 8.4V b) 5.6V c) 7.8V d) 6.6V

168. A potentiometer wire of length 100 cm has a resistance of 10 Ω. It is connected in series with a resistance and a cell of emf 2 V and of negligible internal resistance. A source of emf 10m V is balanced against a length of 40 ern of the potentiometer wire. What is the value of external resistance?

a) 790Ω b) 890Ω c) 990Ω d) 1090Ω

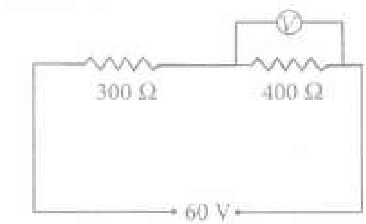
169. The correct combination of three resistances 1Ω, 2 Ω and 3 Ω to get equivalent resistance $\frac{11}{5}\Omega$ is

a) All three are combines in parallel b) All three are combine in series

c) 1 Ω and 2 Ω in parallel and 3 Ω is in series to both

d) 2Ω and 3 Ω are combined in parallel and 1 Ω is in series to both.

170. A heater is designed to operate with a power of 1000W in a 100 V line. It is connected in combination with a resistance of 10 Ω and a resistance R, to a 100 V mains as shown in the figure. What will be the value of R so that the heater operates with a power of 62.5 W?



a) 15Ω b) 10Ω c) 5Ω d) 25Ω

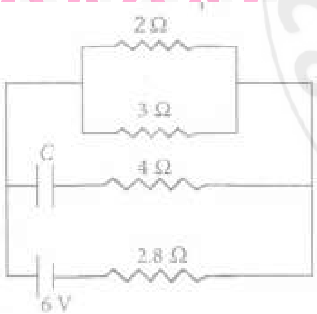
171. The resistance of a wire is R ohm. If it is melted and stretched to n times its original length, its new resistance will be ________.
a) nR b) $\frac{R}{n}$ c) n^2R d) $\frac{R}{n^2}$

172. A battery of 6 volts is connected to the terminals of a three metre long wire of uniform thickness and resistance of the order of 100 Ω. The difference of potential between two points separated by 50 cm on the wire will be :
a) 1 V b) 1.5 V c) 2 V d) 3 V

173. When a metal conductor connected to left gap of a meter bridge is heated, the balancing point
a) shifts towards right b) shifts towards left c) remains unchanged d) remains at zero

174. The equivalent resistance of series combination of four equal resistors is S. If they are joined in parallel, the total resistance is P. The relation between S and P is given by S = nP. Then the minimum possible value of n is:
a) 12 b) 14 c) 16 d) 10

175. Calculate the steadystate current in the 2 Ω resistor shown in the circuit in the figure. The internal resistance of the battery is negligible and the capacitance of the condenser C is 0.2 μF.



a) 0.6 A b) 0.9A c) 1.2A d) 0.1A

176. Ten identical cells connected in series are needed to heat a wire of length one metre and radius 'r' by 10°C in time 't'. How many cells will be required to heat the wire of length two metre of the same radius by the same temperature in time ________.
a) 10 b) 20 c) 30 d) 40

177. Arrange the following materials in increasing order of their resistivity, Nichrome, Copper, Germanium, Silicon
a) Copper < Nichrome < Germanium < Silicon
b) Germanium < Copper < Nichrome < Silicon
c) Nichrome < Copper < Germanium < Silicon
d) Silicon < Nichrome < Germanium < Copper

178. There are three copper wires of length and cross-sectional area (L, A), (2L, A/2) (L/2,2A).In which case is the resistance minimum?

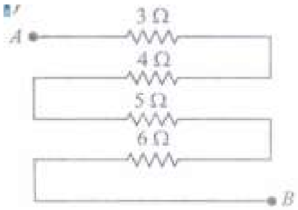
a) It is the same in all three cases b) Wire of cross-sectional area 2A
c) Wire of cross-sectional area A d) Wire of cross-sectional area $\frac{1}{2}A$

179. 3 V potentiometer used for the determination of internal resistance of a 2.4V cell. The balance point of the cell in open circuit is 75.8 cm. When a resistor of 10.2 Ω is used in the external circuit of the cell the balance point shifts to 68.3 ern length of the potentiometer wire. The internal resistance of the cell is
a) 2.5Ω b) 2.25Ω c) 1.12Ω d) 3.2Ω

180. A current of 21, passing through a conductor produces 80 J of heat in 10s. The resistance of the conductor in ohm is ________.
a) 0.5 b) 2 c) 4 d) 20

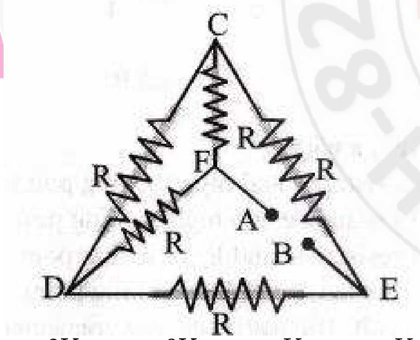
181. A milli voltmeter of 25 millivolt range is to be converted into an ammeter of 25-ampere range. The value (in ohm) of necessary shunt will be _______.
a) 0.001 b) 0.01 c) 1 d) 0.05

182. Equivalent resistance (in ohm) of the given network is



a) 28 b) 18 c) 26 d) 25

183. Five equal resistances each of resistance R are connected as shown in the figure. A battery of V volts is connected between A and B. The current flowing in AFCEB will be ______.



a) $\frac{2V}{R}$ b) $\frac{3V}{R}$ c) $\frac{V}{R}$ d) $\frac{V}{2R}$

184. In an atom electrons revolves around the nucleus along a path of radius 0.72 $\mathring{A}$ making 9.4 $\times$ 10^{18} revolution per second. The equivalent current is (e = 1.6 $\times$ 10^{-19} C)
a) 1.2 A b) 1.5 A c) 1.4 A d) 1.8 A

185. n equal resistors are first connected in series and then parallel. What is the ratio of the maximum to minimum resistance?
a) n b) 1 / n^2 c) n^2 d) 1 / n

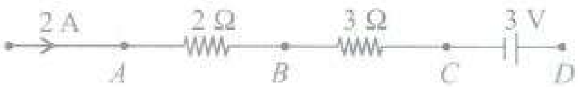
186. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion : In meter bridge experiment, a high resistance is always connected in series with a galvanometer.
Reason : As resistance increases current through the circuit increases.

a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

187. Four wires of the same diameter are connected, in turn, between two points maintained at a constant potential difference. Their resistivities and lengths are; ρ and L (wire 1), 1.2 ρ and 1.2 L (wire 2), 0.9 ρ and 0.9 L (wire 3) and ρ and 1.5 L (wire 4). Rank the wires according to the rates at which energy is dissipated as heat, greatest first,
a) 4 > 3 > 1 > 2 b) 4 > 2 > 1 > 3 c) 1 > 2 > 3 > 4 d) 3 > 1 > 2 > 4

188. A wire has a resistance of 3.1 W at 30°C and resistance of 4.5W at 100°C. The temperature coefficient of resistance of the wire is _______.
a) 0.0064°C^{-1} b) 0.00034°C^{-1} c) 0.0025°C^{-1} d) 0.0012°C^{-1}

189. In the given circuit the potential at point B is zero, the potential at points A and D will be



a) V_A = 4 V; V_D = 9 V b) V_A = 3 V; V_D = 4 V c) V_A = 9 V; V_D = 3 V d) V_A = 4 V; V_D = 3 V

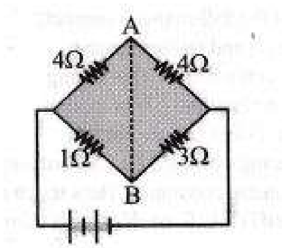
190. A galvanometer of resistance 50 W is connected to battery of 3 V along with a resistance of 2950 W in series. A full scale deflection of 30 divisions is obtained in the galvanometer. In order to reduce this deflection to 20 divisions, the resistance in series should be ______.
a) 5050 W b) 5550 W c) 6050 W d) 4450 W

191. In the series combination of n cells each cell having emf ϵ and internal resistance r. If three cells are wrongly connected, then total emf and internal resistance of this combination will be
a) nϵ, (nr-3r) b) (nϵ - 2ϵ), nr c) (nϵ - 4ϵ), nr d) (nϵ - 6ϵ), nr

192. In producing chlorine through electrolysis, 100-watt power at 125 V is being consumed. How much chlorine per minute is liberated? (E.C.E. of chlorine is 0.367 x 10-6 kg/coulomb).
a) 21.3 mg b) 24.3 mg c) 13.6 mg d) 17.6 mg

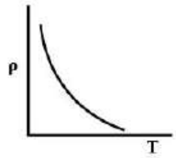
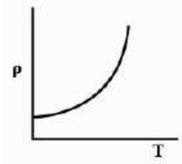
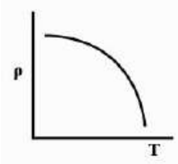
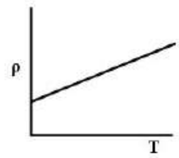
193. A cell can be balanced against 110 cm and 100 cm of potentiometer wire, respectively with and without being short-circuited through a resistance of 10 W. Its internal resistance is _______.
a) 1.0 ohm b) 0.50 ohm c) 2.0 ohm d) zero

194. In the circuit shown, if a conducting wire is connected between points A and B, the current in this wire will _______.



a) flow in the direction which will be decided by the value of V b) be zero
c) flow from B to A d) flow from A to B

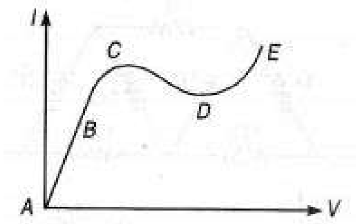
195. Which of the following graph represents the variation of resistivity (r) with temperature (T) for copper?

a)  b)  c)  d) 

196. The resistances of the four arms P, Q, R and S in a Wheatstone bridge are 10 ohm, 30 ohm, 30 ohm and 90 ohm, respectively. The e.m.f. and internal resistance of the cell are 7 volt and 5 ohm respectively. If the galvanometer resistance is 50 ohm, the current drawn from the cell will be :

a) 2.0 A b) 1.0 A c) 0.2 A d) 0.1 A

197. From the graph between current I and voltage V shown in figure, identify the portion corresponding to negative resistance.



a) DE b) CD c) BC d) AB

198. If a neglegibly small current is passed through a wire of length 15 m and of resistance 5 Ω having uniform cross-section of $6 \times 10^{-7} m^2$, then coefficient of resistivity of material, is _______.

a) 1×10^{-7} Ω-m b) 2×10^{-7} Ω-m c) 3×10^{-7} Ω-m d) 4×10^{-7} Ω-m

199. A wire connected in the left gap of a meter bridge balance a 10 Ω resistance in the right gap to a point, which divides the bridge wire in the ratio 3 : 2. If the length of the wire is 1m. The length of one ohm wire is:

a) 0.057 m b) 0.067 m c) 0.37 m d) 0.134 m

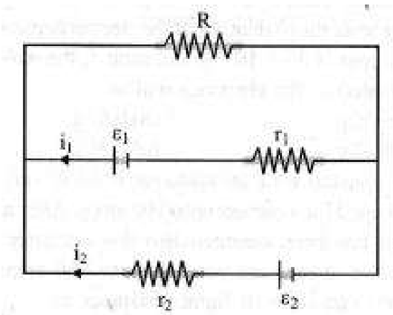
200. A steady current of 1.5 amp flows through a copper voltameter for 10 minutes. If the electro chemical equivalent of copper is 30×10^{-5} g coulomb^{-1}, the mass of copper deposited on the electrode will be _____.

a) 0.50 g b) 0.67 g c) 0.27 g d) 0.40 g

201. The temperature co-efficient of resistance of a wire is $0.00125/^0C$. At 300 K it's resistance is 1 Ω. The resistance of the wire will be 2Ω at :

a) 1154 K b) 1127 K c) 1100 K d) 1400 K

202. See the electric circuit shown in the figure.

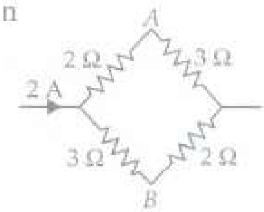


Which of the following equations is correct equation for it?

a) $\varepsilon_2 - i_2 r_2 - \varepsilon_1 - i_1 \eta_1 = 0$ b) $-\varepsilon_2 - (i_1 + i_2) R + i_1 r_2 = 0$

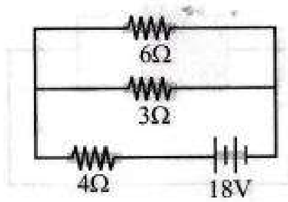
c) $\varepsilon_1 - (i_1 + i_2) R + i_1 r_1 = 0$ d) $\varepsilon_1 - (i_1 + i_2) R - i_1 \eta_1 = 0$

203. The potential difference between A and B as shown in figure is



a) 1 V b) 2 V c) 3 V d) 4 V

204. The total power dissipated in watts in the circuit shown here is _______.



a) 40 b) 54 c) 4 d) 16

205. Match the Column I with Column II.

Column I		Column II	
(A)	Ohm's law is applicable to	(p)	metals
(B)	Ohm's law is not applicable to	(q)	greater resistivity
(C)	alloys have	(r)	diodes, electrolytes, semiconductors

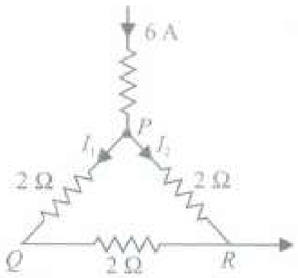
a) A-r, B-q, C-p b) A-p, B-r, C-q c) A-r, B-p, C-q d) A-q, B-r, C-p

206. The color code of a resistance is given below

The vaiues ofresistance and tolerance, respectively, are:

a) 470Ω,5% b) 470kΩ,5% c) 47kΩ,10% d) 4.7 kΩ,5%

207. A current of 6 A enters one corner P of an equilateral triangle PQR having 3 wires of resistances 2 Ω each and leaves by the corner R. Then the currents I_1 and I_2 are



a) 2 A, 4 A b) 4 A, 2 A c) 1 A, 2 A d) 2 A, 3 A

208. A metal rod of length 10cm and a rectangular cross section of 1 cm x $\frac{1}{2}$ cm is connected to a battery across opposite faces. The resistance will be

a) maximum when the battery is connected across 1 cm x $\frac{1}{2}$ cm faces

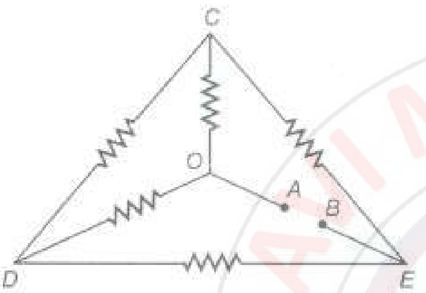
b) maximum when the battery is connected across 10 cm x $\frac{1}{2}$ cm faces.

c) maximum when the battery is connected across 10 cm x $\frac{1}{2}$ crn faces

d) same irrespective of the three faces.

209. With increase in temperature the conductivity of
a) metals increases and of semiconductor decreases
b) semiconductors increases and of metals decreases.
c) in both metals and semiconductors increases
d) in both metal and semiconductor decreases.

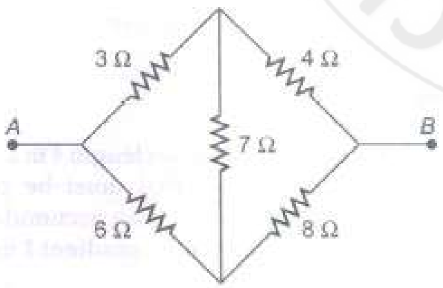
210. In the network shown in the figure each of resistance is equal to 2 Ω. The resistance between A and B is



a) 1 Ω b) 2 Ω c) 3 Ω d) 4 Ω

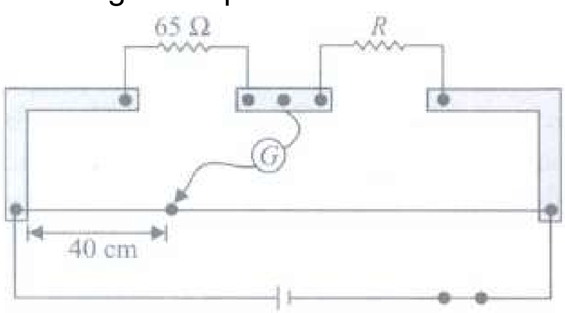
211. The potential gradient along the length of a uniform wire is 10 volt/metre. B and C are the two points at 30 cm and 60 cm point on a meter scale fitted along the wire. The potential difference between B and C will be :
a) 3 volt b) 0.4 volt c) 7 volt d) 4 volt

212. In the given figure, equivalent resistance between A and B will be :



a) $\frac{14}{3}\Omega$ b) $\frac{3}{14}\Omega$ c) $\frac{9}{14}\Omega$ d) $\frac{14}{9}\Omega$

213. What is the value of unknown resistance R, if galvanometer shows null deflection in the given meter bridge set up?



a) 97.50Ω b) 105Ω c) 150Ω d) 110Ω

214. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

Assertion: Drift velocity of electrons is independent of time.

Reason : Electrons are accelerated in the presence of electric field

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false

215. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

Assertion : Current can be represented with an arrow.

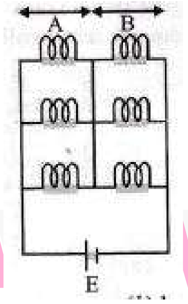
Reason: Current is a vector quantity

a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false

216. Six similar bulbs are connected as shown in the figure with a DC source of emf E and zero internal resistance. The ratio of power consumption by the bulbs when (i) all are glowing and (ii) in the situation when two from section A and one from section B are glowing, will be: ________.

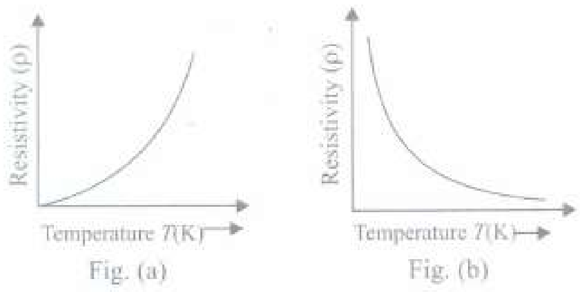


a) 9:4 b) 1:2 c) 2:1 d) 4:9

217. A battery of emf 15V and internal resistance of 4 Ω is connected to a resistor. If the current in the circuit is 2 A and the circuit is closed. Resistance of the resistor and terminal voltage of the battery will be

a) 2.5 Ω, 6 V b) 3.5 Ω, 6 V c) 2.5 Ω,7 V d) 3.5 Ω, 7 V

218. Figure (a) and figure (b) both are showing the variation of resistivity (p) with temperature (T) for some materials. Identify the type of these materials.



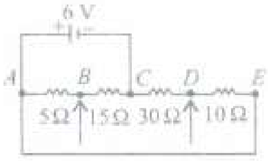
a) Conductor and semiconductor b) Conductor and Insulator

c) Insulator and semiconductor d) Both are conductors

219. The rate of increase of themo e.m.f. with temperature at the neutral temperature of a thermocouple __________.

a) is positive b) is zero
c) depends upon the choice of the two materials of the thermocouple d) is negative

220. Four resistors are connected as shown in the figure. A 6 V battery of negligible resistance is connected across terminals A and C. The potential difference across terminals B and D will be



a) Zero b) 1.5V c) 2V d) 3V

221. Resistances P, Q, S and R are arranged in a cyclic order to form a balanced Wheatstone's network. The ratio of power consumed in the branches (P + Q) and (R + S) is:
a) 1: 1 b) R: P c) $p^2: Q^2$ d) $p^2: R^2$

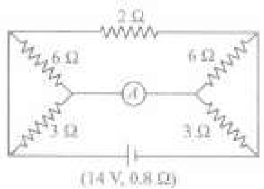
222. A 5-ampere fuse wire can withstand a maximum power of 1 watt in the circuit. The resistance of the fuse wire is _______.
a) 0.04 ohm b) 0.2 ohm c) 5 ohm d) 0.4 ohm

223. The resistance of wire in a heater at room temperature is 65 Ω . When the heater is connected to a 220 V supply the current settles after a few seconds to 2.8 A. What is the steady temperature of the wire. (Temperature coefficient of resistance α = 1. 70 $\times$ 10^{-4} °C^{-1})
a) 955°C b) 1055°C c) 1155°C d) 1258°C

224. Two copper wires of length l and 2l have radii, r and 2r respectively. What is the ratio of their specific resistances?
a) 1 : 2 b) 2 : 1 c) 1 : 1 d) 1 : 3

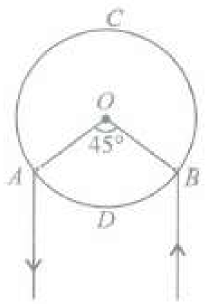
225. Two rods A and B of same material and length have their electric resistances are in ratio 1 : 2. When both the rods are dipped in water, the correct statement will be :
a) A has more loss of weight b) B has more loss of weight
c) Both have same loss of weight d) Loss of weight will be in the ratio 1 : 2

226. The reading of ammeter shown in figure is



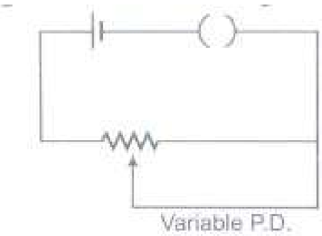
a) 6.56A b) 3.28A c) 2.18A d) 1.09A

227. A and B are two points on a uniform ring of resistance 15 Ω. The $\angle AOB = 45^0$ The equivalent resistance between A and B is



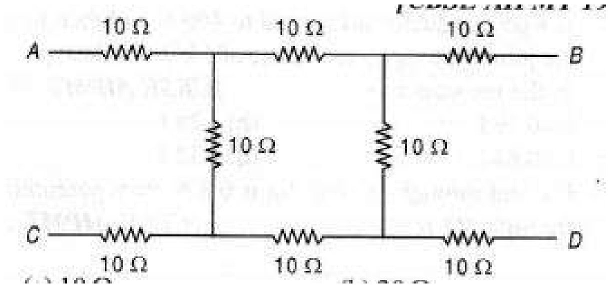
a) 1.64Ω b) 2.84Ω c) 4.57Ω d) 2.64Ω

228. The arrangement as shown in figure is called as :



a) Potential divider b) Potential adder c) Potential subtracter d) Potential multiplier

229. What will be the equivalent resistance of circuit shown in figure between two points A and D?



a) 10 Ω b) 20 Ω c) 30 Ω d) 40 Ω

230. Two identical batteries each of emf 2V and internal resistance 1Ω are available to produce heat in an external resistance by passing a current through it. The maximum power that can be developed across R using these batteries is __________.

a) 3.2Ω b) 2 Ω c) 1.28 Ω d) $\frac{8}{9}$ Ω

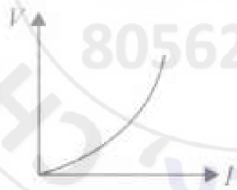
231. The direction of the flow of current through electric circuit is

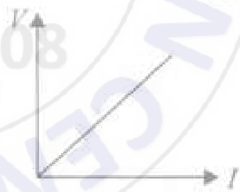
a) from low potential to high potential. b) from high potential to low potential.

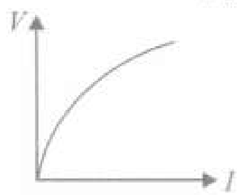
c) does not depend upon potential value. d) current cannot flow through circuit.

232. Which of the following is correct for V-I graph of a good conductor?

a) 

b) 

c) 

d) 

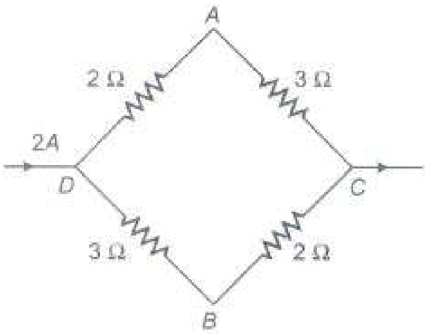
233. The internal resistance of a 2.1 V cell which gives a current of 0.2 A through a resistance of 10 Ω is:

a) 1.0 Ω b) 0.2 Ω c) 0.5 Ω d) 0.8 Ω

234. A battery is charged at a potential of 15V for 8 hours when the current flowing is 10A. The battery on discharge supplies a current of 5A for 15 hours. The mean terminal voltage during discharge is 14V. The "watt-hour" efficiency ofthe battery is _______.

a) 87.5% b) 82.5% c) 80% d) 90%

235. A current of 2 A flows in a system of conductors as shown. The potential difference (V_A - V_B) will be :



a) + 2V b) + 1V c) - 1 V d) - 2 V

236. n equal resistors are first connected in series and then connected in parallel. What is the ratio of the maximum to the minimum resistance ________.

a) n b) $1/n^2$ c) n^2 d) 1/n

237. Combine three resistors 5 Ω , 4.5 Ω and 3 Ω in such a way that the total resistance of this combination is maximum

a) 12.5 Ω b) 13.5 Ω c) 14.5 Ω d) 16.5 Ω

238. The potential difference between the terminals of a cell in an open circuit is 2.2 V. When a resistor of 5W is connected across the terminals of the cell, the potential difference between the terminals of the cell is found to be 1.8 V. The internal resistance of the cell is _______.

a) $\frac{7}{12}\Omega$ b) $\frac{10}{9}\Omega$ c) $\frac{9}{10}\Omega$ d) $\frac{12}{9}\Omega$

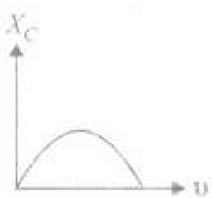
239. In a wheatstone bridge if the battery and galvanometer are interchanged then the deflection in galvanometer will

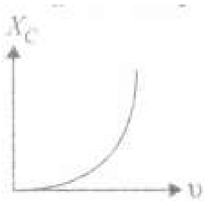
a) change in previous direction b) not change c) change in opposite direction
d) none of these

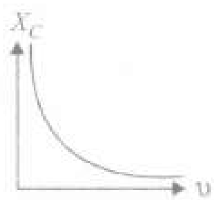
240. A battery having 12 V emf and internal resistance 3 Ω is connected to a resistor. If the current in the circuit is 1A, then the resistance of resistor and lost voltage of the battery when circuit is closed will be

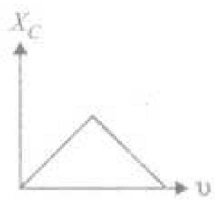
a) 7 Ω , 7 V b) 8 Ω , 8 V c) 9 Ω , 9 V d) 9 Ω , 10 V

241. Which of the following graphs represents the correct variation of capacitive reactance X_c with frequency υ ?

a) 

b) 

c) 

d) 

242. Point out the right statements about the validity of Kirchhoff's junction rule

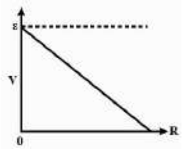
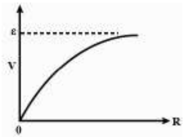
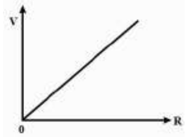
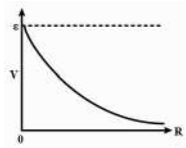
a) it is based on conservation of charge.

b) outgoing currents add up and are equal to incoming currents at a junction.

c) bending or reorienting the wire does not change the validity of Kirchhoff's junction rule.

d) all of above

243. A cell having an emf e and internal resistance r is connected across a variable external resistance R. As the resistance R is increased, the plot of potential difference V across R is given by: _______.

a)  b)  c)  d) 

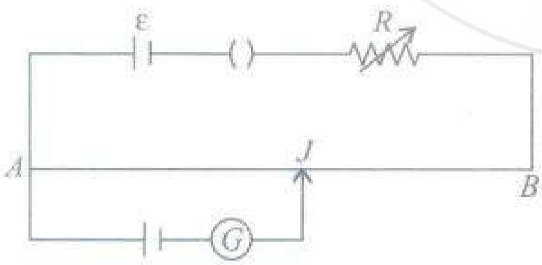
244. A wire of a certain material is stretched slowly by 10 percent. Its new resistance and specific resistance become respectively ______.
a) 1.2 times, 1.3 times b) 1.21 times, same c) both remains the same
d) 1.1 times, 1.1 times

245. A current of 2A flows through a 2Ω resistor when connected across a battery. The same battery supplies a current of 0.5 A when connected across a 9Ω resistor. The internal resistance of the battery is _______.
a) 0.5 Ω b) 1/3 Ω c) 1/4 Ω d) 1 Ω

246. Two wires of the same metal have same length, but their cross-sections are in the ratio 3:1. They are joined in series. The resistance of thicker wire is 10Ω. The total resistance of the combination will be ____________.
a) 10Ω b) 20Ω c) 40Ω d) 100Ω

247. A straight copper wire of length 1000 m and cross sectional are a 1.0 nm^2 carries a current 4.5 A. Assuming that one free electron corresponds to each copper atom. (Density of copper = 8.96 x 103 kg m^{-3}, Atomic mass of copper = 63.5 g, Resistivity of copper wire = 1.69 x 10^{-8} Ω m)
a)
The time taken by an electron to displace from one end of the wire to the other is 4 x 106 s.
b) The sum of electric force acting on all free electrons in the given wire is 1 x 106 N
c)
The time taken by an electron to displace from one end of the wire to the other is 3 x 106 s.
d) Both (b) and (c).

248. AB is a wire of potentiometer with the increase in the value of resistance R, the shift in the balance point J will be



a) towards B b) towards A c) remains constant d) first towards B then back towards A.

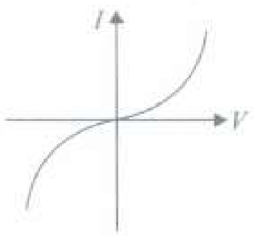
249. Nichrome or Manganin is widely used in wire bound standard resistors because of their:
a) temperature independent resistivity b) very weak temperature dependent resistivity
c) strong dependence of resistivity with temperature d) mechanical strength

250. In the series combination of two or more than two resistances
a) the current through each resistance is same
b) the voltage through each resistance is same
c) neither current nor voltage through each resistance is same
d) both current and voltage through each resistance are same.

251. In meter bridge, the balancing length from left is found to be 20 cm when standard resistance of 1Ω is in right gap. The value of unknown resistance is _______.
a) 0.25 Ω b) 0.4 Ω c) 0.5 Ω d) 4 Ω

252. The current in a wire varies with time according to the equation I = 4 + 2 t, where I is in ampere and t is in second. The quantity of charge which has to be passed through a cross-section of the wire during the time t = 2 s to t = 6 s is
a) 40 C b) 48 C c) 38 C d) 43 C

253. The I- V characteristics shown in figure represents



a) ohmic conductors b) non-ohmic conductors c) insulators d) superconductors

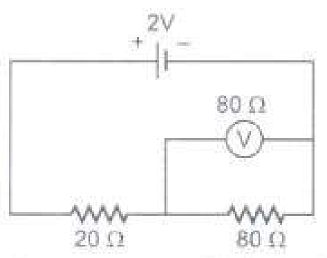
254. Four resistances of 3Ω , 3Ω, 3Ω and 4Ω respectively are used to form a Wheatstone bridge. The 4Ω resistance is short circuited with a resistance R in order to get bridge balanced. The value of R will be:
a) 10Ω b) 11Ω c) 12Ω d) 13Ω

255. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: Kirchhoff's junction rule can be applied to a junction of several lines or a point in a line.
Reason: When steady current is flowing, there is no accumulation of charges at any junction or at any point in a line.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true and reason is the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

256. The solids which have the negative tempearture coefficient ofresistance are _________.
a) insulators and semicondutors b) metals c) insulators only d) semiconductors only

257. A6 volt battery is connected to the terminals of the three metre long wire of uniform thickness and resistance of 100 ohm. The difference of potential between two points on the wire separated by a distance of 50 cm will be ______.
a) 1.5 volt b) 3 volt c) 3 volt d) 1 volt

258. In the adjoining circuit, the e.m.f. of the cell is 2 volt and the internal resistance is negligible. The resistance of the voltmeter is 80 ohm. The reading of the voltmeter will be :

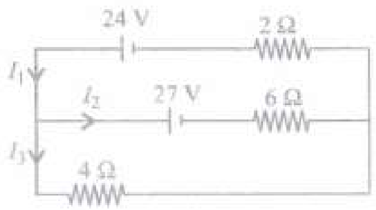


a) 0.80 volt b) 1.60 volt c) 1.33 volt d) 2.00 volt

259. An electric heater is connected to the voltage supply. After few seconds, current gets its steady value then its initial current will be
a) equal to its steady current b) slightly higher than its steady current
c) slightly less than its steady current d) zero

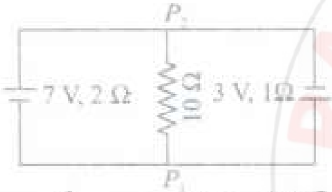
260. In a potentiometer a cell of emf 1.5 V gives a balanced point at 32 cm length of the wire. If the cell is replaced by another cell then the balance point shifts to 65.0 cm then the emf of second cell is
a) 3.05 V b) 2.05 V c) 4.05 V d) 6.05 V

261. In the circuit shown, the value of currents I_1, I_2 and I_3 are



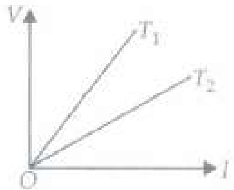
a) $3A, \frac{-3}{2}A, \frac{9}{2}A$ b) $\frac{9}{2}A, 3A, \frac{-3}{2}A$ c) 5A,4A,-3A d) $7A, \frac{5}{4}A, \frac{9}{2}A$

262. A 7 V battery with Internal resistance 2 Ω and a 3 V battery with internal resistance 1 Ω are connected to a 10 Ω resistor as shown in figure, 10 Ω resistor is



a) 0.27A b) 0.31A c) 0.031A d) 0.53A

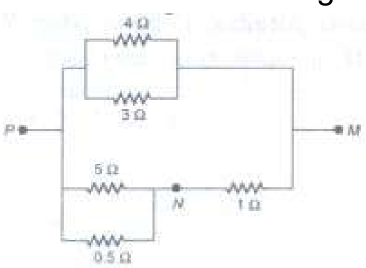
263. The voltage V and current I graphs for a conductor at two different temperatures T_1 and T_2 are shown in the figure. The relation between T_1 and T_2 is



a) $T_1 > T_2$ b) $T_1 < T_2$ c) $T_1 = T_2$ d) $T_1 = \frac{1}{T_2}$

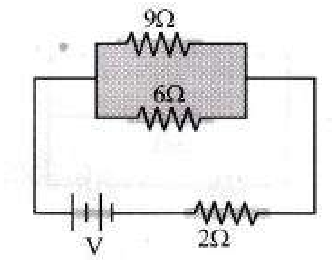
264. The thermo e.m.f E in volts of a certain thermocouple is found to vary with temperature difference θ in °C between the two junctions according to the relation $E = 30\theta - \frac{\theta^2}{15}$. The neutral temperature for the thermocouple will be ________.
a) 30°C b) 450°C c) 400°C d) 225°C

265. In the circuit shown, the current through the 4 Ω resistor is 1 amp when the points P and M are connected to a d.c. voltage source. The potential difference between the points M and N is :



a) 3.2 volt b) 1.5 volt c) 1.0 volt d) 0.5 volt

266. If power dissipated in the 9 W resistor in the circuit shown is 36 watt, the potential difference across the 2 W resistor is _________.



a) 4 volt b) 8 volt c) 10 volt d) 2 volt

267. A battery of 10 V and internal resistance 0.5 Ω is connected across a variable resistance R. The value of R for which the power delivered is maximum is equal to _______.

a) 0.25 Ω b) 0.5 Ω c) 1.0 Ω d) 2.0 Ω

268. A 4 μF conductor is charged to 400 V and then its plates are joined through a resistance of 1 kΩ. The heat produced in the resistance is ________.

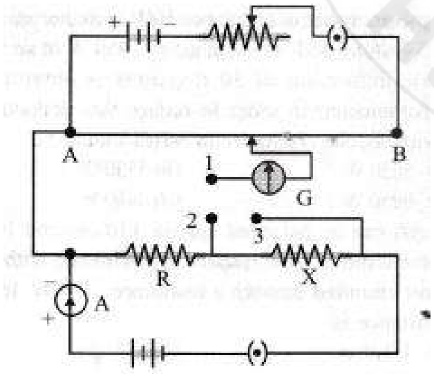
a) 0.16 J b) 1.28 J c) 0.64 J d) 0.32 J

269. Direct current is passed through a copper sulphate solution using platinum electrodes. The elements liberated at the electrodes are _______.

a) copper at anode and sulphur at cathode b) sulphur at anode and copper at cathode

c) oxygen at anode and copper at cathode d) copper at anode and oxygen at cathode

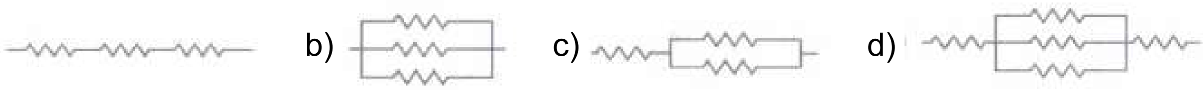
270. A potentiometer circuit is set up as shown. The potential gradient, across the potentiometer wire, is k volt/cm and the ammeter, present in the circuit, reads 1.01 when two way key is switched off. The balance points, when the key between the terminals (i) 1 and 2 (ii) 1 and 3, is plugged in, are found to be at lengths l_1 cm and l_2 cm respectively. The magnitudes of the resistors R and X, in ohms, are then, equal, respectively, to _______.



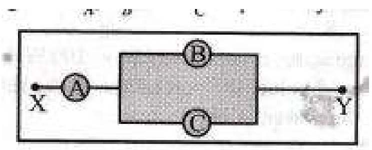
a) $k(l_2 - l_1)$ and kl_2 b) kl_1 and $k(l_2 - l_1)$ c) $k(l_2 - l_1)$ and kl_1 d) kl_1 and kl_2

271. Which arrangement of 3 Ω resistors will give a total resistance of 7 Ω?

a) b) c) d)



272. A, B and C are voltmeters of resistance R, 1.5 R and 3 R respectively as shown in the figure. When some potential difference is applied between X and. Y the voltmeter readings are V_A, V_B and V_C respectively. Then _________.



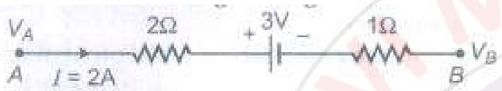
a) $V_A \neq V_B = V_C$ b) $V_A = V_B \neq V_C$ c) $V_A \neq V_B \neq V_C$ d) $V_A = V_B = V_C$

273. A 5^{o}C rise in temperafure is observed in a conductor by passing a current. When the current is doubled the rise in temperature will be approximately _______.
a) 16^{o}C b) 10^{o}C c) 20^{o}C d) 12^{o}C

274. A student rneasures the tenninal potential difference (V) of a cell (of emf E and internal resistance r) as a function of the current (I) flowing through it. The slope and intercept, of the graph between V and I, then, respectively, equal: ______.
a) -r and E b) r and -E c) -E and r d) E and -r

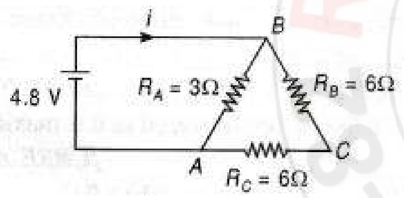
275. Resistances n, each of r ohm, when connected in parallel give an equivalent resistance of R ohm. If these resistances were connected in series, the combination would have a resistance in ohms, equal to ________.
a) nR b) n^2R c) R/n^2 d) R/n

276. The potential difference (V_A - V_B) between the points A and B in the given figure is :



a) -3 V b) +3 V c) +6 V d) +9 V

277. The current (i) in the given circuit is _______.



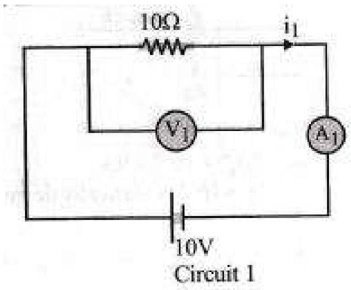
a) 1.6A b) 2A c) 0.32A d) 3.2A

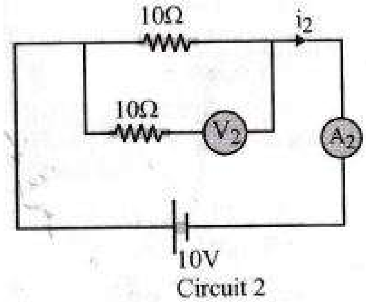
278. Forty electric bulbs are connected in series across 220 V supply. After one bulb is fused the remaining 39 are connected again in series across the same potential. the illumination will be :
a) more with 40 bulbs than with 39 bulbs b) more with 39 bulbs then with 40 bulbs
c) equal in both cases d) in ratio 40^2 : 39^2

279. The resistance of an ideal voltmeter is :
a) Zero b) Very low c) Very large d) Infinite

280. When three identical bulbs of 60 watt, 200-volt rating are connected in series to a 200 volt supply, the power drawn by them will be _______.
a) 20 watt b) 60 watt c) 180 watt d) 10 watt

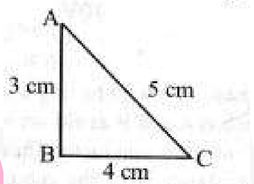
281. In the circuits shown below, the readings of voltmeters and the ammeters will be ______.





a) $V_1=V_2$ and $i_1>i_2$ b) $V_1=V_2$ and $i_1=i_2$ c) $V_1>V_2$ and $i_1>i_2$ d) $V_2>V_1$ and $i_1=i_2$

282. A 12 cm wire is given a shape of a right-angled triangle ABC having sides 3 cm, 4 cm and 5 cm as shown in the figure. The resistance between two ends (AB, BC, CA) of the respective sides are measured one by one by a multimeter. The resistances will be in the ratio of ________.

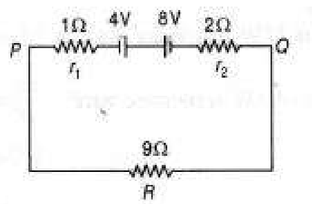


a) 3:4:5 b) 9:16:25 c) 27:32:35 d) 21:24:25

283. A heater coil is rated 100 W, 200 V. It is cut into two idential parts. Both parts are connected together in parallel, to the same source of 200 V. The energy liberated per second in the new combination is

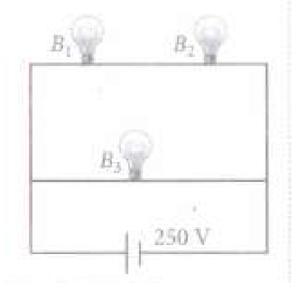
a) 100 J b) 200 J c) 300 J d) 400 J

284. Two batteries of emf 4V and 8V with internal resistance 1 Ω and 2 Ω are connected in a circuit with a resistance of 9 Ω as shown in figure. The current and potential difference between the points P and Q are



a) $\frac{1}{3}$ A and 3 V b) $\frac{1}{6}$ A and 4 V c) $\frac{1}{9}$ A and 9 V d) $\frac{1}{12}$ A and 12 V

285. A 100 W bulb B_1 and two 60 W bulbs B_2 and B_3, are connected to a 250 V source, as shown in figure. Now W_1 W_2 and W_3 are the output powers of the bulbs B_1, B_2 and B_3, respectively. Then



a) $W_1 > W_2 = W_3$ b) $W_1 > W_2 > W_3$ c) $W_1 < W_2 = W_3$ d) $W_1 < W_2 < W_3$

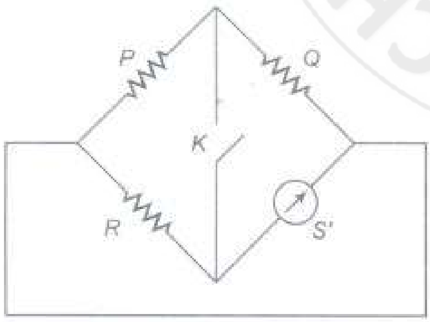
286. The resistance of the four p, e, R and S in a Wheatstone,s bridge are 10 ohm, 30 ohm, 30 ohm and 90 ohm, respectively. The e.m.f. and internal resistance of the cell are 7 volt and 5 ohm respectively. If the galvanometer resistance is 50 ohm, the current drawn from the cell will be ________.
a) 0.2 A b) 0.1 A c) 2.0 A d) 1.0 A

287. Three resistors 2Ω , 4Ω and 5Ω are combined in parallel. This combination is connected to a battery of emf 20 V and negligible internal resistance. The total current drawn from the battery is
a) 10 A b) 15 A c) 19 A d) 23 A

288. A potentiometer consists of a wire of length 4 m and resistance 10 Ω. It is connected to a cell of e.m.f. 2 V. The potential difference per unit length of the wire will be :
a) 0.5 V/m b) 2 V/m c) 5 V/m d) 10 V/m

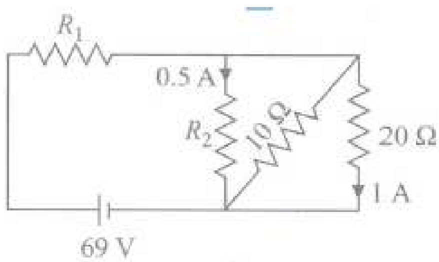
289. The resistance of the wire in the platinum resistance thermometer at ice point is 5 Ω and at steam point is 5.25 Ω. When the thermometer is inserted in an unknown hot bath its resistance is fourid to be 5.5 Ω. The temperature of the hot bath is
a) 100°C b) 200°C c) 300°C d) 350°C

290. In the following Wheatstone bridge P/Q=R/S. If key K is closed, then the galvanometer will show deflection :



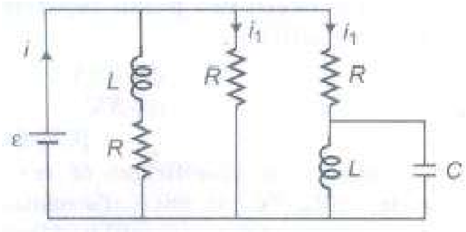
a) In left side b) In right side c) No deflection d) In either side

291. In the circuit shown in the given figure, the resistances R_1 and R_2 are respectively



a) 14Ω and 40Ω b) 40Ω and 14Ω c) 40Ω and 30Ω d) 14Ω and 30Ω

292. Figure shows a circuit that contains three identical resistors with resistance R = 9.0 Ω each, two identical inductors with inductance L = 2.0 mH each, and an ideal battery with emf ε = 18 V. The current "i" through the battery just after the switch closed is :



a) 0.2 A b) 2 A c) 0 ampere d) 2 mA

293. The resistance of a discharge tube is ______.
a) Zero b) ohmic c) non-ohmic d) infinity

294. Two cities are 150 km apart. Electric power is sent from one city to another city through copper wires. The fall of potential per km is 8 volt and the average resistance per km is 0.5 W. The power loss in the wires is _______.
a) 19.2 J b) 12.2 kw c) 19.2 w d) 19.2 kw

295. In an ammeter 0.2%o of main current passes through the galvanometer. If resistance of galvanometer is G, the resistance of ammeter will be _______.
a) $\frac{1}{499}G$ b) $\frac{499}{500}G$ c) $\frac{1}{500}G$ d) $\frac{500}{499}G$

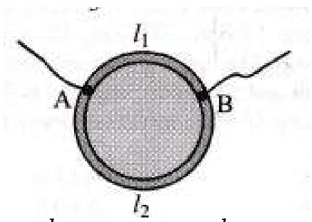
296. What is the order of magnitude of the resistance of a dry human body?
a) 10 Ω b) 10 kΩ c) 10 MΩ d) 10 $\mu\Omega$

297. Two 220 volt, 100 watt bulbs are connected first in series and then in parallel. Each time the combination is connected to a 220 volt a.c. supply line. The power drawn by the combination in each case respectively will be _______.
a) 50 watt, 200 watt b) 50 watt, 100 watt c) 100 watt, 50 watt d) 1 watt, 150 watt

298. A beam of electrons moving at a speed of 10^6 m/s along a line produces a current of 1.6 x 10^{-6} A. The number of electrons in the 1 metre of the beam is :
a) 10^6 b) 10^7 c) 10^{13} d) 10^{19}

299. The resistivity (specific resistance) of a copper wire ______.
a) increases with increase in its temperature
b) decreases with increase in its cross-section c) increases with increase in its length
d) increases with increase in its cross-section.

300. A ring is made of a wire having a resistance R_0 = 12 W. Find the points A and B as shown in the figure, at which a current-carrying conductor should be connected so that the resistance R of the sub-circuit between these points is equal to $\frac{8}{3}\Omega$.

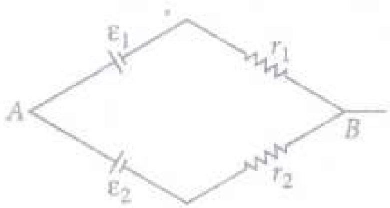


a) $\frac{l_1}{l_2}=\frac{5}{8}$ b) $\frac{l_1}{l_2}=\frac{1}{3}$ c) $\frac{l_1}{l_2}=\frac{3}{8}$ d) $\frac{l_1}{l_2}=\frac{1}{2}$

301. A charge is moving across a junction, then

a) momentum will be conserved b) momentum will not be conserved.
c)
at some places momentum will be conserved and at some other places momentum will not be conserved.
d) none of these.

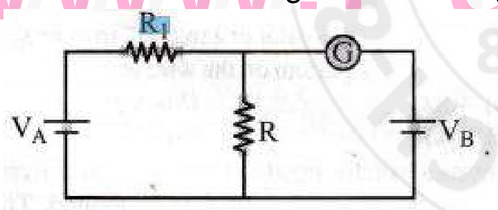
302. Two batteries of emf ε_1 and $\varepsilon_2(\varepsilon_2 > \varepsilon_1)$ and internal resistances r_1 and r_2 respectively are connected in parallel as shown in figure.



a) The equivalent emf ε_{eq} of the two cells is between ε_1 and ε_2 i.e. $\varepsilon_1 < \varepsilon_{eq} < \varepsilon_2$
b) The equivalent emf ε_{eq} is smaller than ε_1 c) The ε_{eq} is given by $\varepsilon_{eq} = \varepsilon_1 + \varepsilon_2$ always
d) ε_{eq} is independent of internal resistances r_1 and r_2

303. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: Potentiometer is used only to compare potential differences.
Reason: The potentiometer draws current from the voltage source being measured.
a) If assertion is true but reason is false b) If both assertion and reason are false
c) If both assertion and reason are true and reason is the correct explanation of assertion.
d) If both assertion and reason are true but reason is not the correct explanation of assertion

304. In the circuit shown, the cells A and B have negligible resistances. For V_A = 12 V R_l = 500 W and R = 100 W the galvanometer (G) shows no deflection. The value of V_B ________.



a) 4V b) 2V c) 12V d) 6V

305. A current in a wire is given by the equation, $I = 2t^2 - 3t + 1$, the charge through cross section of wire in time interval t = 3 s to t = 5 s is
a) 32.33 C b) 43.34 C c) 45.5 C d) 42 C

306. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion : Current is passed through a metallic wire, heating it red. Half of its portion is cooled by cold water jacket, then rest of the half portion become more hot.
Reason : Resistances decreases due to decrease in temperature and so current through wire increases.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

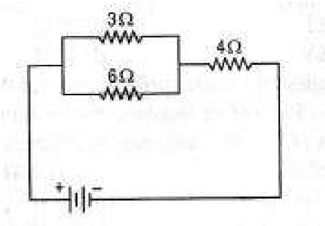
307. A heating coil is labelled 100 W 220 V. The coil is cut in two equal halves and the two pieces are joined in parallel to the same source. The energy now liberated per second is ___________.

a) 25 J b) 50 J c) 200 J d) 400 J

308. Across a metallic conductor of non-uniform cross section a constant potential difference is applied. The quantity which remains constant along the conductor is _______.

a) current b) drift velocity c) electric field d) current density

309. Current through 3Ω resistor is 0.8 A, then potential drop through 4Ω resistor is ___________.



a) 9.6 V b) 2.6 V c) 4.8 V d) 1.2 V

310. 40 electric bulbs are connected in series across a 220 V supply. After one bulb is fused the remaining 39 are connected again in series across the same supply. The illumination will be

a) more with 40 bulbs than with 39 b) more with 39 bulbs than with 40

c) equal in both the cases d) in the ratio $40^2:39^2$

311. A wire of length L and resistance R is stretched to get the radius of cross-section half. What is new resistance :

a) 5 R b) 8 R c) 4 R d) 16 R

312. By ammeter, which of the following can be measured :

a) Electric potential b) Potential difference c) Current d) Resistance

313. A boy has two spare light bulbs in his drawer. One is marked 240 V and 100Wand the other is marked 240 V and 60 W He tries to decide which of the following assertions are correct?

a) The 60 W light bulb has more resistance and therefore burns less brightly.

b) The 60 W light bulb has less resistance and therefore burns less brightly.

c) The 100 W bulb has more resistance and therefore burns more brightly

d) The 100W bulb has less resistance and therefore burns less brightly.

314. The battery of a trunk has an emf of 24 V If the internal resistance of the battery is 0.8 Ω. What is the maximum current that can be drawn from the battery?

a) 30 A b) 32 A c) 33 A d) 34 A

315. In a circuit a cell with internal resistance r is connected to an external resistance R. The condition for the maximum current that drawn from the cell is

a) R = r b) R < r c) R > r d) R = 0

316. For which of the following dependences of drift velocity v_d on electric field E, is Ohm's law obeyed?

a) $v_d \propto E$ b) $v_d \propto E^2$ c) $v_d \propto \sqrt{E}$ d) $v_d \propto \frac{1}{E}$

317. Kirchhoff's first and second laws for electrical circuits are consequences of _________.

a) conservation of electric charge and energy respectively

b) conservation of electric charge

c) conservation of energy and electric charge respectively d) conservation of energy

318. The current density varies with radial distance r as $J = ar^2$, in a cylindrical wire of radius R. The current passing through the wire between radial distance R/3 and R/2 is,

a) $\frac{65\pi aR^4}{2592}$ b) $\frac{25\pi aR^4}{72}$ c) $\frac{65\pi a^2R^3}{2938}$ d) $\frac{81\pi a^2R^4}{144}$

319. Wire bound resistors are made by

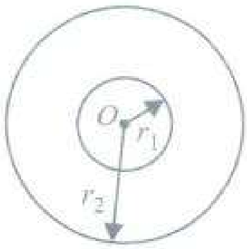
a) winding the wires of an alloy viz, Cu, Al, Ag

b) winding the wires of an alloy viz, Si, Tu, Fe

c) winding the wires of an alloy viz, Ge, Au, Gr

d) winding the wires of an alloy viz, manganin, constantan, nichrome.

320. Space between two concentric spheres of radii r_1 and r_2 such that $r_1 < r_2$ is filled with a material of resistivity p. Find the resistance between inner and outer surface of the material.



a) $\frac{r_1}{r_2}\frac{\rho}{2}$ b) $\frac{r_2-r_1}{r_1r_2}\frac{\rho}{4\pi}$ c) $\frac{r_1r_2}{r_2-r_1}\frac{\rho}{4\pi}$ d) None of these

321. Which of the following acts as a circuit protection device?

a) Inductor b) Switch c) Fuse d) Conductor

322. Two cells, having the same e.m.f. are connected in series through an external resistance R. Cells have internal resistances r_1 and r_2 ($r_1 > r_2$) respectively. When the circuit is closed, the potential difference across the first cell is zero. The value of R is ______.

a) $\frac{r_1+r_2}{2}$ b) $\frac{r_1-r_2}{2}$ c) $r_1 + r_2$ d) $r_1 - r_2$

323. Three resistances each of 4W are connected to form a triangle. The resistance between any two terminals is ___________.

a) 12 Ω b) 2 Ω c) 6 Ω d) $\frac{8}{3}$ Ω

324. Kirchhoff's first law of electricity follows ______.

a) only law of conservation of energy b) only law of conservation of charge

c) law of conservation of both energy and charge

d) sometimes law of conservation of energy and some

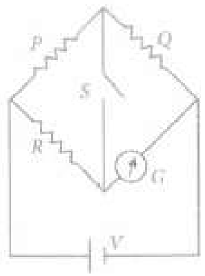
325. If 25Ω, 220 V and 100Ω, 220 V bulbs are connected in series across a 440 V line, then ______.

a) only 25Ω bulb will fuse b) only 100Ω bulb will fuse c) both bulbs will fuse d) none of these

326. Three resistors of resistances 3Ω , 4Ω and 5 Ω are combined in parallel. This combination is connected to a battery of emf 12 V and negligible internal resistance, current through each resistor in ampere is

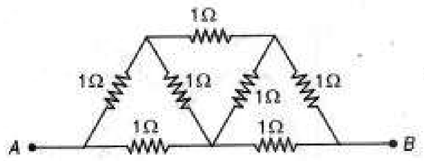
a) 4, 3, 2, 4 b) 8, 7, 3, 4 c) 2, 5, 1, 8 d) 5, 5, 8, 2

327. In the circuit P $\neq$ R, the reading of the galvanometer is same with switch S open or closed. Then



a) $I_R=I_G$ b) $I_P=I_G$ c) $I_Q=I_G$ d) $I_Q=I_R$

328. In the network shown in figure each resistance is 1Ω. The effective resistance between A and B is _______.



a) $\frac{4}{3}\Omega$ b) $\frac{3}{2}\Omega$ c) 7Ω d) $\frac{8}{7}\Omega$

329. A resistance R is to be measured using a meter bridge. Student chooses the standard resistance S to be 100 Ω He finds the null point at l_1 = 2.9 cm. He is told to attempt to improve the accuracy. Which of the following is a useful way?

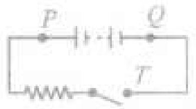
a) He should measure l_1 more accurately

b) He should change S to 1000 Ω and repeat the experiment

c) He should change S to 3 Ω and repeat the experiment

d) He should give up hope of a more accurate measurement with a meter bridge

330. A battery, an open switch and a resistor are connected in series as shown in figure. Consider the following three statements concerning the circuit. A voltmeter will read zero if it is connected across points

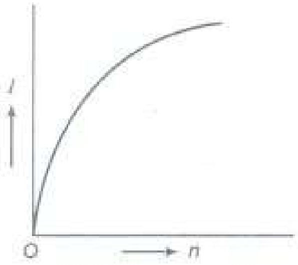


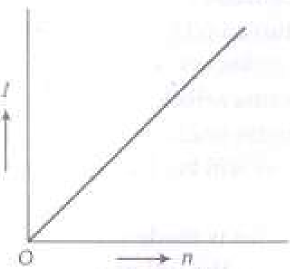
(i) P and T (Ii) P and Q (iii) Q and T

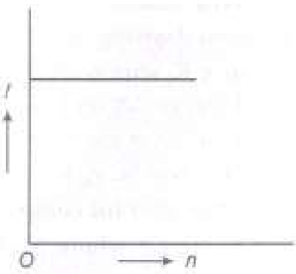
Which one of the above is/are true?

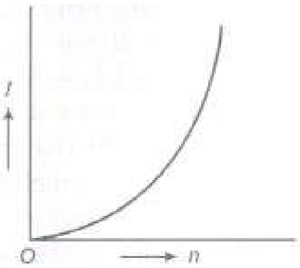
a) only (i) and (iii) b) (i), (ii) and (iii) c) only (i) d) only (iii)

331. A battery consists of a variable number 'n' of identical cells (having internal resistance 'r' each) which are connected in series. The terminals of the battery are short-circuited and the current I is measured. Which of the graphs shows the correct relationship between I and n?

a) 

b) 

c) 

d) 

332. In a meter bridge experiment, the ratio of the left gap resistance to right gap resistance is 2 : 3, the balance point from left is
a) 60 cm b) 50 cm c) 40 crn d) 20 cm

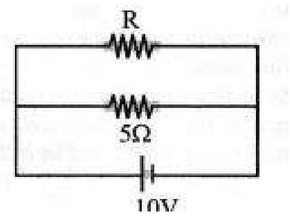
333. An infinite ladder network of resistances is constructed with 1Ω and 2Ω resistance as shown in figure. The 6 V battery between A and B has negligible internal resistance. The equivalent resistance between A and B is

a) 1Ω b) 2Ω c) 3Ω d) 4Ω

334. Faraday's laws are consequence of conservation of ________.
a) energy b) energy and magnetic field c) charge d) magnetic field

335. If a wire of resistance R is melted and recasted to half of its length, then the new resistance of the wire will be _____.
a) $\frac{R}{4}$ b) $\frac{R}{2}$ c) R d) 2R

336. The power dissipated in the circuit shown in the figure is 30 Watts. The value of R is ________.



a) 20 Ω b) 15 Ω c) 10 Ω d) 30 Ω

337. A resistor is marked with the rings coloured brown, black, green and gold. The resistance in ohm is
a) (3.5×10^5 ± 5%) b) (1.10×10^5 ± 10%) c) (8×10^6 ± 5%) d) (1×10^6 ± 5%)

338. A 100 W 200 V bulb is connected to a 160 V power supply. The power consumption would be ______.
a) 125 W b) 100 W c) 80 W d) 64 W

339. A carbon resistor of (47 ± 4.7) kΩ is to be marked with rings of different colours for its identification. The colour code sequence will be :
a) Yellow- Green - Violet- Gold b) Yellow- Violet - Orange - Silver
c) Violet - Yellow- Orange - Silver d) Green - Orange - Violet - Gold

340. When a current of 2 A flows in a battery from negative to positive terminal, the potential difference across it is 12 V If a current of 3 A flowing in the opposite direction produces a potential difference of 15 V, the emf of the battery is
a) 12.6 V b) 13.2 V c) 13.5 V d) 14.0 V

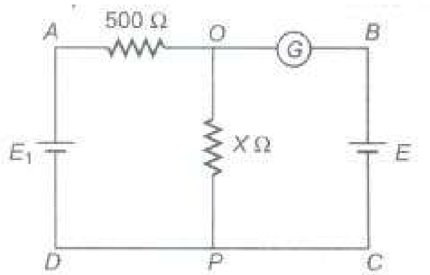
341. The resistance of a heating element is 99 Ω at room temperature. What is the temperature of the element if the resistance is found to be 116 Q? (Temperature coefficient of the material of the resistor is 1.7×10^{-4}°C^{-1})
a) 999.9°C b) 1005.3°C c) 1020.2°C d) 1037.1°C

342. The electrical resistance of a conductor depends upon:
a) size of conductor b) temperature of conductor c) geometry of conductor
d) all of these

343. A potentiometer circuit has been set up for finding the internal resistance of a given cell. The main battery, used across the potentiometer wire, has an emf of 2.0 V and a negligible internal resistance. The potentiometer wire itself is 4m long. When the resistance, R, connected across the given cell, has values of (i) infinity (ii) 9.5 Ω, the 'balancing lengths', on the potentiometer wire are found to be 3 m and 2.85 m, respectively. The value of internal resistance of the cell is :
a) 0.25 Ω b) 0.95 Ω c) 0.5 Ω d) 0.75 Ω

344. It is desired to make a long cylindrical conductor whose temperature coefficient of resistivity at 20°C will be close to zero. If such a conductor is made by assembling alternate disks of iron and carbon, find the ratio of the thickness of a carbon disk to that an iron disk. (For carbon, ρ= 3500 X 10^{-8} Ω m and α = -0.50 x 10^{-3} °C^{-1} for iron, ρ= 9.68 X 10^{-8} Ω m and a = 6.5 x 10^{-3} °C^{-1})
a) 0.36 b) 0.036 c) 1.0 d) 2.0

345. In the adjoining circuit, the battery E_1 has as emf of 12 volt and zero internal resistance, while the battery E has an emf of 2 volt. If the galvanometer reads zero, then the value of resistance X ohm is :



a) 10 b) 100 c) 500 d) 200

346. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion : Electrons which constitute the current are negatively charged.
Reason : Current carrying wire is negatively charged

a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

347. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as
Assertion: The resistance of a conductor decreases with increase in cross-sectional area.
Reason : On increasing the cross-sectional area of a conductor, more current will flow through the conductor
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

348. In a meter bridge, the balancing length from the left end (standard resistance of one ohm is in the right gap) is found to be 20 cm. The value of the unknown resistance is:
a) 0.8 Ω b) 0.5 Ω c) 0.4 Ω d) 0.25 Ω

349. If specific resistance of a potentiometer wire is 10^{-7} Wm, the current flow through it is 0.1 A and the cross-sectional area of wire is 10^{-6} m^2 then potential gradient will be ______.
a) 10^{-2} volt/m b) 10^{-4} volt/m c) 10^{-6} volt/m d) 10^{-8} volt/m

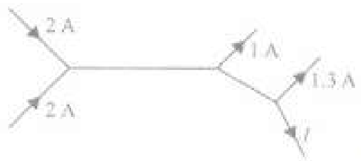
350. Three resistances P, Q, R each of 2 W and an unknown resistance S form the four arms of a Wheatstone bridge circuit. When a resistance of 5 W is connected in parallel to S the bridge gets balanced. What is the value of S?
a) 3 Ω b) 6 Ω c) 1 Ω d) 2 Ω

351. Kirchhoff's first law, i.e., Si = 0 at a junction, deals with the conservation of _______.
a) angular momentum b) linear momentum c) energy d) charge

352. The masses of the three wires of copper are in the ratio of 1: 3: 5 and their lengths are in the ratio of 5: 3: 1. The ratio of their electrical resistance is________.
a) 1: 3: 5 b) 5: 3: 1 c) 1: 25: 125 d) 125: 15: 1

353. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion: Ohm's law is not valid if current depends on voltage non-linearly.
Reason: Ohm's law is a fundamental law of nature.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

354. Figure shows currents in a part of an electric circuit, then current I is



a) 1.7A b) 3.7A c) 1.3A d) 1A

355. If nearly 10^5 C liberate 1g equivalent of aluminum, then the amount of aluminium (equivalent weight 9) deposited through electrolysis in 20 min by a current of 50 A will be _____.
a) 0.6 g b) 0.09 g c) 5.4 g d) 10.8 g

356. In a potentiometer of 10 wires, the balance point is obtained on the 7^{th} wire. To shift the balance point to 9^{th} wire, we should

a) decrease resistance hi the main circuit. b) increase resistance in the main circuit.

c) decrease resistance in series with the cell whose emf is to be measured.

d) increase resistance in series with the cell whose emf is to be determined.

357. Consider a current carrying wire (current 1) in the shape of a circle. Note that as the current progresses along the wire, the direction of $\vec{J}$ (current density) changes in an exact manner, while the current I remains unaffected. The agent that is essentially responsible for it is

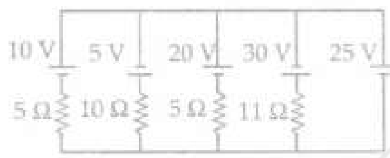
a) source of e.mf b) electric field produced by charges accumulated on the surface of wire

c)

the charges just behind a given segment of wire which push them just right way by repulsion

d) the charges ahead.

358. In the CIrcuit shown, current flowing through 25 V cell is



a) 7.2A b) 10A c) 12A d) 14.2A

359. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

Assertion: If we bend an insulated conducting wire, the resistance of the wire increases.

Reason: The drift velocity of electrons in bent wire decreases

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false

360. A potentiometer wire has length 4 m and resistance 8Ω. The resistance that must be connected in series with the wire and an accumulator of e .m.f. 2V, so as to get a potential gradient I mV per/cm on the wire is ________.

a) 40Ω b) 44Ω c) 48Ω d) 32Ω

361. **Assertion:** For good conductors, the I- V graph is a perfect straight line inclined to current axis.

Reason: By Ohm's law, voltage across the ends of a conductor is directly proportional to the resistance point in a line. of the conductor.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false

362. If n cells each of emf ϵ and internal resistance r are connected in parallel, then the total emf and internal resistances will be

a) $\epsilon, \frac{r}{n}$ b) $\epsilon,\ nr$ c) $n\epsilon, \frac{r}{n}$ d) $n\varepsilon, nr$

363. The total resistance in the parallel combination of three resistances 9 Ω, 7Ω and 5 Ω is

a) 1.22 Ω b) 2.29 Ω c) 4.22 Ω d) 2.02 Ω

364. 1 ampere current is equivalent to

a) 6.25×10^{18} electrons S^{-1} b) 2.25×10^{18} electrons S^{-1} c) 6.25×10^{14} electrons S^{-1}
d) 2.25×10^{14} electrons S^{-1}

365. A wire has a resistance of 2.5 Ω at 28°C and a resistance of 2.9 Ω at 100°C. The temperature coefficient of resistivity of material of the wire is
a) 1.06×10^{-3} °C^{-1} b) 3.5×10^{-2} °C^{-1} c) 2.22×10^{-3} °C^{-1} d) 3.95×10^{-2} °C^{-1}

366. 100 cells each of emf 5V and internal resistance 1 Ω are to be arranged so as to produce maximum current in a 25 Ω resistance. Each row contains equal number of cells. The number of rows should be:
a) 2 b) 4 c) 5 d) 100

367. Ten million electrons pass from point P to point Q in one microsecond. The current and its direction is

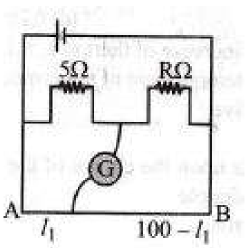
a) 1.6×10^{-14} A, from point P to point Q b) 3.2×10^{-14} A, from point P to point Q
c) 1.6×10^{-6} A, from point Q to point P d) 3.2×10^{-12} A, from point Q to point P

368. Which of the following characteristics of electrons determines the current in a conductor?
a) Drift velocity alone b) Thermal velocity alone c) Both drift velocity and thermal velocity
d) Neither drift nor thermal velocity

369. A wire of resistance 4 Ω is used to wind a coil of radius 7 cm. The wire has a diameter of 1.4 mm and the specific resistance of its material is 2×10^{-7} Ω m. The number of turns in the coil is
a) 50 b) 40 c) 60 d) 70

370. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion : Some electric appliance have three pins, even though if we remove the top pin, it will continue working.
Reason : The third pin is used only as a safety device.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reaso is not the correct explanation of assertion
c) If assertion is true but reason is false. d) If both assertion and reason are false

371. The resistances in the two arms of the metre bridge are 5W; and RW, respectively. When the resistance R is shunted with an equal resistance, the new balance point is at $1.6l_1$. The resistance 'R' is ______.



a) 10 Ω b) 15 Ω c) 20 Ω d) 25 Ω

372. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion : Electromotive force is a force which helps the electrons to flow and produce

current.

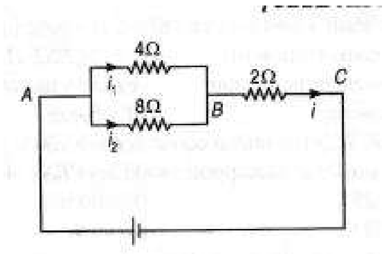
Reason: Electromotive force is independent of the voltage across the cell.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false.   d) If both assertion and reason are false

373. In the circuit of figure, the current in 4Ω resistance is 1.2 A, what is the potential difference between B and C?



a) 3.6V   b) 6.3V   c) 1.8V   d) 2.4V

374. A wire with 15 Ω resistance is stretched by one tenth of its original length and volume of wire is kept constant. Then its resistance will be

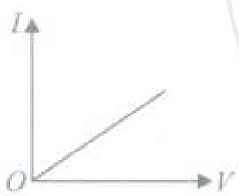
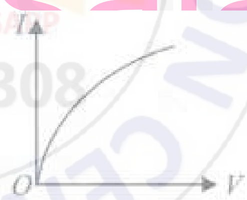
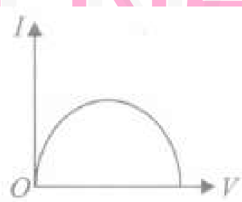
a) 15.18 Ω b) 81.15 Ω c) 51.18 Ω d) 18.15 Ω

375. Three resistances 2 Ω , 4Ω, 5Ω are combined in series and this combination is connected to a battery of 12 V emf and negligible internal resistance. The potential drop across these resistances are

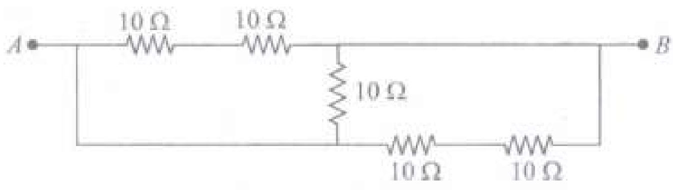
a) (5.45, 4.36, 2.18) V   b) (2.18, 5.45, 4.36) V   c) (4.36, 2.18, 5.45) V

d) (2.18, 4.36, 5.45) V

376. Which of the following I- V graph represents ohmic conductors?

a)  b)  c)  d) 

377. Five equal resistances of 10Ω are connected between A and B as shown in figure. The resultant resistance is



a) 10Ω   b) 5Ω   c) 15Ω   d) 6Ω

378. In a Wheatstone's network, P = 2 Ω, Q = 2 Ω, R = 2 Ω and S = 3 Ω. The resistance with which S is to be shunted in order that the bridge may be balanced is

a) 1Ω   b) 2Ω   c) 4Ω   d) 6Ω

379. The resistance of an ammeter is 13W and its scale is graduated for a current upto 100 amps. After an additional shunt has been connected to this ammeter it becomes possible to measure currents upto 750 amperes by this metre. The value of shunt-resistance is ________.

a) 2 Ω   b) 0.2 Ω   c) 2k Ω   d) 20 Ω

380. A charged particle having drift velocif of 7 .5 x $10^{-4}ms^{-1}$ is an electric field of 3 x 10^{-10} Vm^{-1}, has a mobility in $m^2V^{-1}s^{-1}$ of __________.
a) 2.25 x 10^{-15} b) 2.25 x 10^{15} c) 2.5 x 10^6 d) 2.15 x 10^6

381. A cylindrical rod is reformed to half of its original length keeping volume constant. If its resistance before this change were R, then the resistance after reformation of rod will be
a) R b) R/4 c) 3R/4 d) R/2

382. Match the Column I with Column II.

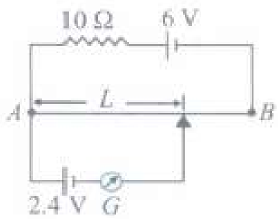
Column I		**Column II**	
(A)	Smaller the resistance greater the current in a circuit	(p)	If the same voltage is applied across a resistance
(B)	Greater or smaller the resistance the current is same	(q)	If the same current is passed
(C)	Greater the resistance smaller the power	(r)	When resistances are connected in series
(D)	Greater the resistance greater the power	(s)	When resistances are connected in parallel

a) A - r, B - p, C - q, D - s b) A - p, B - r, C - q, D - s c) A - r, B - p, C - s, D - q
d) A - s, B - r, C - p, D - q

383. Fuse wire is a wire of ________.
a) low resistance and high melting point b) high resistance and high melting point
c) high resistance and low melting point d) low resistance and low melting point

384. The electric resistance of a certain wire of iron is R. If its length and radius are both doubled, then ________.
a) the resistance and the specific resistance, will both remain unchanged
b) the resistance will be doubled and the specific resistance will be halved
c) the resistance will be halved and the specific resistance will remain unchanged
d) the resistance will be halved and the specific resistance will be doubled

385. A potentiometer wire of length 200 cm has a resistance of 20 Ω. It is connected in series with a resistance of 10 Ω and an accumulator of emf 6 V having negligible internal resistance. A source of 2.4 V is balanced against a length L of the potentiometer wire. The value of L is

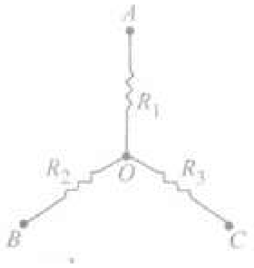


a) 100cm b) 120cm c) 110cm d) 140cm

386. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :
Assertion : Current flows in a conductor only when there is an external electric field within the conductor.
Reason: The drift velocity of the electrons is directly proportional to the electric field.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false

387. A circuit has a section ABC as shown in figure. If the potentials at points A, B and C are V_1 V_2 and V_3 respectively. The potential at point O is:



a) $V_1+V_2+V_3$ b) $\left[\frac{V_1}{R_1}+\frac{V_2}{R_2}+\frac{V_3}{R_3}\right]\left[\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}\right]^{-1}$ c) Zero

d) $\left[\frac{V_1}{R_1}+\frac{V_2}{R_2}+\frac{V_3}{R_3}\right](R_1+R_2+R_3)$

388. Three equal resistors connected in series across a source of emf together dissipate 10 W of power. What will be the power dissipated in Watt if the same resistors are connected in parallel across the same source of emf?

a) $\frac{10}{3}$ b) 10 c) 30 d) 90

389. In a potentiometer the balancing with a cell is at length of 220 cm. On shunting the cell with are sistance of 3 Ω balance length becomes l30 cm. What is the internal resistance of this cell?

a) 4.5Ω b) 7.8Ω c) 6.3Ω d) 2.08Ω

390. Two metal wires of identical dimensions are connected in series. If σ_1 and σ_2 are the conductivities of the metals respectively, the effective conductivity of the combination is

a) $\sigma_1+\sigma_2$ b) $\frac{\sigma_1+\sigma_2}{2}$ c) $\sqrt{\sigma_1\sigma_2}$ d) $\frac{2\sigma_1\sigma_2}{\sigma_1+\sigma_2}$

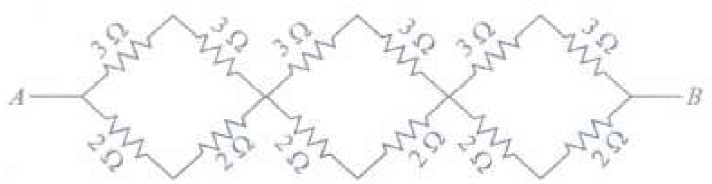
391. A wire of resistance 12 ohms per metre is bent to form a complete circle of radius 10 cm. The resistance between its two diametrically opposite points, A and B as shown in the figure, is ______.

a) 3 Ω b) 6 pΩ c) 6 Ω d) 0.6 pΩ

392. In producing chlorine by electrolysis 100 kW power at 125 V is being consumed. How much chlorine per minute is liberated? (E.C.E. of chlorine is 0.3 67 x 10^{-6} kg/C)

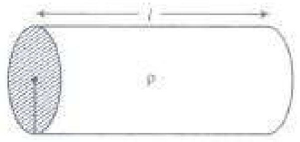
a) 1.76 x. 10^{-3}kg b) 9.67 x 10^{-3}kg c) 17.61 x 10^{-3}kg d) 3.67 x 10^{-3}kg

393. Equivalent resistance of the given network between points A and B is

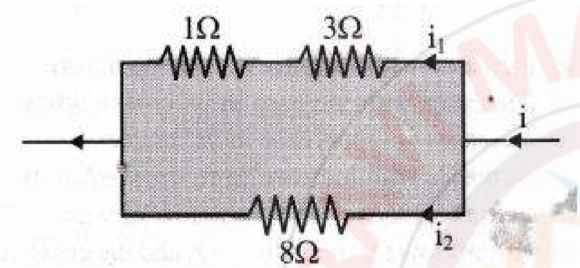


a) 31/5Ω b) 41/5Ω c) 36/5Ω d) 49/5Ω

394. A thermocouple of negligible resistance produces an e.m.f. of 40 mV/°C in the linear range of temperature. A galvanometer of resistance 10 ohm whose sensitivity is 1 mA/div, is employed with the thermocouple. The smallest value of temperature difference that can be detected by the system will be ________.
a) 0.5°C b) 1°C c) 0.1°C d) 0.25°C
395. An electric cable contains a single copper wire of radius 9 mm. It's resistance is 5 Ω. This cable is replaced by six insulated copper wires, each of radius 3 mm. The resultant resistance of cable will be:



a) 7.5 Ω b) 45 Ω c) 90 Ω d) 270 Ω
396. Power dissipated across the 8W resistor in the circuit shown here is 2 watt. The power dissipated in watt units across the 3W resistor is _______.



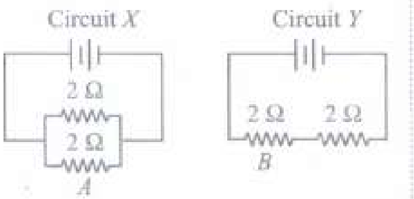
a) 1.0 b) 0.5 c) 3.0 d) 2.0
397. The velocity of charge carries of current (about IA) in a metal under normal conditions is of the order of _________.
a) a fraction of mm/s b) velocity of light c) several thousand m/s d) a few hundred m/s
398. In parallel combination of n cells, we obtain
a) more voltage b) more current c) less voltage d) less current
399. When a wire of uniform cross-section a, length/and resistance R is bent into a complete circle, resistance between any two of diametrically opposite points will be:
a) $\frac{R}{4}$ b) 4R c) $\frac{R}{8}$ d) $\frac{R}{2}$
400. In a Wheatstone's bridge all the four arms have equal resistance R. If the resistance of the galvano meter arm is also R, the equivalent resistance of the combination as seen by the battery is _______.
a) 2R b) $\frac{R}{4}$ c) $\frac{R}{2}$ d) R
401. Two batteries of emf ε_1 and ε_2 having internal resistance r_l and r_2 respectively are connected in series to an external resistance R. Both the batteries are getting discharged. The above described combination of these two batteries has to produce a weaker current than when anyone of the batteries is connected to the same resistor. For this requirement to be fulfilled.
a) $\frac{\varepsilon_2}{\varepsilon_1}$ must not lie between $\frac{r_2}{r_1+R}$ and $\frac{r_1}{r_2+R}$
b) $\frac{\varepsilon_2}{\varepsilon_1}$ must not lie between $\frac{r_2}{r_1+R}$ and $\frac{r_2+R}{r_1}$

c) $\frac{\varepsilon_2}{\varepsilon_1}$ must lie between $\frac{r_2+R}{r_1}$ and $\frac{r_1}{r_2+R}$ d) $\frac{\varepsilon_2}{\varepsilon_1}$ must lie between $\frac{r_2}{r_1+R}$ and $\frac{r_2+R}{r_1}$

402. A wire of resistance 4W is stretched to twice its original length. The resistance of stretched wire would be _______.

a) 4 Ω b) 8 Ω c) 16 Ω d) 2 Ω

403. Two 2Ω resistances are connected in parallel in circuit X and in series in circuit Y. The batteries in the two circuits are identical and have zero internal resistance. Assume that the energy transferred to resistor A in circuit X Within a certain time is W. The energy transferred to resistor B in circuit Y in the same time will be

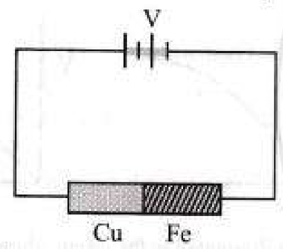


a) $\frac{1}{4}$W b) $\frac{1}{2}W$ c) 2 W d) 4 W

404. Two rods are joined end to end, as shown. Both have a cross-sectional area of 0.01 cm2. Each is 1 metre long.

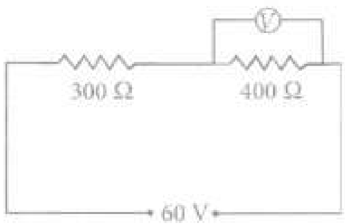
One rod is of copper with a resistivity of 1.7 x 10^{-6} ohm centimeter, the other is of iron with a resistivity of 10^{-5} ohm centimetre.

How much voltage is required to produce a current of ampere in the rods?



a) 0.117V b) 0.00145V c) 0.00145V d) 1.7 x 10^{-6}V

405. In the circuit shown in figure, a voltmeter reads 30 volts when it is connected across 400 ohm resistance. Calculate what the same voltmeter will read when it is connected across the 300 ohm resistance.

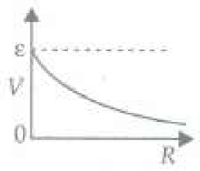
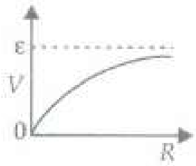
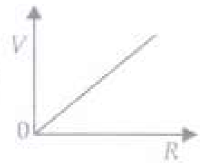


a) 30V b) 12.5V c) 15V d) 22.5V

406. A set of 'n' equal resistors, of value 'R' each, are connected in series to a battery of emf 'E' and internal resistance 'R'. The current drawn is I. Now, the 'n' resistors are connected in parallel to the same battery. Then the current drawn from battery becomes 101. The value of 'n' is :

a) 20 b) 11 c) 10 d) 9

407. A cell having an emf e and internal resistance r is connected across a variable external resistance R. As the resistance R is increased, the plot of potential difference V across R is given by

a)  b)  c)  d) 

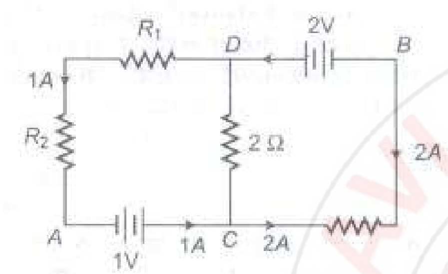
408. An electric kettle has two heating coils. When one of the coils is connected to an a.c. source, the water in the kettle boils in 10 minutes. When the other coil is used, the water boils in 40 minutes. If both the coils are connected in parallel, the time taken by the same quantity of water to boil will be _______.

a) 15 min b) 8 min c) 4 min d) 25 min

409. A battery of emf 10 V and internal resistance 0.5 W is connected across a variable resistance R. The value of R for which the power delivered in it is maximum, is given by _______.

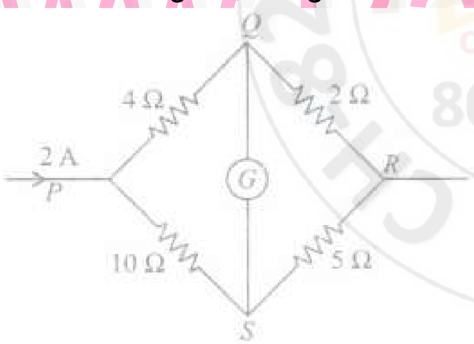
a) 0.5 Ω b) 1.0 Ω c) 2.0 Ω d) 0.25 Ω

410. In the circuit shown in the figure, if potential at point A is taken to be zero the potential at point B is:



a) 1V b) +2V c) 2V d) +1V

411. In the shown figure, bridge is balanced, the current flowing through 2 Ω resistance is



a) $\frac{10}{7}A$ b) $\frac{11}{7}A$ c) $\frac{13}{7}A$ d) $\frac{8}{7}A$

412. A resitance wire connected in the left gap of metre bridge balances a 10W resistance in the right gap at a point which divides the bridge wire in the ratio 3 : 2. If the length of the resistance wire is 1.5 m, then the length of lW of the resistance wire is ___________.

a) 1.5×10^{-2} m b) 1.0×10^{-2} m c) 1.0×10^{-1} m d) 1.5×10^{-1} m

413. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

Assertion: Insulators do not allow flow of current through them.

Reason: Insulators have no free charge carriers

a) If both assertion and reason are true and reason is the correct explanation of assertion.

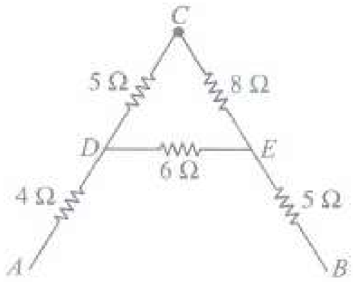
b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false. d) If both assertion and reason are false

414. The resistivity of alloy manganin is

a) Nearly independent of temperature b) Increases rapidly with increase in temperature
c) Decreases with increase in temperature
d) Increases rapidly with decrease in temperature

415. The equivalent resistance between A and B for the circuit shown in figure is



a) 13.1Ω b) 15.1Ω c) 17.1Ω d) 19.1Ω

416. Si and Cu are cooled to a temperature of 300 K, then resistivity?
a) For Si increases and for Cu decreases b) For Cu increases and for Si decreases
c) Decreases for both Si and Cu d) Increases for both Si and Cu

417. A copper cylindrical tube has inner radius a and outer radius b. The resistivity is ρ . The resistance of the cylinder between the two ends is

a) $\frac{\rho l}{b^2-a^2}$ b) $\frac{\rho l}{2\pi(b-a)}$ c) $\frac{\rho l}{\pi(b^2-a^2)}$ d) $\frac{\pi(b^2-a^2)}{\rho l}$

RAVI MATHS TUITION CENTER

Ravi Maths Tuition Centre

Time : 1 Mins **MAGNETIC EFFECTS AND MAGNETISM 1** **Marks : 1073**

1. Identify the mismatched pair.
   a) Hard magnet -Alnico b) Soft magnet -Soft iron
   c) Bar magnet - Equivalent solenoid d) Electromagnet - Loud speaker

2. Among which the magnetic susceptibility does not depend on the temperature
   a) Dia-magnetic b) Paramagnetic c) Ferro-magnetism d) Ferrite

3. A bar magnet is hung by a thin cotton thread in a uniform horizontal magnetic field and is in equilibrium state. The energy required to rotate it by 60° is W. Now the torque required to keep the magnet in this new position is:
   a) $W/\sqrt{3}$ b) $\sqrt{3}W$ c) $2W/\sqrt{3}$ d) $\frac{\sqrt{3}}{2}W$

4. A charged particle would continue to move with a constant velocity in a region where in, which of the following conditions is not correct?
   a) E=0, B≠0 b) E≠0, B≠0 c) E≠0, B=0 d) E=0, B=0

5. A straight wire of length 0.5 m and carrying a current of 1.2 A is placed in uniform magnetic field of induction 2 T. The magnetic field is perpendicular to the length of the wire. The force on the wire is ______________ .
   a) 2.4 N b) 1.2 N c) 3.0 N d) 2.0 N

6. A ring of mean radius 15 cm has 3500 turns of wire wound on a ferromagnetic core of relative permeability 800. The magnetic field in the core for a magnetising current of 1.2 A is
   a) 2.48T b) 3.48T c) 4.48 T d) 5.48 T

7. A wire carries a current. Maintaining the same current it is bent first to form a circular plane coil of one turn which produces a magnetic field B at the centre of the coil. The same length is now bent more sharply to give a double loop of smaller radius. The magnetic field at the centre of the double loop, caused by the same current is _____
   a) 4 B b) B / 4 c) B / 2 d) 2 B

8. A proton carrying 1 MeV kinetic energy is moving in a circular path of radius R in uniform magnetic field. What should be the energy of an a-particle to describe a circle of same radius in the same field?
   a) 2 Mev b) 1 Mev c) 0.5 Mev d) 4 Mev

9. The magnetic force $\vec{F}$ on a current carrying conductor of length l in an external magnetic field $\vec{B}$ is given by:

a) $\frac{\vec{l} \times \vec{B}}{\vec{l}}$ b) $\frac{\vec{l} \times \vec{B}}{I}$ c) $I(\vec{l} \times \vec{B})$ d) $I^2\vec{l} \times \vec{B}$

10. The hysteresis cycle for the material of a transformer core is
a) short and wide b) tall and narrow c) tall and wide d) short and narrow

11. The magnetic susceptibility of a paramagnetic material at -73°C is 0.0075, its value at - 173°C will be
a) 0.0045 b) 0.0030 c) 0.015 d) 0.0075

12. A circular loop of radius R carrying a current I is placed in a uniform magnetic field B perpendicular to the loop. The force on the loop is
a) $2\pi RIB$ b) $2\pi RI^2B^3$ c) πR^2IB d) zero

13. If an electron is moving with velocity $\vec{v}$ produces a magnetic field $\vec{B}$, then
a) the direction of field $\vec{B}$ will be same as the direction of velocity $\vec{v}$
b) the direction of field $\vec{B}$ will be opposite to the direction of velocity $\vec{v}$
c) the direction of field $\vec{B}$ will be perpendicular to the direction of velocity $\vec{v}$
d) the direction of field $\vec{B}$ does not depend upon the direction of velocity $\vec{v}$

14. The cyclotron frequency υc is given by
a) $\frac{qB}{2\pi m}$ b) $\frac{MB}{2\pi q}$ c) $\frac{2\pi m}{qB}$ d) $\frac{2\pi B}{qm}$

15. Magnetic field due to 0.1 A current flowing through a circular coil of radius 0.1 m and 1000 turns at the centre of the coil is_____
a) 0.2 T b) 2×10^{-4} T c) 6.28×10^{-4} T d) 9.8×10^{-4} T

16. An electron is moving in a cyclotron at a speed of 3.2×10^7 m s^{-1} in a magnetic field of 5×10^{-4} T perpendicular to it. What is the frequency of this electron? ($q = 1.6 \times 10^{-19}$ C, $m_e = 9.1 \times 10^{-31}$ kg)
a) 1.4×10^5 Hz b) 1.4×10^7 Hz c) 1.4×10^6 Hz d) 1.4×10^9 Hz

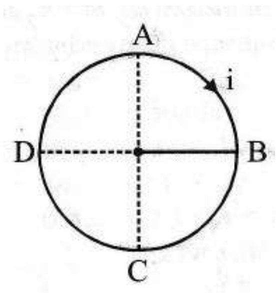
17. The relation connecting magnetic susceptibility χ_m and relative permeability μ_r is:
a) $\chi_m = \mu_r + 1$ b) $\chi_m = \mu_r - 1$ c) $\chi_m = \frac{1}{\mu_r}$ d) $\chi_m = 3(1 + \mu_r)$

18. A conductor of length 2 m carrying current 2 A is held parallel to an infinitely long conductor carrying current of 12 A at a distance of 100 mm, the force on small conductor is
a) 8.6×10^{-5} N b) 6.6×10^{-5} N c) 7.6×10^{-5} N d) 9.6×10^{-5} N

19. An electron moving in a circular orbit of radius r makes n rotations per second. The magnetic field produced at the centre has magnitude_____

a) Zero b) $\frac{\mu_0 n^2 e}{r}$ c) $\frac{\mu_0 ne}{2r}$ d) $\frac{\mu_0 ne}{2\pi r}$

20. A circular coil A B C D carrying a current i is placed in a uniform magnetic field. If the magnetic force on the segment A B is $\vec{F}$, the force on the remaining segment B C D A is___



a) $\vec{F}$ b) $-\vec{F}$ c) $3\vec{F}$ d) $-3\vec{F}$

21. If a solenoid is having magnetic moment of 0.65 JT^{-1} is free to turn about the vertical direction and has a uniform horizontal magnetic field of 0.25 T applied. What is the magnitude of the torque on the solenoid when its axis makes an angle of 30° with the direction of applied field?

a) 0.075 N m b) 0.080 N m c) 0.081 N m d) 0.091 N m

22. If BE represents equatorial magnetic field and BA represents axial magnetic field due to a bar magnet. Which of the following relationships between BE and BA is correct?

a) $B_E = 2B_A$ b) $B_A = 2B_E$ c) $B_E = 4B_A$ d) $B_A = 4B_E$

23. A paramagnetic sample shows a net magnetisation of 8 Am^{-1} when placed in an external magnetic field of 0.6 T at a temperature of 4 K. When the same sample is placed in an external magnetic field of 0.2 T at a temperature of 16 K, the magnetisation will be

a) $\frac{32}{3} Am^{-1}$ b) $\frac{2}{3} Am^{-1}$ c) $6 Am^{-1}$ d) $2.4 Am^{-1}$

24. A long solenoid carrying a current produces a magnetic field B along its axis. If the current is double and the number of tums per cm is halved, the new value of the magnetic field is____

a) 4B b) B/2 c) B d) 2B

25. **Assertion:** The net magnetic force on a current loop in a uniform magnetic field is zero but torque may or may not be zero.

Reason: Torque on a current carrying coil in a magnetic field is given by

$\vec{\tau} = nI(\vec{A} \times \vec{B})$.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

26. Which of the following is not correct about cyclotron?
a) It is a machine to accelerate charged particles or ions to high energies.
b)
Cyclotron uses both electric and magnetic fields in combination to increase the energy of charged particles.
c)
The operation of the cyclotron is based on the fact that the time for one revolution of an ion is independent of its speed or radius of its orbit.
d) The charged particles and ions in cyclotron can move on any arbitrary path.

27. A magnetising field of 1500 A m^{-l} produces flux of 2.4 x 10^{-5} weber in a iron bar of the cross-sectional area of 0.5 cm^2. The permeability of the iron bar is
a) 245 b) 250 c) 252 d) 255

28. Which of the following is not correct about relative magnetic permeability (μ_r)?
a) It is a dimensionless pure ratio. b) For vacuum medium its value is one.
c) For ferromagnetic materials μ_r >> 1 d) For paramagnetic materials μ_r > 1

29. To convert a galvanorneter into an ammeter, one needs to connect a ____
a) low resistance in parallel b) high resistance in parallel
c) low resistance in series d) high resistance in series

30. At a certain location in Africa, compass points 12° west of geographic north. The north tip of magnetic needle of a dip circle placed in the plane of magnetic meridian points 60° above the horizontal. The horizontal component of earth's field is measured to be 0.16 G. The magnitude of earth's field at the location is
a) 0.32 G b) 0.42 G c) 4.2 G d) 3.2 G

31. At what distance from a long straight wire carrying a current of 12 A will the magnetic field be equal to 3×10^{-5} Wb/m^2 ?
a) 8×10^{-2} m b) 12×10^{-2} m c) 18×10^{-2} m d) 24×10^{-2} m

32. Which of the following independent quantities is not used to specify the earth's magnetic field?
a) Magnetic declination (θ). b) Magnetic dip (δ).
c) Horizontal component of earth's field (B_H).

d) Vertical component of earth's field (B_V).

33. The magnetic force acting on a charged particle of charge -2 mC in a magnetic field of 2 T acting in y direction, when the particle velocity is $(2\hat{i} + 3\hat{j}) \times 10^6 \text{ ms}^{-1}$, is ______

a) 4 N in z direction b) 8 N in y direction c) 8 N in z direction
d) 8 N in -z direction

34. A long straight wire carries a certain current and produces a magnetic field of 2×10^{-4} weber / m^2 at a perpendicular distance of 5 cm from the wire. An electron situated at 5 cm from the wire moves with a velocity 10^7 m/s towards the wire along perpendicular to it. The force experienced by the electron will be______
(charge on electron $= 1.6 \times 10^{-19}$C)
a) Zero b) 3.2 N c) 3.2×10^{-16} N d) 1.6×10^{-16} N

35. If the galvanometer current is 10 mA, resistance of the galvanometer is 40 Ω and shunt of 2 Ω is connected to the galvanometer, the maximum current which can be measured by this ammeter is
a) 0.21 A b) 2.1 A c) 210 A d) 21 A

36. A square current carrying loop is suspended in a uniform magnetic field acting in the plane of the loop. If the force on one arm of the loop is $\vec{F}$, the net force on the remaining three arms of the loop is______
a) $3\vec{F}$ b) $-\vec{F}$ c) $-3\vec{F}$ d) $\vec{F}$

37. A circular coil of radius 10 crn having 100 turns carries a current of 3.2 A. The magnetic field at the center of the coil is
a) 2.01×10^{-3} T b) 5.64×10^{-3} T c) 2.64×10^{-4} T d) 5.64×10^{-4} T

38. A particle having charge q moves with a velocity $\vec{v}$ through a region in which both an electric field $\vec{E}$ and a magnetic field $\vec{B}$ are present. The force on the particle is______

a) $q\vec{E} + q(\vec{B} \times \vec{v})$ b) $q\vec{E} + (\vec{B} \times \vec{v})$ c) $q\vec{v} + q(\vec{E} \times \vec{B})$ d) $q\vec{E} + q(\vec{v} \times \vec{B})$

39. A dipole of magnetic moment $\vec{m} = 30\hat{j}$ Am^2 is placed along the y-axis in a uniform magnetic field $\vec{B} = (2\hat{j} + 5\hat{j})$ T. The torque acting on it is
a) -40 $\hat{k}Nm$ b) -50 $\hat{k}Nm$ c) -60 $\hat{k}Nm$ d) -70 $\hat{k}Nm$

40. Out of given paramagnetic substance (Calcium, Chromium, Oxygen and Tungsten) which substance has maximum susceptibility?
a) Calcium b) Chromium c) Oxygen d) Tungsten

41. A circular coil of radius 4 cm has 50 turns. In this coil a current of 2 A is flowing. It is placed in a magnetic field of 0.1 weber/m^2. The amount of work done in rotating it through 180^0 from its equilibrium position will be :

a) 0.1 J b) 0.2 J c) 0.4 J d) 0.8 J

42. In the question number 34, the kinetic energy (in MeV) of the proton beam produced by the accelerator is (radius of dees = 60 cm)

a) 5 b) 6.5 c) 10.6 d) 12.6

43. **Assertion:** Magnetic field lines always form closed loops.

Reason: Moving charges or currents produce a magnetic field.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

44. A proton and an a-particle enter in a uniform magnetic field perpendicularly with same speed. The ratio of time periods of both particle $\left(\frac{T_p}{T_\alpha}\right)$ will be

a) 1: 2 b) 1: 3 c) 2: 1 d) 3: 1

45. The torque and magnetic potential energy of a magnetic dipole in most stable position in a uniform magnetic field $\left(\vec{B}\right)$ having magnetic moment $\left(\vec{M}\right)$ will be

a) -mB, zero b) mB, zero c) zero, mB d) zero, -mB.

46. Magnetic susceptibility of a diamagnetic substances

a) increases with increase in temperature

b) increases with decrease in temperature

c) remains constant with change in temperature d) none of these

47. Which of the following is universal magnetic property?

a) Ferromagnetism b) Diamagnetism c) Paramagnetism

d) Anti-ferromagnetism

48. A circular coil of magnetic moment 0.355 JT^{-1}rests with its plane normal to an external field of magnitude 5.0 x 10^{-2} T. The coil is free to turn about an axis in its plane perpendicular to the field direction. When the coil is turned slightly and released, it oscillates about its stable equilibrium with a frequency of 2 Hz. The moment of inertia of the coil about its axis of rotation is

a) 1.13×10^{-1} kg m^2 b) 1.13×10^{-2} kg m^2 c) 1.13×10^{-3} kg m^2
d) 1.13×10^{-4} kg m^2

49. In an ammeter 0.2% of main current passes through the galvanometer. If resistance of galvanometer is G, the resistance of ammeter will be:
a) 1/499 G b) 499/500 G c) 1/500 G d) 500/499 G

50. An eleohon moves in a circular orbit with a uniform speed v. It produces a magnetic field B at the centre of the circle. The radius of the circle is proportional to_____
a) $\sqrt{\frac{B}{v}}$ b) $\frac{B}{y}$ c) $\sqrt{\frac{v}{B}}$ d) $\frac{v}{B}$

51. A circular coil of 70 turns and radius 5 cm carrying a current of 8 A is suspended vertically in a uniform horizontal magnetic field of magnitude 1.5 T. The field lines make an angle of 30° with the normal of the coil then the magnitude of the counter torque that must be applied to prevent the coil from turning is:
a) 33 N m b) 3.3 N m c) 3.3×10^{-2} N m d) 3.3×10^{-4} N m

52. The nature of parallel and anti-parallel currents are
a) parallel currents repel and antiparallel currents attract.
b) parallel currents attract and antiparallel currents repel. c) both currents attract.
d) both currents repel

53. A charged particle is moving in a cyclotron, what effect on the radius of path of this charged particle will occur when the frequency of the radio frequency field is doubled?
a) It will also be doubled. b) It will be halved.
c) It will be increased by four times. d) It will remain unchanged.

54. The inner and outer radius of a toroid core are 28 cm and 29 cm respectively and around the core 3700 turns of a wire are wounded. If the current in the wire is 10A, then the magnetic field inside the core of the toroid is
a) 2.60×10^{-2} T b) 2.60×10^{-3} T c) 4.52×10^{-2} T d) 4.52×10^{-3} T

55. A toroid of n turns, mean radius R and cross-sectional radius a carries current I. It is placed on a horizontal table taken as x-y plane. Its magnetic moment $\vec{M}$
a) is non-zero and points in the z-direction by symmetry
b) points along the axis of the toroid ($\vec{M} = M\hat{\phi}$)
c)
is zero, otherwise there would be a field falling as $\frac{1}{r^3}$ at large distances outside the toroid
d) is pointing radially outwards.

56. Which of the following is correct about magnetic monopole?

a) Magnetic monopole exist. b) Magnetic monopole does not exist.

c) Magnetic monopole have constant value of monopole momentum.

d) The monopole momentum increase due to increase at its distance from the field.

57. A current carrying coil is subjected to a uniform magnetic field. The coil will orient so that its plane becomes___
a) inclined at 45^o to the magnetic field
b) inclined at any arbitrary angle to the magnetic field
c) parallel to the magnetic field d) perpondicular to the magnetic field

58. An alternating electric field, of frequency v, is applied across the dees (radius =R) of a cyclotron that is being used to accelerate protons (mass =m). The operating magnetic field (B) used in the cyclotron and the kinetic energy (K) of the proton beam, produced by it, are given by______

a) $B = \frac{mv}{e}$ and $K = 2m\pi^2v^2R^2$ b) $B = \frac{2\pi mv}{e}$ and $K = m^2\pi vR^2$

c) $B = \frac{2\pi mv}{e}$ and $K = 2m\pi^2v^2R^2$ d) $B = \frac{mv}{e}$ and $K = m^2\pi vR^2$

59. The magnetic field of given length of wire for single turn coil at its centre is 'B' then its value for two turns coil for the same wire is:
a) B/4 b) B/2 c) 4B d) 2B

60. In a mass spectrometer used for measuring the masses of ions, the ions are initially accelerated by an electric potential V and then made to describe semicircular path of radius R using a magnetic field B, If V and B are kept constant, the ratio

$\left(\frac{\text{charge on the ion}}{\text{mass of the ion}}\right)$ will be proportional to_____

a) 1 / R^2 b) R^2 c) R d) 1 / R

61. An electron having momentum 2.4 x 10^{-23}kg m s^{-1} enters a region of uniform magnetic field of 0.15 T. The field vector makes an angle of 30° with the initial velocity vector of the electron. The radius of the helical path of the electron in the field shall be

a) 2 mm b) 1 mm c) $\frac{\sqrt{3}}{2}$mm d) 0.5 mm

62. A straight wire having mass of 1.2 kg and length of 1m carries a current of 5 A. If the wire is suspended in mid-air by a uniform horizontal magnetic field, then the magnitude of field is
a) 0.65 T b) 1.53 T c) 2.4 T d) 3.2 T

63. If you made a map of magnetic field lines at Melbourne in Australia, then the magnetic field lines seem to be
a) go into the ground b) come out of the ground

c) maintain a spiral path on the surface of earth

d) move on helical path above the surface of ground

64. The magnetic moment of a current I carrying circular coil of radius r and number of turns N varies as

a) $\frac{1}{r^2}$ b) $\frac{1}{r}$ c) r d) r^2

65. A solenoid of cross-sectional area 2 x 10^{-4} m^2 and 900 turns has 0.6 A m^2 magnetic moment. Then the current flowing through it is

a) 2.24 A b) 2.34 mA c) 3.33 A d) 3.33 mA

66. In a moving coil galvanometer the deflection (ϕ) on the scale by a pointer attached to the spring is

a) $\left(\frac{NA}{kB}\right)I$ b) $\left(\frac{N}{kB}\right)I$ c) $\left(\frac{NAB}{k}\right)I$ d) $\left(\frac{NAB}{kI}\right)$

67. A circular disc of radius 0.2 metre is placed in a uniform magnetic field of induction $\frac{1}{\pi}\left(\mathrm{Wb/m^2}\right)$ in such a way that its axis makes an angle of 60° with $\vec{B}$. The magnetic flux linked with the disc is___

a) 0.02 Wb b) 0.06 Wb c) 0.08 Wb d) 0.01 Wb

68. A uniform horizontal magnetic field of 7.5 x 10^{-2} T is set up at an angle of 30° with the axis of a solenoid and the magnetic moment associated with it is 1.28 JT^{-1}. Then the torque on it is

a) 4.8 x 10^{-2} N m b) 1.6 x 10^{-2} N m c) 1.2 x 10^{-2} N m d) 4.8 x 10^{-4} N m

69. Which of the following statement is correct?

a) The magnetic field in the open space inside the toroid is constant.

b) The magnetic field in the open space exterior to the toroid is constant.

c) The magnetic field inside the core of toroid is constant.

d) The magnetic field inside the core of toroid is zero.

70. A particle of mass m, charge Q and kinetic energy T enters a transverse uniform magnetic field of induction B. After 3 seconds, the kinetic energy of the particle will be_________

a) 3 T b) 2 T c) T d) 4 T

71. **Assertion:** Magnetic lines of force form continuous closed loops.

Reason: Magnetic poles always occur in pairs as north poleand south pole.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

72. A cyclotron is operated at an oscillator frequency of 12 MHz and has a dee radius R = 50 cm. What is the magnitude of the magnetic field needed for a proton to be accelerated in the cyclotron?
a) 0.72 T b) 0.65 T c) 0.39 T d) 0.12 T

73. **Assertion:** The energy of a charged particle moving in a uniform magnetic field does not change.
Reason: Work done by the magnetic field on a charge particle is zero.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

74. The magnitude of torque experienced by a square coil of side 12 cm which consists of 25 turns and carries a current 10 A suspended vertically and the normal to the plane of coil makes an angle of 30° with the direction of a uniform horizontal magnetic field of magnitude 0.9 T is:
a) 1.6 Nm b) 1.2 Nm c) 1.4 Nm d) 1.8 Nm

75. A short bar magnet placed with its axis at 30° with a uniform external magnetic field of 0.35 T experiences a torque of magnitude equal to 4.5×10^{-2} N m. The magnitude of magnetic moment of the given magnet is
a) 26 J T^{-1} b) 2.6 J T^{-1} c) 0.26 J T^{-1} d) 0.026 J T^{-1}

76. A voltmeter has resistance of 2000 ohms and it can measure upto 2V. If we want to increase its range to 10 V, then the required resistance in series will be :
a) 2000 Ω b) 4000 Ω c) 6000 Ω d) 8000 Ω

77. A long straight wire carrying current of 30 A rests on a table. Another wire AB of length 1 m, mass 3 g carries the same current but in the opposite direction, the wire AB is free to slide up and down. The height upto which AB will rise is
a) 0.6 cm b) 0.7 cm c) 0.4 cm d) 0.5 cm

78. Two moving coil metres M_1 and M_2 have the following particular
R_l = 10 Q; N_1 = 30; $A_1 = 3.6 \times 10^{-3}\ m^2$; B_1 = 0.25 T; R_2 = 14 Q; N_2 = 42; $A_2 = 1.8 \times 10^{-3}\ m^2$; B_2 = 0.50 T The spring constants are identical for the two metres. What is the ratio of current sensitivity and voltage sensitivity of M_2 to M_1?
a) 1.4,1 b) 1.4,0 c) 2.8,2 d) 2.8,0

79. A long solenoid of diameter 0.1 m has 2×10^4 turns per meter. At the centre of the solenoid, a coil of 100 turns and radius 0.01 m is placed with its axis coinciding with the solenoid axis. The current in the solenoid reduces at a constant rate to OA from 4

A in 0.05s.If the resistance of the coil is $10\pi^2\Omega$, the total charge flowing through the coil during this time is:

a) 16 μC b) 32 μC c) 16 πμC d) 32 πμC

80. A circular coil of wire consisting of 100 turns each of radius 9 cm carries a current of 0.4 A. The magnitude of magnetic field at the centre of the coil is

a) 2.4×10^{-4} T b) 3.5×10^{-4} T c) 2.79×10^{-4} T d) 3×10^{-4} T

81. Point out the correct set of diamagnetic substances

a) aluminium, sodium calcium and oxygen b) bismuth, copper, lead and silicon

c) cobalt, nickel, gadolinium and aluminium

d) silver, niobium, magnesium and calcium

82. A solenoid has a core of a material with relative permeability of 500. The windings of the solenoid are insulated from the core and carry a current of 2 A. If the number of turns is 1000 per meter, then magnetisation is:

a) 7.78×10^5 A m^{-1} b) 8.88×10^5 A m^{-1} c) 9.98×10^5 A m^{-1}

d) 10.2×10^5 A m^{-1}

83. An electron is moving in a circular path under the influence of a transverse magnetic field of 3.57×10^{-2} T. If the value of elm is 1.76×10^{11} C/kg, frequency of revolution of the electron is

a) 1 GHz b) 100 MHz c) 6.28 MHz d) 6.28 MHz

84. A galvanometer of resistance, G is shunted by a resistance S ohm. To keep the main current in the circuit unchanged, the resistance to be put in series with the galvanometer is____

a) $\frac{S^2}{(S+G)}$ b) $\frac{SG}{(S+G)}$ c) $\frac{G^2}{(S+G)}$ d) $\frac{G}{(S+G)}$

85. A 200 turn closely wound circular coil of radius 15 cm carries a current of 4 A. The magnetic moment of this coil is

a) 36.5 A m^2 b) 56.5 A m^2 c) 66.5 A m^2 d) 108 A m^2

86. Two parallel wires 2 m apart carry currents of 2 A and 5 A respectively in same direction, the force per unit length acting between these two wires is

a) 2×10^{-6} N m^{-1} b) 3×10^{-6} N m^{-1} c) 1×10^{-6} N m^{-1} d) 4×10^{-6} N m^{-1}

87. A bar ma~net having a magnetic moment of $2 \times 10^4 JT^{-1}$ is free to rotate in a horizontal plane. A horizontal magnetic field B = 6×10^{-4}T exists in the space. The work done in taking the magnet slowly from a' direction parallel to the field to a direction 60° from the field is :

a) 12 J b) 6 J c) 2 J d) 0.6 J

88. A closely wound solenoid of 3000 turns and area of cross section 2×10^{-4} m^2, carrying a current of 6 A is suspended through its centre allowing it to turn in a horizontal plane. The magnetic moment associated with this solenoid is

a) 1.2 J T^{-1} b) 2.4 J T^{-1} c) 3.0 J T^{-1} d) 3.6 J T^{-1}

89. A galvanometer having a coil resistance of 60 Ω shows full scale deflection when a current of 1.0 ampere passes through it. It can be converted into an ammeter to read currents upto 5.0 ampere by_____
    a) putting in series a resistance of 15 Ω b) putting in series a resistance of 240 Ω
    c) putting in parallel a resistance of 15 Ω
    d) putting in parallel a resistance of 240 Ω
90. The magnetising field required to be applied in opposite direction to reduce residual magnetism to zero is called
    a) retentivity b) coercivity c) hysteresis d) flux
91. A long solenoid of 50 cm length having 100 turns carries a current of 2.5 A. The magnetic field at the centre of the solenoid is
    $\left(m_0 = 4p \times 10^{-7} TmA^{-1}\right)$____
    a) 3.14×10^{-5} T b) 6.28×10^{-4} T c) 3.14×10^{-4} T d) 6.28×10^{-5} T
92. A charge moving with velocity v in x-direction is subjected to a field of magnetic induction in negative x-direction.
    As a result, the charge will ______
    a) remain unaffected b) start moving in a circular y-z plane c) retard along x-axis
    d) move along a helical path around x-axis
93. The earth behaves as a magnet with magnetic field pointing approximately from the geographic
    a) North to South b) South to North c) East to West d) West to East
94. In a permanent magnet at room temperature:
    a) magnetic moment of each molecule is zero.
    b)
    the individual molecules have non-zero magnetic moment which are all perfectly aligned.
    c) domains are partially aligned. d) domains are all perfectly aligned
95. A uniform electric ficld and uniform magnetic field are acting along the same direction in a certain region. If an electron is projected in the region such that its velocity is pointed along the direction of fields, then the electron_____
    a) will turn towards right of direction of motion b) speed will decrease
    c) speed will increase d) will turn towards left direction of motion
96. **Assertion:** Magnetic field interacts with a moving charge and not with a stationary charge.
    Reason: A moving charge produces a magnetic field.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true and reason is the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

97. A charged particle with charge q enters a region of constant, uniform and mutually orthogonal fields $\vec{E}$ and $\vec{B}$ with a velocity v perpendicular to both $\vec{E}$ and $\vec{B}$, and comes out without any change in its magnitude or direction. Then

a) $\vec{v}=\vec{B}\times\vec{E}/E^2$ b) $\vec{v}=\vec{E}\times\vec{B}/B^2$ c) $\vec{v}=\vec{B}\times\vec{E}/B^2$ d) $\vec{v}=\vec{E}\times\vec{B}/E^2$

98. A circular current loop of magnetic moment M is in an arbitrary orientation in an external magnetic field B. The work done to rotate the loop by 30° about an axis perpendicular to its plane is

a) MB b) $\sqrt{3}\frac{MB}{2}$ c) $\frac{MB}{2}$ d) Zero

99. The angles of dip at the poles and the equator respectively are

a) 30°,60° b) 0°,90° c) 45°,90° d) 90°,0°

100. When a proton is released from rest in a room, it starts with an initial acceleration a_0 towards west. When it is projected towards north with a speed v_0 it moves with an initial acceleration $3a_0$ towards west. The electric and magnetic fields in the room are respectively_____

a) $\frac{ma_0}{e}$ west, $\frac{2ma_0}{ev_0}$ down b) $\frac{ma_0}{e}$ east, $\frac{3ma_0}{ev_0}$ up c) $\frac{ma_0}{e}$ east, $\frac{3ma_0}{ev_0}$ down

d) $\frac{ma_0}{e}$ west, $\frac{2ma_0}{ev_0}$ up

101. A 90 cm long solenoid has six layers of windings of 450 turns each. If the diameter of solenoid is 2.2 cm and current carried is 6 A, then the magnitude of magnetic field inside the solenoid, near its centre is

a) 50πG b) 60πG c) 72πG d) 80πG

102. Which of the following is not showing the essential difference between electrostatic shielding by a conducting shell and magnetostatic shielding?

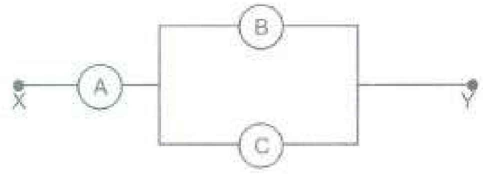
a) Electrostatic field lines can end on charges and conductors have free charges.

b) Magnetic field lines can end but conductors cannot end them.

c)
Lines of magnetic field cannot end on any material and perfect shielding is not possible.

d)
Shells of high permeability materials can be used to divert lines of magnetic field from the interior region.

103. A, B and C are voltmeters of resistance R, 1.5 R and 3R respectively as shown in the fig. When some potential difference is applied between X and Y, the voltmeter reading are V_A, V_B and V_C respectively.



a) $V_A = V_B = V_C$ b) $V_A \neq V_B = V_C$ c) $V_A = V_B \neq V_C$ d) $V_A \neq V_B \neq V_C$

104. A galvanometer coil has a resistance of 15 Ω and the metre shows full scale deflection for a current of 4 mA. To convert the meter into a voltmeter of range 0 to 18 V,the required resistance is
a) 5885 Ω in series b) 4485 Ω in series c) 5885 Ω in parallel
d) 4485 Ω in parallel

105. The magnitude of the magnetic field at the centre of the tightly wound 150 turn coil of radius 12 ern carrying a current of 2 A is
a) 18 G b) 19.7 G c) 15.7 G d) 17.7 G

106. Two small bar magnets are placed in a line with like poles facing each other at a certain distance d apart. If the length of each magnet is negligible as compared to d, the force between them will be inversely proportional to :
a) d b) d^2 c) $1/d^2$ d) d^4

107. A long wire carrying a steady current is bent into a circular loop of one turn. The magnetic field at the centre of the loop is B. It is then bent into a circular coil of n turns. The magnetic field at the centre of this coil of n turns will be:
a) nB b) n^2B c) 2nB d) $2n^2B$

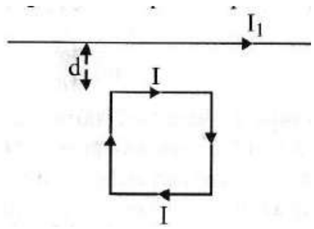
108. An 8 cm long wire carrying a current of 10 A is i placed inside a solenoid perpendicular to its axis. If the magnetic field inside the solenoid is 0.3 T, then magnetic force on the wire is
a) 0.14 N b) 0.24 N c) 0.34 N d) 0.44 N

109. The horizontal component of earth's magnetic field at a certain place is 3.0×10^{-5} T and having a direction from the geographic south to geographic north. The force per unit length on a very long straight conductor carrying a steady current of 1.2A in east to west direction is
a) 3.0×10^{-5} N m^{-1} b) 3.2×10^{-5} N m^{-1} c) 3.6×10^{-5} N m^{-1} d) 3.8×10^{-5} N m^{-1}

110. If a long straight wire carries a current of 40 A, then the magnitude of the field B at a point 15 ern away from the wire is
a) 5.34×10^{-5} T b) 8.34×10^{-5} T c) 9.6×10^{-5} T d) 10.2×10^{-5} T

111. A rod of ferromagnetic material with dimensions 10 cm x 0.5 cm x 0.2 cm is placed in a magnetic field of strength 0.5 cm x 10^4 A m^{-1} as a result of which a magnetic moment of 5 A m^{-2} is produced in the rod. The value of magnetic induction will be
a) 0.358 T b) 0.54 T c) 6.28 T d) 2.519 T

112. A square loop, carrying a steady current I, is placed in a horizontal plane near a long straight conductor carrying a steady current I_1 at a distance d from the conductor as shown in figure. The loop will experience____



a) a net repulsive force away from the conductor
b) a net torque acting upward perpendicular to the horizontal plane
c) a net torque acting downward normal to the horizontal plane
d) a net attractive force towards the conductor

113. A charged particle is moving on circular path with velocity v in a uniform magnetic field B, if the velocity of the charged particle is doubled and strength of magnetic field is halved, then radius becomes:
a) 8 times b) 4 times c) 2 times d) 16 times

114. A solenoid has core of a material with relative permeability 500 and its windings carry a current of 1 A. The number of turns of the solenoid is 500 per metre. The magnetization of the material is nearly
a) 2.5×10^3 A m^{-1} b) 2.5×10^5 A m^{-1} c) 2.0×10^3 A m^{-1} d) 2.0×10^5 A m^{-1}

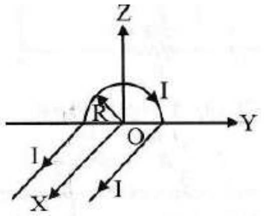
115. Which one of the following is correct statement about magnetic forces?
a) Magnetic forces always obey Newton's third law
b) Magnetic forces do not obey Newton's third law
c) For very high current, magnetic forces obey Newton's third law
d) Inside low magnetic field, magnetic forces obey Newton's third law

116. The magnitude of the equatorial magnetic field due to a bar magnet of length 2 cm at a distance of 1 m from its mid-point is (magnetic moment of the bar magnet is 0.60 A m^2)
a) 5.0×10^{-5} T b) 6.0×10^{-8} T c) 7.0×10^{-7} T d) 8.0×10^{-8} T

117. When a 12Ω resistor is connected with a moving coil galvanometer then its deflection reduces from 50 divisions to 10 divisions. The resistance of the galvanometer is
a) 24 Ω b) 36 Ω c) 48 Ω d) 60 Ω

118. A diamagnetic substance is brought near a strong magnet, then it is;
a) attracted by a magnet b) repelled by a magnet
c) repelled by north pole and attracted by south pole
d) attracted by north pole and repelled by south pole

119. A wire carrying current I has the shape as shown in figure. Linear parts of the wire are very long and parallel to X-axis while semicircular portion of radius R is lying in Y-Z plane. Magnetic field at point O is____



a) $\vec{B} = -\frac{\mu_0}{4\pi}\frac{I}{R}(\pi\hat{i} + 2\hat{k})$ b) $\vec{B} = -\frac{\mu_0}{4\pi}\frac{I}{R}(\pi\hat{i} - 2\hat{k})$ c) $\vec{B} = -\frac{\mu_0}{4\pi}\frac{I}{R}(\pi\hat{i} + 2\hat{k})$

d) $\vec{B} = \frac{\mu_0}{4\pi}\frac{l}{R}(\pi\hat{i} - 2\hat{k})$

120. A galvanometer of resistance 50 Ω is connected to a battery of 3 V along with a resistance of 2950 Ω in series. A full scale deflection of 30 divisions is obtained in the galvanometer. In order to reduce this deflection to 20 divisions, the resistance in series should be
a) 6050 Ω b) 4450 Ω c) 5050 Ω d) 5550 Ω

121. A current I flows in a rectangularly shaped wire whose center lies at (xo, 0, 0) and whose vertices are located at the points A(xo + d, -a, -b), B(xo - d, a, -b), C(xo - d, a, b), and D(xo + d, -a, b) respectively. Assume that a, b, d < < xo. Find the magnitude of magnetic dipole moment vector of the rectangular wire frame. (Given: b = 10 m, d = 4 m, a = 3 m, I = 0.01 A)
a) 2 J T^{-1} b) 4 J T^{-1} c) 3 J T^{-1} d) 9 J T^{-1}

122. A current loop in a magnetic field _________ .
a) can be in equilibrium in one orientation
b) can be in equilibrium in two orientations, both the equilibrium states are unstable
c) can be in equilibrium in two orientations, one stable while the other is unstable
d)
experiences a torque whether the field is uniform or non-uniform in all orientations

123. The magnetic field at a distance r from a long wire carrying current i is 0.4 T. The magnetic field at a distance 2r is______
a) 0.2 T b) 0.8 T c) 0.1 T d) 1.6 T

124. A short bar magnet has a magnetic moment of 0.39 JT^{-1}. The magnitude and direction of the magnetic field produced by the magnet at a distance of 20 cm from the centre of the magnet on the equatorial line of the magnet is

a) 0.049 G, N-S direction b) 4.95 G, S-N direction c) 0.0195 G, S-N direction
d) 19.5 G, N-S direction

125. Two similar coils of radius are lying concentrically with their planes at right angles to each other. The currents flowing in them are 1 and 21 respectively. The resultant magnetic field induction at the centre will be ___________ .
a) $\frac{\sqrt{5}u_0 I}{2R}$ b) $\frac{3u_0 I}{2R}$ c) $\frac{u_0 I}{2R}$ d) $\frac{u_0 I}{R}$

126. Long straight wire in the horizontal plane carries a current of 75 A in north to south direction, magnitude and direction of field B at a point 3 m east of the wire is:
a) 4 x 10^{-6} T, vertical up b) 5 x 10^{-6} T, vertical down c) 5 x 10^{-6} T, vertical up
d) 4 x 10^{-6} T, vertical down

127. An electron enters a region where magnetic field (B) and electric field (E) are mutually perpendicular, then______
a) it will always move in the direction of B
b) it will always move in the direction of E c) it always possess circular motion
d) it can go undeflected also

128. **Assertion:** Magnetic field due to current carrying solenoid is independent of its length and crosssectional area.
Reason: The magnetic field inside the solenoid is uniform.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

129. A beam of electron passes undeflected through mutually perpendicular electric and magnetic fields. If the electric field is switched off, and the same magnetic field is maintained, the electrons move_____
a) in a circular orbit b) along a parabolic path c) along a straight line
d) in an elliptical orbit

130. The gyromagnetic ratio of an electron in sodium atom is :
a) depending upon the atomic number of the atom
b) depending upon the shell number of the atom
c) independent of that orbit it is in d) having positive value

131. Unit of magnetic flux density (or magnetic induction) is :
a) Tesla b) Weber/metre^2 c) Newton/ampere-metre d) All of the above

132. A beam of electrons passes un deflected through mutually perpendicular electric and magnetic fields. It the electric field is switched off, and the same magnetic field is maintained, the electrons move:

a) along a straight line b) in an elliptical orbit c) in a circular orbit
d) along a parabolic path

133. A steady current I goes through a wire loop PQR having shape of a right angle triangle with PQ = 3x, PR = 4x and QR = 5x. If the magnitude of : the magnetic field at P due to this loop is k$\left(\frac{\mu_0 I}{48\pi x}\right)$. find the value of k.

a) 9 b) 5 c) 10 d) 7

134. A coil having magnetic moment 15 A m^2 placed in a uniform magnetic field of 4 T in the horizontal direction exists such that initially the axis of coil is in the direction of the field. If the coil is rotated by 45° and the moment of inertia of the coil is 0.5 kg m^2 then the angular speed acquired by the coil is

a) 20 rad s^{-1} b) 10 rad s^{-1} c) 8.34 rad s^{-1} d) 4.5 rad s^{-1}

135. The pole strength of 12 cm long bar magnet is 20 A m. The magnetic induction at a point 10 cm away from the centre of the magnet on its axial line is

$$\left[\frac{\mu_0}{4\pi} = 10^{-7} Hm^{-1}\right]$$

a) 1.17×10^{-3} T b) 2.20×10^{-3} T c) 1.17×10^{-2} T d) 2.20×10^{-2} T

136. A permanent magnet in the shape of a thin cylinder of length 50 cm has intensity of magnetisaton 10^6A m^{-1}. The magnetisation current is

a) 5×10^5A b) 6×10^5A c) 5×10^4A d) 6×10^4A

137. **Assertion:** Electron revolves around a positively charged nucleus like a planet revolvesaround the sun.

Reason: The force acting in both the cases is of same kind.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

138. Which of the following property shows the property of ferromagnetic substances?

a) The ferromagnetic property depends on temperature.

b) The ferromagnetic property does not depend on temperature.

c) At high enough temperature ferromagnet becomes a diamagnet.

d) At low temperature ferromagnet becomes a paramagnet

139. A length L of wire carries a steady current I. It is bent first to form a circular plane coil of one turn. The same length is now bent more sharply to give a double loop of smaller radius. The magnetic field at the centre caused by the same current is :
a) A quarter of its first value b) Unaltered c) Four times of its first value
d) A half of its first value

140. Two wires are held perpendicular to the plane of paper at 5 m apart. They carry currents of 2.5 A and 5A in same direction. Then the magnetic field strength B at a point midway between the wires will be:
a) $(\mu_0/4\pi)$ T b) $(\mu_0/2\pi)$ T c) $(3\mu_0/2\pi)$ T d) $(3\mu_0/4\pi)$ T

141. A circular coil of 100 turns, radius 10 cm carries a current of 5 A. It is suspended vertically in a uniform horizontal magnetic field of 0.5 T and the field lines make an angle of 60° with the plane of the coil. The magnitude of the torque that must be applied on it to prevent it from turning is
a) 2.93 N m b) 3.43 N m c) 3.93 N m d) 4.93 N m

142. The conversion of a moving coil galvanometer into a voltmeter is done by
a) introducing a resistance of large value in series
b) introducing a resistance of small value in parallel
c) introducing a resistance oflarge value in parallel
d) introducing a resistance of small value in series

143. A long magnetic needle of length 2L, magnetic moment M and pole strength m units is broken into two pieces at the middle. The magnetic moment and pole strength of each piece will be :
a) M/2, m/2 b) M, m/2 c) M/2, m d) M, m

144. Materials suitable for permanent magnet, must have which of the following properties?
a) High retentivity, low coercivity and high permeability.

b) Low retentivity, low coercivity and low permeability.

c) Low retentivity, high coercivity and low permeability.

d) High retentivity, high coercivity and high permeability.

145. Points A and B are situated perpendicular to the axis of a 2 cm long bar magnet at large distances x and 3x from its centre on opposite sides. The ratio of tile magnetic fields at A and B will be approximately equal to:
a) 1:9 b) 2:9 c) 27:1 d) 9:1

146. Which of the following material is used in making the core of a moving coil galvanometer?
a) Copper b) Nickel c) Iron d) Both (a) and (b)

147. The angle of dip at a certain place where the horizontal and vertical components of the earth's magnetic field are equal is
a) 30° b) 75° c) 60° d) 45°

148. When a charged particle moving with velocity $\vec{v}$ is subjected to a magnetic field of induction $\vec{B}$, the force on it is non-zero. This implies that_____
a) angle between $\vec{v}$ and $\vec{B}$ can have any value other than 90°
b) angle between $\vec{v}$ and $\vec{B}$ can have any value other than zero and 180°
c) angle between $\vec{v}$ and $\vec{B}$ is either zero or 180°
d) angle between $\vec{v}$ and $\vec{B}$ is necessarily 90°

149. **Assertion:** Galvanometer cannot as such be used as an ammeter to measure the value of the current in a given circuit.
Reason: Galvanometer gives a full-scale deflection for a current of the order of micro ampere.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

150. A bar magnet of magnetic moment Mis placed in a magnetic field of induction B. The torque exerted on it is:
a) MB b) -MB c) M x B d) -M x B

151. The energy of emergent protons in MeV from a cyclotron having radius of its dees 1.8 m and applied magnetic field 0.7 T is (mass of proton = 1.67x 10^{-27}kg)
a) 50 b) 60 c) 70 d) 76

152. Two identical long conducting wires AOB and COD are placed at right angle to each other, with one above other such that 'O' is their common point for the two. The wires carry I_1 and I_2 currents, respectively. Point 'P' is lying at distance "d' from 'O' along a direction perpendicular to the plane containing the wires. The magnetic field at the point 'P' will be :
a) $(\mu_0/2\pi d) \times (I_1/I_2)$ b) $(\mu_0/2\pi d)(I_1/I_2)$ c) $(\mu_0/2\pi d) \times (I^2_1 - I^2_2)$
d) $(\mu_0/2\pi d) \times (I^2_1 + I^2_2)^{1/2}$

153. A bar magnet of magnetic moment M and moment of inertia I (about centre perpendicular to length) is cut into two equal pieces perpendicular to length. Let T be the period of oscillations of the original magnet about an axis through the mid point perpendicular to length in magnetic field B. The similar period T' for each piece would be

a) $\frac{T}{2}$ b) $\frac{3T}{4}$ c) $\frac{5T}{2}$ d) T

154. A circular coil of 25 turns and radius 12 cm is placed in a uniform magnetic field of 0.5 T normal to the plane of the coil. If the current in the coil is 6 A then total torque acting on the coil is

a) zero b) 3.4 N m c) 3.8 N m d) 4.4 N m

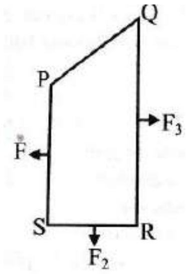
155. A 2.5 m long straight wire having mass of 500 g is suspended in mid air by a uniform horizontal magnetic field B. If a current of 4 A is passing through the wire then the magnitude of the field is (Take g = 10m s^{-2})

a) 0.5 T b) 0.6 T c) 0.25 T d) 0.8 T

156. A ball of superconducting material is dipped in liquid nitrogen and placed near a bar magnet. In which direction will it move?

a) Away from bar magnet b) Towards the bar magnet c) Around the bar magnet d) Remain constant

157. A closed loop PQRS carrying a current is placed in a uniform magnetic field. If the magnetic forces on segments P S, S R, and R Q are F_1, F_2 and F_3 respectively and are in the plane of the paper and along the directions shown the force on the segment QP is___



a) $F_3 - F_I - F_2$ b) $\sqrt{(F_3 - F_1)^2 + F_2^2}$ c) $\sqrt{(F_3 - F_1)^2 - F_2^2}$ d) $F_3 - F_5 + F_2$

158. A circular coil of 20 turns and 10cm radius is placed in a uniform magnetic field of 0.10 T normal to the plane of the coil. If the current in the coil is 5 A, cross-sectional area is 10-5m2 and coil is made up of copper wire having free electron density about 10^{29} m^{-3}, then the average force on each electron in the coil due to magnetic field is

a) 2.5 x 10^{-25}N b) 5 x 10^{-25}N c) 4 X 10^{-25}N d) 3 x 10^{-25}N

159. **Assertion:** Cyclotron does not accelerate electrons.

Reason: Mass of the electrons is very small

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

160. A coil carrying electric current is placed in uniform magnetic field _____
a) torque is formed b) emf is induced c) Both (a) and (b) are correct
d) None of the above

161. A bar magnet has a magnetic moment of 200 A m^2. The magnet is suspended in a magnetic field of 0.30 N A^{-1} m^{-1}. The torque required to rotate the magnet from its equilibrium position through an angle of 30°, will be :
a) 30 N m b) $30\sqrt{3}$ N m c) 60 N m d) $60\sqrt{3}$ N m

162. The range of magnetic susceptibility and relative magnetic permeability for diamagnetic substances are:
a) $-1 \geq \chi > 0,\ 0 \leq \mu_r < 1$ b) $-1 \leq \chi > 0,\ 0 \geq \mu_r < 1$ c) $-1 \geq \chi > 1,\ 0 \leq \mu_r < 1$
d) $-1 \leq \chi < 0,\ 0 \leq \mu_r < 1$

163. A charged particle (charge q) is moving in a circle of radius R with uniform speed v. The associated magnetic moment m is given by______
a) q v R^2 b) q v R^2 / 2 c) q v R d) q v R / 2

164. The primary origin of magnetism lies in
a) atomic current and intrinsic spin of electrons.

b) polar and non polar nature of molecules. c) pauli exclusion principle.

d) electronegative nature of materials.

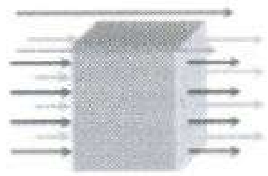
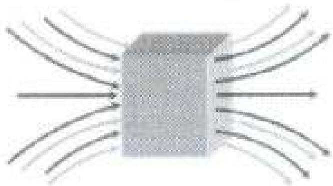
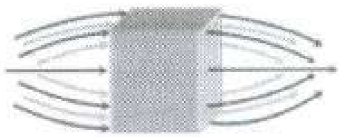
165. Charge q is uniformly spread on a thin ring of radius R. The ring rotates about its axis with a uniform frequency f Hz. The magnitude of magnetic induction at the centre of the ring is______
a) $\frac{\mu_0 qf}{2R}$ b) $\frac{u_0 q}{2fR}$ c) $\frac{u_0 q}{2\pi fR}$ d) $\frac{u_0 df}{2\pi R}$

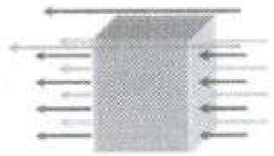
166. At a given place on earth's surface the horizontal component of earths magnetic field is 2 x 10^{-5} T and resultant magnetic field is 4 x 10^{-5} T. The angle of dip at this place is
a) 30° b) 60° c) 90° d) 45°

167. In a certain region of space electric field $\vec{E}$ and magnetic field $\vec{B}$ are perpendicular to each other and an electron enters in region perpendicular to the direction of $\vec{B}$ and $\vec{E}$ both and moves undeflected, then velocity of electron is______

a) $\frac{|\vec{E}|}{|\vec{B}|}$ b) $\vec{E} \times \vec{B}$ c) $\frac{|\vec{B}|}{|\vec{E}|}$I d) $\vec{E}, \vec{B}$

168. A uniform magnetic field, parallel to the plane of tile paper existed in space initially directed from left to right. When a bar of soft iron is placed in tile field parallel to it, tile lines of force passing through it will be represented by :

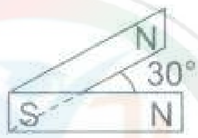
a)  b)  c) 

d) 

169. Following figures show the arrangement of bar magnets in different configurations. Each magnet has magnetic dipole moment m. Which configuration has highest net magnetic dipole moment?

a) 

b) 

c) 

d) 

170. A charged particle of charge q and mass m enters perpendicularly in a magnetic field B. Kinetic energy of the particle is E then frequency of rotation is______

a) $\frac{qB}{m\pi}$ b) $\frac{qB}{2\pi m}$ c) $\frac{gBE}{2\pi m}$ d) $\frac{qB}{2\pi E}$

171. A straight wire of diameter 0.5 mm carrying a current of 1 A is replaced by another wire of 1 mm diameter carrying same current. The strength of magnetic field far away is_____

a) twice the earlier value b) same as the earlier value

c) one-half of the earlier value d) one-quarter of the earlier value

172. The strength of the earth's magnetic field is

a) constant everywhere b) zero everywhere c) having very high value

d) vary from place to place on the earths surface

173. When a magnetic compass needle is carried near by to a straight wire carrying current, then

(I) the straight wire cause a noticeable deflection in the compass needle.

(II) the alignment of the needle is tangential to an imaginary circle with straight wire as its centre and has a plane perpendicular to the wire.

a) (I) is correct b) (II) is correct c) both (I) and (II) are correct

d) neither (1) nor (II) is correct

174. A short bar magnet of magnetic moment 0.4 JT^{-1} is place in a uniform magnetic field of 0.16T. The magnet is stable equilibrium when the potential energy is:
a) -0.64 J b) zero c) -0.082 J d) 0.064

175. A closely wound solenoid of 1000 turns and area of cross section 1.4×10^{-4} m^2 carrying a current of 3 A is suspended through its centre allowing it to turn in a horizontal plane. The magnetic moment associated with this solenoid is
a) 0.22 JT^{-1} b) 0.32 JT^{-1} c) 0.42 JT^{-1} d) 0.52 JT^{-1}

176. The electric current in a circular coil of two turns produced a magnetic induction of 0.2 T at its centre. The coil is unwound and then rewound into a circular coil of four turns. If same current flows in the coil, the magnetic induction at the centre of the coil now is
a) 0.2 T b) 0.4 T c) 0.6 T d) 0.8 T

177. Two circular coils 1 and 2 are made from the same wire but the radius of the 1st coil is twice that of the 2 nd coil. What potential difference in volts should be applied across them so that the magnetic field at their centres is the same ___________ .
a) 4 b) 6 c) 2 d) 3

178. Two a-particles have the ratio of their velocities as 3 : 2 on entering the field. If they move in different circular paths, then the ratio of the radii of their paths is
a) 2: 3 b) 3: 2 c) 9: 4 d) 4: 9

179. To convert a 800 m V range milli voltmeter of resistance 40 Ω into a galvanometer of 100 mA range, the resistance to be connected as shunt is :
a) 10 Ω b) 20 Ω c) 30 Ω d) 40 Ω

180. A particle having a mass of 10^{-2} kg carries a charge of 5×10^{-8}C. The particle is given an initial horizontal velocity of 10^5 ms^{-1} in the presence of electric field $\vec{E}$ and magnetic field $\vec{B}$. To keep the particle moving in a horizontal direction, it is necessary that__

(1) $\vec{B}$ should be perpendicular to the direction of velocity and $\vec{E}$ should be along the direction of velocity.

(2) Both $\vec{B}$ and $\vec{E}$ should be along the direction of velocity.

(3) Both $\vec{B}$ and $\vec{E}$ are mutually perpendicular and perpendicular to the direction of velocity.

(4) $\vec{B}$ should be along the direction of velocity and $\vec{E}$ should be perpendicular to the direction of velocity.

Which one of the following pairs of statements is possible?
a) (2) and (4) b) (1) and (3) c) (3) and (4) d) (2) and (3)

181. In the magnetic meridian of a certain place the horizontal component of earth's magnetic field is 0.25 G and dip angle is 60°. The magnetic field of the earth at this location is

a) 0.50 G b) 0.52 G c) 0.54 G d) 0.56 G

182. A closely wound solenoid of 2000 turns and area of crosssection $1.5 \times 10^{-4}\ m^2$ carries a current of 2.0 A. It suspended through its centre and perpendicular to its length, allowing it to turn in a horizontal plane in a uniform magnetic field 5×10^{-2} tesla making an angle of 30^o with the axis of the solenoid. The torque on the solenoid will be______

a) $3 \times 10^{-2}\ N - m$ b) $3 \times 10^{-3}\ N - m$ c) $1.5 \times 10^{-3}\ N - m$ d) $1.5 \times 10^{-2}\ N - m$

183. Two particles of equal charges after being accelerated through the same potential difference enter in a uniform transverse magnetic field and describe circular paths of radii R_1 and R_2. Then the ratio of their respective masses (M_1/ M_2) is

a) R_1/R_2 b) $(R_1/R_2)^2$ c) (R_2/R_1) d) $(R_2/R_1)^2$

184. Electromagnets are made of soft iron because soft iron has:

a) low retentivity and high coercive force

b) high retentivity and high coercive force c) low retentivity and low coercive force

d) high retentivity and low coercive force

185. A solenoid of length 0.6 m has a radius of 2 cm and is made up of 600 turns If it carries a current of 4 A, then the magnitude of the magnetic field inside the solenoid is

a) 6.024 x 10^{-3} T b) 8.024 x 10^{-3} T c) 5.024 x 10^{-3} T d) 7.024 x 10^{-3} T

186. A galvanometer of resistance 40 Ω gives a deflection of 5 divisions per mA. There are 50 divisions on the scale. The maximum current that can pass through it when a shunt resistance of 2 Ω is connected is

a) 210 mA b) 155 mA c) 420 mA d) 75 mA

187. A magnetising field of 2 x $10^3 Am^{-1}$ produces a magnetic flux density of 8 π T in an iron rod. The relative permeability of the rod will be

a) 10^2 b) 1 c) 10^4 d) 10^3

188. **Assertion:** A galvanometer can be used as a voltmeter to measure the voltage across a given section of the circuit.

Reason: For this it must be connected in parallel with that section of the circuit

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

189. A domain in ferromagnetic iron is in the form of a cube of side length $2\mu m$ then the number of iron atoms in the domain are (Molecular mass of iron = 55 g mol^{-1}and density = 7.92 g cm^{-3})
a) 6.92 x 10^{12}atoms b) 6.92 x 10^{11}atoms c) 6.92 x 10^{10}atoms
d) 6.92 x 10^{13}atoms

190. If a long hollow copper pipe carries a current, then magnetic field is produced______
a) inside the pipe only b) outside the pipe only
c) both inside and outside the pipe d) no where

191. A charge 'q' moves in a region where electric field and magnetic field both exist, then force on it is:
a) q (V x B) b) qE + q (v x B) c) qE + q (B x V) d) qB + q (E x v)

192. What is the magnitude of axial field due to a bar magnet of length 3 cm at a distance of 75 cm from its mid-point if its magnetic moment is 0.6 A m^2?
a) $0.013\mu T$ b) $0.113\mu T$ c) $0.213\mu T$ d) $0.313\mu T$

193. The magnetic field dB due to a small element at a distance r and carrying current i is_____

a) $\mathbf{dB} - \frac{\mu_0}{4\pi} i \left(\frac{d\mathbf{l} \times r}{r} \right)$ b) $\mathrm{dB} = \frac{\mu_0}{4\pi} i^2 \left(\frac{\mathrm{dl} \times r}{r^2} \right)$ c) $\mathbf{dB} = \frac{\mu_0}{4\pi} i^2 \left(\frac{dl \times r}{r} \right)$ d) $\mathbf{dB} = \frac{\mu_0}{4\pi} i \left(\frac{\mathbf{dl} \times r}{r^3} \right)$

194. A magnet of magnetic moment M and pole strength m is divided in two equal parts, then magnetic moment of each part will be :
a) M b) M/2 c) M/4 d) 2M

195. Which of the following is not correct about the magnetic field lines?
a) The magnetic field lines of a magnet form continuous closed loops
b)
The tangent to the field line at a given point represents the direction of the net magnetic field B at that point.
c)
The larger the number of field lines crossing per unit area, the stronger is the magnitude of the magnetic field B.
d)
The larger the number of field lines crossing per unit area, the stronger is the magnitude of the magnetic field B.

196. **Assertion:** Two parallel conducting wires carrying currents in opposite direction, come close to each other.
Reason: Parallel currents repel and anti parallel currents attract.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

197. The earth's field departs from its dipole shape substantially at large distance (greater than about 3000 km). The responsible factor for this distortion is
a) motion of ions in earth's ionosphere b) motion of ions in earth's atmosphere
c) motion of ions in earth's lithosphere d) motion of ions in the space.

198. A magnetic needle has a magnetic moment 5.0 x 10^{-2} A m^2 and moment of inertia 8.5 x 10^{-7} Kg m^2. It performs oscillation of time period 0.65 s. What is the magnitude of the magnetic field?
a) 0.0016 T b) 1.6 T c) 0.16 T d) 16 T

199. 10 eV electron is circulating in a plane at right angle to a uniform field of magnetic induction $10^{-4}\ \mathrm{Wb/m^2}$ (=1.0. gauss). The orbital radius of the electron is______
a) 12 cm b) 16 cm c) 11 cm d) 18 cm

200. A galvanometer of resistance 70 Q, is converted to an ammeter by a shunt resistance r_s = 0.03 Q. The value of its resistance will become
a) 0.025 b) 0.022 c) 0.035 d) 0.030

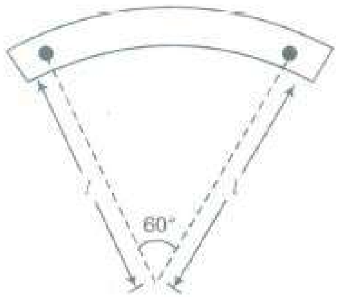
201. Magnetic moment for a solenoid and corresponding bar magnet is
a) equal for both b) more for solenoid c) more for bar magnet d) none of these

202. A closely wound solenoid of 750 turns and area of cross section of 5 x 10^{-4} m^2 carries a current of 3.0 A. Its associated magnetic moment is
a) 4.12 JT^{-1} b) 3.12 JT^{-1} c) 2.12 JT^{-1} d) 1.13 JT^{-1}

203. A galvanometer having a resistance of 50 Ω, gives a full scale deflection for a current of 0.05 A. The length (in metres) of a resistance wire of area of cross section 3 x 10^{-2} cm^2 that can be used to convert the galvanometer into an ammeter which can read a maximum of 5 A current is (Specificresistance of the wire p = 5 x 10^{-7} Q m)
a) 9 b) 6 c) 3 d) 1.5

204. A galvanometer of 50 ohm resistance has 25 divisions. A current of 4×10^{-4} ampere gives a deflection of one per division. To convert this galvanometer into a voltmeter having a range of 25 volts, it should be connected with a resistance of______
a) 2450 Ω in series b) 2500 Ω in series c) 245 Ω in series d) 2550 Ω in series

205. A bar magnet of length 'l' and magnetic dipole moment 'M' is bent in the form of an arc as shown in figure. The new magnetic dipole moment will be:



a) M/2 b) M c) 3M/π d) 2M/π

206. A circular loop of radius 3 cm is having a current of 12.5 A. The magnitude of magnetic field at a distance of 4 cm on its axis is
a) 5.65 x 10^{-5} T b) 5.27 x 10^{-5} T c) 6.54 x 10^{-5} T d) 9.20 x 10^{-5} T

207. A 4 A current carrying loop consists of three identical quarter circles of radius 5 cm lying in the positive quadrants of the x-y, y-z and z-x planes with their centres at the origin joined together, value of $\vec{B}$ at the origin is
a) $\frac{\mu_0}{10}(\hat{i}+\hat{j}-\hat{k})T$ b) $\frac{\mu_0}{10}(-\hat{i}+\hat{j}+\hat{k})T$ c) $\frac{\mu_0}{5}(\hat{i}+\hat{j}+\hat{k})T$ d) $10\mu_0(\hat{i}+\hat{j}+\hat{k})T$

208. Two free parallel wires carrying currents in opposite directions
a) Attract each other b) Repel each other c) Neither attract nor repel
d) Get rotated to be perpendicular to each other

209. If the current sensitivity of a galvanometer is doubled, then its voltage sensitivity will be
a) doubled b) halved c) unchanged d) four times

210. Two equal electric currents are flowing perpendicular to each other as shown in the figure. AB and CD ate perpendicular to each other and s;anmehically placed wr.t the currents, where do we expect the resultant magnetic field to be zero?
a) On AB b) On CD c) On both AB and CD d) On both OD and BO

211. A coil of one turn is made of a wire of certain length and then from the same length a coil of two turns is made. If the same current is passed in both the cases, then the ratio of the magnetic induction at their centres will be___
a) 2: 1 b) 1: 4 c) 4: 1 d) 1: 2

212. A magnetic needle suspended parallel to a magnetic field requires 3 J of work to turn it through 60°. The torque needed to maintain the needle in this position will be:
a) 3 J b) $\sqrt{3}$ J c) 3/2 J d) 2$\sqrt{3}$ J

213. A current carrying circular loop of radius R is placed in the x-y plane with centre at the origin. Half of the loop with x > 0 is now bent so that it now lies in the y-zplane.
a) The magnitude of magnetic moment now diminishes.
b) The magnetic moment does not change.

c) The magnitude of 13 at (0, 0, z),z >> R increases.

d) The magnitude of $\vec{B}$ at (0, 0, z), z >> R is unchanged

214. Tesla is the unit of______

a) magnetic flux b) magnetic field c) magnetic induction d) magnetic moment

215. Ampere's circuital law is given by

a) $\oint \vec{H}.\vec{dl} = \mu_0 I_{enc}$ b) $\oint \vec{B}.\vec{dl} = \mu_0 I_{enc}$ c) $\oint \vec{B}.\vec{dl} = \mu_0 J$ d) $\oint \vec{H}.\vec{dl} = \mu_0 J$

216. A galvanometer can be converted into a voltmeter by connecting _____________ .

a) A high resistance in parallel b) A low resistance in series

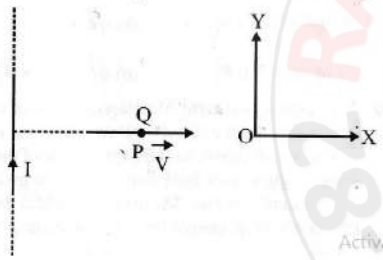
c) A high resistance in series d) A low resistance in parallel

217. A short bar magnet has a magnetic moment of 0.48 J^{-1}. The magnitude and direction of magnetic field produced by the magnet at a distance of 10 cm from the centre of the magnet on its axis is:

a) 0.48 x 10^{-4} T along N-S direction b) 0.28 x 10^{-4} T along S-N direction

c) 0.28 x 10^{-4} T along N-S direction d) 0.96 x 10^{-4} T along S-N direction

218. A very iong straight wire carries a current I. At the instant when a charge +Q at point P has velocity $\vec{v}$ as shown, the force on the charge is______



a) along OY b) opposite to OY c) along OX d) opposite to OX

219. Assume the dipole model for earth's magnetic field B which is given by the vertical component of magnetic field, Bv =$B_V = \frac{\mu_0}{4\pi}\frac{2m\cos\theta}{r^3}$ and the horizontal component of magnetic field B_H = $B_H = \frac{\mu_0}{4\pi}\frac{m\sin\theta}{r^3}$ where θ= 90° - latitude as measured from magnetic equator, then the loci of point for which dip angle is ± 45°.

a) $\tan^{-1}(3)$ b) $\tan^{-1}(2)$ c) $\tan^{-1}(0.5)$ d) $\tan^{-1}(1)$

220. The magnetic force per unit length on a wire carrying a current of 10 A and making an angle of 45° with the direction of a uniform magnetic field of 0.20 T is

a) $2\sqrt{2}$N m^{-1} b) $\frac{2}{\sqrt{2}}$N m^{-1} c) $\frac{\sqrt{2}}{2}$N m^{-1} d) $4\sqrt{2}$N m^{-1}

221. Under the influence of a uniform magnetic field, a charged particle moves with constant speed v in a circle of radius R. The time period of rotation of the particle_____

a) depends on R and not on v b) is independent of both v and R

c) depends on both v and R d) depends on v and not on R

222. An electron of energy 1800 eV describes a circular path in magnetic field of flux density 0.4 T. The radius of path is ($q = 1.6 \times 10^{-19}$C, $m_e = 9.1 \times 10^{-31}$kg)
a) 2.58×10^{-4} m b) 3.58×10^{-4} m c) 2.58×10^{-3}m d) 3.58×10^{-3}m

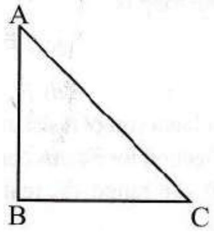
223. The magnetic induction at a point P which is at the distance of 4 cm from a long current carrying wire is 10^{-3} T. The field of induction at a distance 12 cm from the current will be______
a) $3.33 \times 10^{-4} T$ b) 1.11×10^{-4} T c) $3 \times 10^{-3} T$ d) $9 \times 10^{-3} T$

224. A bar magnet is oscillating in the Earth's magnetic field with a period T. What happens to this period and motion if this mass is quadrupled
a) Motion remains S.H. with time period = T/2
b) Motion remains S.H. with time period = 2T
c) Motion remains S.H. with time period = 4T
d) Motion remains S.H. with time and period remains nearly constant

225. Which of the following is responsible for the earth's magnetic field?
a) Convective currents in earth's core. b) Diversive current in earth's core.
c) Rotational motion of earth . d) Translational motion of earth .

226. If a diamagnetic substance is brought near the north or the south pole of a bar magnet, it is :
a) repelled by the north pole and attracted by the south pole
b) attracted by the north pole and repelled by the c) attracted by both the poles
d) repelled by both the poles

227. A current carrying loop in the form of a right angle isosceles triangle ABC is placed in a uniform magnetic field acting along AB. If the magnetic force on the arm BC. is F, what is the force on the arm AC?



a) $-\sqrt{2}F$ b) $-\vec{F}$ c) F d) $\sqrt{2}F$

228. In an experiment it is found that the magnetic susceptibility of given substance is much more greater than one. The possible substance is
a) diamagnetic b) paramagnetic c) ferromagnetic d) nonmagnetic

229. Cubical region of space is filled with some uniform electric and magnetic field. An electron enters the cube across one of its faces with velocity v and a positron enters via opposite face with velocity - v. At this instant, which one of the following is not correct?

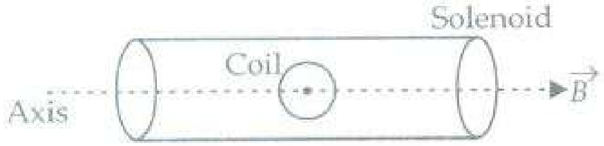
a) The electric forces on both the particles cause identical acceleration.

b) The magnetic forces on both the particles cause equal acceleration.

c) Both particles gain or loose energy at the same rate.

d) The motion of the centre of mass is determined by B alone.

230. The torque required to hold a small circular coil of 10 turns, area 1 mm^2 and carrying a current of $(\frac{21}{44})$ A in the middle of a long solenoid of 10^3 turns/m carrying a current of 2.5 A, with its axis perpendicular to the axis of the solenoid is



a) 1.5×10^{-6} N m b) 1.5×10^{-8} N m c) 1.5×10^{6} N m d) 1.5×10^{8} N m

231. A current loop consists of two identical semicircular parts each of radius R, one lying in the x-y plane and the other in x-z plane. If the current in the loop is i, the resultant/? magnetic field due to the two semicircular parts at their common centre is ______________ .

a) $\frac{\mu_0 i}{\sqrt{2}R}$ b) $\frac{\mu_0 i}{2\sqrt{2}R}$ c) $\frac{\mu_0 i}{2R}$ d) $\frac{\mu_0 i}{4R}$

232. A paramagnetic liquid is taken in a U-tube and arranged so that one of its limbs is kept between pole pieces of the magnet. The liquid level in the limb

a) goes down b) rises up c) remains same d) first goes down and then rise

233. A positively charged particle moving due cast enters a region of uniform magnetic field directed vertically upwards. The particle will____

a) continue to move due East b) move in a circular orbit with its speed unchanged

c) move in a circular orbit with its speed increased

d) gets deflected vertically upwards

234. The work done in turning a magnet of magnetic moment 'M' by an angle of 90° from tile meridian is 'n' times tile corresponding work done to turn it through an angle of 60°, where 'n' is given by:

a) 1/2 b) 2 c) 1/4 d) 1

235. A proton, a deutron and an a-particle with same kinetic energy enter perpendicularly in a uniform magnetic field, then the ratio of radii of their circular paths is

a) $1 : 1 : \sqrt{2}$ b) $\sqrt{2} : 1 : 1$ c) $1 : \sqrt{2} : 1$ d) $1 : 2 : \sqrt{2}$

236. Magnetic intensity for an axial point due to a short bar magnet of magnetic moment M is given by :

a) $(\mu_0/4\pi) \times M/d^3$ b) $(\mu_0/4\pi) \times M/d^2$ c) $(\mu_0/2\pi) \times M/d^3$ d) $(\mu_0/2\pi) \times M/d^2$

237. **Assertion:** The magnetic field at the ends of a very long current carrying solenoid is half of that at the centre.
Reason: If the solenoid is sufficiently long, the field within it is uniform.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

238. A circular coil of 300 turns and diameter 14 cm carries a current of 15 A. The magnitude of magnetic moment associated with the loop is
a) 51.7 JT^{-1} b) 69.2 JT^{-1} c) 38.6 JT^{-1} d) 19.5 JT^{-1}

239. A beam of electrons is moving with constant velocity in a region having simultaneous perpendicular electric and magnetic fields of strength $20 Vm^{-1}$ and 0.5 T, respectively at right angles to the direction of motion of the electrons. Then, the velocity of electrons must be______
a) 8 m/s b) 20 m/s c) 40 m/s d) 1/40 m/s

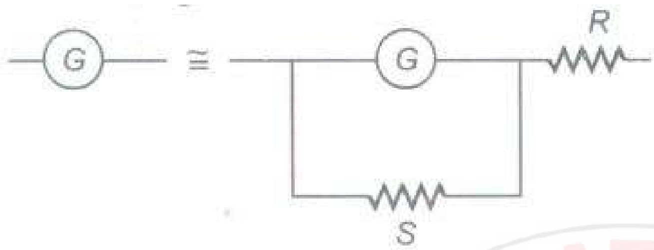
240. **Assertion:** When a magnetic dipole is placed in a non uniform magnetic field, only a torque acts on the dipole.
Reason: Force would also act on dipole if magnetic field were uniform.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

241. **Assertion:** Ampere's circuital law holds for steady currents which do not fluctuate with time.
Reason: Ampere's circuital law is similar to that of Biot-savart's law
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

242. An iron rod of length L and magnetic moment M is bent in the form of a semicircle. Now its magnetic moment will be:
a) M b) 2M/π c) M/π d) Mπ

243. The magnetic moment associated with a circular coil of 35 turns and radius 25 cm, if it carries a current of 11 A is
a) 72.2 A m^2 b) 70.5 A m^2 c) 74.56 A m^2 d) 75.56 A m^2

244. A galvanometer of resistance, G is shunted by a resistance S ohm. To keep the main current in the circuit unchanged, the resistance to be put in series with the galvanometer is:



a) $S^2/(S + G)$ b) S x G/(S + G) c) $G^2/(S + G)$ d) G/(S + G)

245. A galvanometer acting as a voltmeter will have_____
a) a low resistance in series with its coil b) a high resistance in parallel with its coil
c) a high resistance in series with its coil d) a low resistance in parallel with its coil

246. Through two parallel wires A and B, 10 and 2 ampere of currents are passed respectively in opposite directions. If the wire A is infinitely long and the length of the wire B is 2 m, the force on the conductor B, which is situated at 10 cm distance from A will be :
a) 8 x 10^{-5} N b) 4 x 10^{-7} N c) 4 x 10^{-5} N d) 4π x 10^{-7} N

247. Under the influence of a uniform magnetic field a charged particle is moving in a circle of radius R with constant speed v. The time period of the motion_____
a) depends on both R and v b) is independent of both R and v
c) depends on R and not on v d) depends on v and not on R

248. The magnetic moment of a short bar magnet placed with its magnetic axis at 30° to an external field of 900 G and experiences a torque of 0.02 N m is
a) 0.35 A m^2 b) 0.44 A m^2 c) 2.45 A m^2 d) 1.5 A m^2

249. Curie temperature is the temperature above which:
a) Ferromagnetic material becomes diamagnetic material
b) Ferromagnetic material becomes paramagnetic material
c) Paramagnetic material becomes diamagnetic material
d) Paramagnetic material becomes ferromagnetic material

250. A uniform magnetic field acts right angles to the direction of motion of electrons. As a result, the electron moves in a circular path of radius 2 cm. If the speed of electrons is doubled, then the radius of the circular path will be______
a) 2.0 cm b) 0.5 cm c) 4.0 cm d) 1.0 cm

251. A solenoid of length 50 ern, having 100 turns carries a current of 2.5 A. The magnetic field at one end of the solenoid is:
a) 3.14×10^{-4} T b) 6.28×10^{-4} T c) 1.57×10^{-4} T d) 9.42×10^{-4} T

252. Magnetic field intensity at the centre of coil of 50 turns, radius 0.5 m and carrying a current of 2 A is:
a) 0.5×10^{-5} T b) 1.25×10^{-4} T c) 3×10^{-5} T d) 4×10^{-5} T

253. Let the magnetic field on earth be modelled by that of a point magnetic dipole at the centre of earth. The angle of dip at a point on the geographical equator is
a) always zero b) positive, negative or zero c) unbounded d) always negative

254. A galvanometer has a coil of resistance 100 ohm and gives a full-scale deflection for 30 mA current. It is to work as a voltmeter of 30 volt range, the resistance required to be added will be____
a) 900 Ω b) 1800 Ω c) 500 Ω d) 1000 Ω

255. A proton is accelerating on a cyclotron having oscillating frequency of 11 MHz in external magnetic field of 1 T. If the radius of its dees is 55 cm, then its kinetic energy (in MeV) is ($m_p = 1.67 \times 10^{-27}$ kg, $e = 1.6 \times 10^{-19}$ C)
a) 13.36 b) 12.52 c) 14.89 d) 14.49

256. A deutron of kinetic energy 50 keV is describing a circular orbit of radius 0.5 m in a plane perpendicular to magnetic field B. The kinetic energy of the proton that describes a circular orbit of radius 0.5 m in the same plane with the same magnetic field B is __________ .
a) 25 keV b) 50 keV c) 200 keV d) 100 keV

257. A 250 turns rectangular coil of length 2.1 cm and width 1.25 cm carries a current of 85 μA and subjected to a magnetic field of strength 0.85T. Work done for rotating the coil by 1800 against the torque is :
a) 4.55 μJ b) 2.3 μJ c) 1.15 μJ d) 9.1 μJ

258. The work done in moving a dipole from its most stable to most unstable position in a 0.09 T uniform magnetic field is (dipole moment of this dipole = 0.5 A m^2)
a) 0.07J b) 0.08 J c) 0.09 J d) 0.1 J

259. A thin ring of radius R metre has charge q coulomb uniformly spread on it. The ring rotates about its axis with a constant frequency of f revolutions/s. The value of magnetic induction in Wb / m^2 at the centre of the ring is_____
a) $\frac{\mu_0 qf}{2\pi R}$ b) $\frac{\mu_0 q}{2\pi / R}$ c) $\frac{\mu_0 q}{2fR}$ d) $\frac{\mu_0 qf}{2R}$

260. Two bar magnets having same geometry with magnetic moments M and 2M, are firstly placed in such a way that their similar poles are same side then its time period of oscillation is T_1. Now the polarity of one of the magnet is reversed then time period of oscillation is T_2 then:
a) $T_1 < T_2$ b) $T_1 = T_2$ c) $T_1 > T_2$ d) $T_2 = \infty$

261. An a-particle moves in a circular path of radius 0.83 cm in the presence of a magnetic field of 0.25 Wb / m^2. The deBroglie wavelength associated with the particle will be_____

a) 1 A^o b) 0.1 A^o c) 10 A^o d) 0.01 A^o

262. In a region, steady and uniform electric and magnetic fields are present. These two fields are parallel to each other. A charged particle is released from rest in this region. The path of the particle will be a :

a) Helix b) Straight line c) Ellipse d) Circle

263. Gyromagnetic ratio is the ratio of magnetic moment (μ_l) to the orbital angular momentum (l). Its numerical value for an electron is given by:

a) 8.8 x 10^{-12} C kg^{-1} b) 8.8 x 10^{10} Ckg^{-1} c) 1.6 x 10^{-19} C kg^{-1}

d) 6.67 x 10^{11} C kg^{-1}

264. A charged particle moves through a magnetic field in a direction perpendicular to it. Then the __________ .

a) velocity remains unchanged b) speed of the particle remains unchanged

c) dircction of the particle remains unchanged d) acceleration remains unchanged

265. The percentage increase in magnetic field B when the space within a current carrying toroid is filled with aluminium (χ = 2.1 x 10^{-5}) is

a) 0.2% b) 2 x 10^{-3} % c) 2 X 10^{-2} % d) 2 x 10^{-4} %

266. The operating magnetic field for accelerating protons in a cyclotron oscillator having frequency of 12 MHz is (q = 1.6 X 10^{-19} C, mp = 1.67 x 10^{-27} kg and 1 MeV = 1.6 x 10^{-13} J)

a) 0.69 T b) 0.79 T c) 0.59 T d) 0.49 T

267. Permanent magnets are the substances having the property of

a) ferromagnetism at room temperature for a long period of time.

b) paramagnetism at room temperature for a long period of time.

c) anti ferromagnetism at room temperature for a long period of time.

d) diamagnetism at room temperature for a long period of time.

268. A magnetic needle has magnetic moment, 5.8 x 10^{-2} A m^2 and moment of inertia of 7.8 x 10^{-6} kg m^2, it performs 12 complete oscillations in 6.0 s. What is the magnitude of magnetic field?

a) 0.011 T b) 0.021 T c) 0.031 T d) 0.041 T

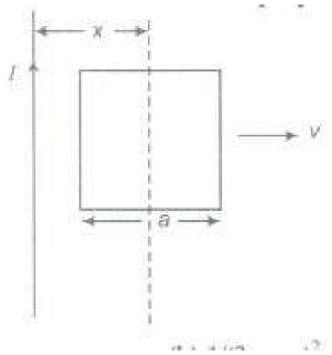
269. Two long parallel wires are at a distance of 1 m. Both of them carry 1 A of current. The force of attraction per unit length between the two wires is _____

a) 2×10^{-7} N/m b) 2×10^{-8} N/m c) 5×10^{-8} N/m d) 10^{-7} N/m

270. The vertical component of earth's magnetic field at a place is $\sqrt{3}$ times the horizontal component the value of angle of dip at this place is

a) 30° b) 45° c) 60° d) 90°

271. A conducting square frame of side a and a long straight wire carrying current I and located in the same plane as shown in the figure. The frame moves to the right with a constant velocity v. The emf induced in the frame will be proportional to



a) $1/x^2$ b) $1/(2x-a)^2$ c) $1/(2x+a)^2$ d) $1/(2x-a)(2x+a)$

272. Two identical current carrying coaxial loops, carry current I in opposite sense. A simple amperian loop passes through both of them once. Calling the loop as C, then which statement is correct?

a) $\oint \vec{B}.\vec{dl} = \mp 2\mu_0 I$ b) the value of $\oint \vec{B}.\vec{dl}$ is independent of sense of C.

c) there may be a point on C where Band dl are parallel. d) none of these

273. Which one of the following is not correct about Lorentz Force?

a)

In presence of electric field $\vec{E}$(r) and magnetic field $\vec{B}$(r) the force on a moving electric charge is $\vec{F}$=q[$\vec{E}$(r)+$\vec{v}$x$\vec{B}$(r)].

b)

The force, due to magnetic field on a negative charge is opposite to that on a positive charge.

c)

The force due to magnetic field becomes zero if velocity and magnetic field are parallel or antiparallel.

d) For a static charge the magnetic forceis maximum.

274. Superconductors are

a) most exotic diamagnetic materials b) ferromagnetic material with low resistivity

c) Paramagnetic materials at high temperature d) none of these

275. The range of voltmeter of resistance 300 Ω is 5 V. The resistance to be connected to convert it into an ammeter of range 5 A is :

a) 1 Ω in series b) 1 Ω in parallel c) 0.1 Ω in series d) 0.1 Ω in parallel

276. **Assertion:** Increasing the current sensitivity of a galvanometer necessarily increases the voltage sensitivity.

Reason: Voltage sensitivity is inversely proportional to current sensitivity.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false.   d) If both assertion and reason are false

277. The equatorial magnetic field of earth is 0.4 G. Then its dipole moment on equator is
a) 1.05×10^{23} A m^2 b) 2.05×10^{23} A m^2 c) 1.05×10^{21} A m^2 d) 2.05×10^{21} A m^2

278. The magnetic induction at a point 1 $\mathring{A}$ away from a proton measured along its axis of spin is (magnetic moment of the proton is 1.4×10^{-26} A m^2)
a) 0.28 mT   b) 28 mT   c) 0.028 mT   d) 2.8 mT

279. The final torque on a coil having magnetic moment 25 A m^2 in a 5 T uniform external magnetic field, if the coil rotates through an angle of 60° under the influence of the magnetic field is
a) 216.5 N m   b) 108.25 N m   c) 102.5 N m   d) 258.1 N m

280. A tightly wound 90 turn coil of radius 15 cm has a magnetic field of 4×10^{-4} T at its centre. The current flowing through it is
a) 1.06 A   b) 2.44 A   c) 3.44 A   d) 4.44 A

281. In an inertial frame of reference, the magnetic force on a moving charged particle is $\vec{F}$. Its value in another inertial frame of reference will be
a) remained same   b) changed due to change in the amount of charge
c) changed due to change in velocity of charged particle
d) changed due to change in field direction

282. What is the correct value of Bohr magneton?
a) 8.99×10^{-24} A m^2 b) 9.27×10^{-24} A m^2 c) 5.66×10^{-24} A m^2
d) 9.27×10^{-28} A m^2

283. Two straight horizontal parallel wires are carrying tile same current in tile same direction; d is tile distance between tile wires. You are provided with a small freely suspended magnetic needle. At which of tile following positions will tile orientation of tile needle be independent of tile magnitude of tile current in tile wires
a) At a distance d/2 from any of the wires
b) At a distance d/2 from any of the wires in the horizontal plane
c)
Anywhere on the circumference of a vertical circle of radius d and centre halfway between the wires
d) At points halfway between the wires in the horizontal plane

284. Two thin long parallel wires separated by a distance b are carrying a current i amp each. The magnitude of the force per unit length exerted by one wire on the other is
a) $\mu_0 i^2/b^2$ b) $\mu_0 i^2/2\pi b$ c) $\mu_0 i/2\pi b$ d) $\mu_0 i/2\pi b^2$

285. A compass needle whose magnetic moment is 60 A m^2 pointing geographical north at a certain place where the horizontal component of earth's magnetic field is 40 x 10^{-6} Wb m^{-2} experiences a torque of 1.2 x 10^{-3}N m. The declination of the place is
a) 20° b) 45° c) 60° d) 30°

286. If an electron is moving in a magnetic field of 5.4 x 10^{-4} T on a circular path of radius 32 cm having a frequency of 2.5 MHz, then its speed will be:
a) 8.56 x 10^6 m s^{-1} b) 5.024 x 10^6 m s^{-1} c) 8.56 x 10^4 m s^{-1}
d) 5.024 x 10^4 m s^{-1}

287. A domain in ferromagnetic iron in the form of cube is having 5 x 10^{10}atoms. If the side length of this domain is 1.5 μm and each atom has a dipole moment of 8 x 10^{-24}A m^2, then magnetisation of domain is:
a) 11.8 x 10^5 A m^{-1} b) 1.18 x 10^4A m^{-1} c) 11.8 x 10^4A m^{-1} d) 1.18 x 10^5 A m^{-1}

288. The temperature of transition from ferromagnetic property to paramagnetic property is called
a) Transition temperature b) Critical temperature c) Curie temperature
d) Triplet temperature.

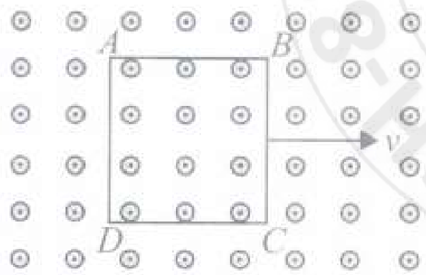
289. Two long and parallel straight wires A and B are carrying currents of 4 A and 7 A in the same direction are separated by a distance of 5 cm. The force acting on a 8 cm section of wire A is
a) 3 x 10^{-6} N b) 6 x 10^{-6} N c) 9 x 10^{-6} N d) 12 x 10^{-6} N

290. If a magnetic material is having magnetic susceptibility (χ) = -1, then the relative magnetic permeability (μ_r) and type of magnetic material is:
a) 0, diamagnetic b) 2, ferromagnetic c) 1, paramagnetic d) -1, diamagnetic

Ravi Maths Tuition Centre

Time : 1 Mins | **ELECTROMAGNETIC INDUCTION AND ALTERNATING CURRENTS 1** | **Marks : 1347**

1. An ac circuit consists of an inductor of inductance 0.5 H and a capacitor of capacitance 8 μF in series. The current in the circuit is maximum when the angular frequency of ac source is :
   a) 500 rad/sec b) 2 x 10^5 rad/sec c) 4000 rad/sec d) 5000 rad/sec
2. A series LCR circuit containing a resistance of 120 Ω has angular resonance frequency 4 x 10^5 rad s^{-1}. At resonance the voltages across resistance and inductance are 60 V and 40 V respectively. The angular frequency at which current in the circuit lags the voltage by 45° is
   a) 16 x 10^5 rad s^{-1} b) 8 x 10^5 rad s^{-1} c) 4 x 10^5 rad s^{-1} d) 2 x 10^5 rad s^{-1}
3. In an AC circuit with voltage V and current i the power dissipated is_____
   a) Depends on the phase between V and i b) $\frac{1}{\sqrt{2}}Vi$ c) $\frac{1}{2}Vi$ d) Vi
4. At resonance frequency the impedance in series LCR circuit is
   a) maximum b) minimum c) zero d) infinity
5. A metallic square loop ABCD is moving in its own plane with velocity v in a uniform magnetic field perpendicular to its plane as shown in D figure. An electric field is induced



   a) in AD, but not in BC b) in Be, but not in AD c) neither in AD nor in BC
   d) in both AD and BC
6. A circular disc of radius 0.2 m is placed in a uniform magnetic field of induction $(\frac{1}{\pi})$Wb m^{-2} in such a way that its axis makes an angle of 60° with $\vec{B}$. The magnetic flux linked with the disc is:
   a) 0.02 Wb b) 0.06 Wb c) 0.08 Wb d) 0.01 Wb
7. Two cities are 150 km apart. Electric power is sent from one city to another city through copper wires. The fallof potential per km is 8 volt and the average resistance per km is 0.5Ω. The power loss in the wire is:
   a) 19.2 W b) 19.2 kW c) 19.2 J d) 12.2 kW
8. An LCR series circuit is under resonance. If I_m is current amplitude, Vm is voltage amplitude, R is the resistance, Z is the impedance, X_L is the inductive reactance and X_c is the capacitive reactance, then

a) $I_m = \frac{Z}{V_m}$ b) $I_m = \frac{V_m}{X_L}$ c) $I_m = \frac{V_m}{X_C}$ d) $I_m = \frac{V_m}{R}$

9. Assertion: It is more difficult to push a magnet into a coil with more loops.
Reason: Emf induced in the current loop resists the motion of the magnet.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

10. In an AC generator, a coil with N turns all of the same area A and total resistance R, rotates with frequency ω in a magnetic field B. The maximum value of emf generated in the coil will be :
a) NABRω b) NAB c) NABR d) NABω

11. An inductive circuit contains a resistance of 10 ohm and an inductance of 2.0 henry. If an ac voltage of 120 volt and frequency of 60 Hz is applied to this circuit, the current in the circuit would be nearly:
a) 0.32 amp b) 0.16 amp c) 048 amp d) 0.80 amp

12. The resonant frequency of a series LCR circuit with L = 2.0 H, C = 32μF and R = 10Ω is
a) 20 Hz b) 30 Hz c) 40 Hz d) 50 Hz

13. In series LCR circuit, the phase angle between supply voltage and current is
a) $tan\phi = \frac{X_L - X_C}{R}$ b) $tan\phi = \frac{R}{X_L - X_C}$ c) $tan\phi = \frac{R}{X_L + X_C}$ d) $tan\phi = \frac{X_L + X_C}{R}$

14. The magnetic flux through a coil perpendicular to its plane and directed into paper is varying according to the relation ϕ = ($2t^2$ + 4t + 6) mWb. The emf induced in the loop at t = 4 s is
a) 0.12 V b) 2.4 V c) 0.02 V d) 1.2 V

15. An a.c. generator consists of a coil of 100 turns and cross-sectional area of 3 m^2, rotating at a constant angular speed of 60 radian/see in a uniform magnetic field of 0.04 T. The resistance of the coil is 500 ohm. What is the maximum power dissipation in the coil?
a) 518.4 W b) 1036 W c) 259.2 W d) Zero

16. Assertion: The self-inductance of a long solenoid is proportional to the area of cross-section and length of the solenoid.
Reason: Self inductance of a solenoid is independent of the number of turns per unit length.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

17. In an a.c circuit the e.m.f. (e) and the current (i) at any instant are given respectively by
$\varepsilon = E_0 \sin \omega t; i = I_0 \sin(\omega t - \phi)$
The average power in the circuit over one cycle of a.c. is_____
a) $\frac{E_0 I_0}{2}$ b) $\frac{E_0 I_0}{2} \sin\phi$ c) $\frac{E_0 I_0}{2} \cos\phi$ d) $E_0 I_0$

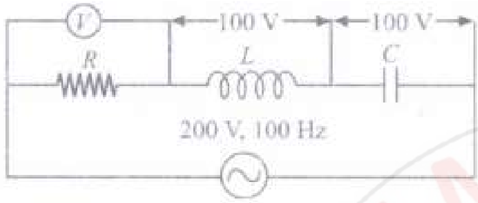
18. An ac source is of $\frac{200}{\sqrt{2}}$ V,50 Hz. The value of voltage after $\frac{1}{600}$ s from the start is
a) 200 V b) $\frac{200}{\sqrt{2}}$ V c) 100 V d) 50 V

19. An infinitely long cylinder is kept parallel to a uniform magnetic field B directed along positive z-axis, The direction of induced current on the surface of cylinder as seen from the z-axis will be
a) clockwise of the positive z-axis b) anticlockwise of the positive z-axis c) zero
d) along the magnetic field

20. A 44 mH inductor is connected to 220 V, 50 Hz ac supply. The rms value of the current in the circuit is
a) 12.8 A b) 13.6 A c) 15.9 A d) 19.5 A

21. In a coil current falls from 5 A to 0 A in 0.2 s. If an average emf of 150 V is induced, then the self inductance of the coil is
a) 4 H b) 2 H c) 3 H d) 6 H

22. In the circuit shown in figure, what will be the reading of the voltmeter?



a) 300 V b) 900 V c) 200 V d) 400 V

23. If the current is halved in a coil, then the energy stored is how much times the previous value?
a) 1/2 b) 1/4 c) 2 d) 4

24. A magnetic field B is confined to a region r $\leq$ a and points out of the paper (the z-axis), r = 0 being the centre of the circular region. A charged ring (charge = q) of radius b(b > a) and mass m lies in the x-y plane with its centre at the origin. The ring is free to rotate and is at rest. The magnetic field is brought to zero in time M. The angular velocity ro of the ring after the field vanishes, is
a) $\frac{qBa^2}{2mb}$ b) $\frac{qBa}{2mb^2}$ c) $\frac{2mb^2}{qBa^2}$ d) $\frac{qBa^2}{2mb^2}$

25. A coil has an area of 0.05 m^2 and it has 800 turns. It is placed perpendicularly in a magnetic field of strength 4 x 10^{-5} Wb/m^2, it is rotated through 90° in 0.1 sec. The average e.m.f. induced in the coil is :
a) 0.056 V b) 0.046 V c) 0.026 d) 0.016 V

26. In an A.C. circuit the current :
a) Always leads the voltage b) Always lags behind the voltage
c) Is always in phase with the voltage
d) May lead or lag behind or be in phase with the voltage

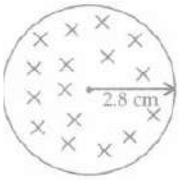
27. A step-up transformer operates on a 230 V line and supplies current of 2 A to a load. The ratio of the primary and secondary winding is 1: 25. The current in the primary coil is____
a) 15 A b) 50 A c) 25 A d) 12.5 A

28. Alternating current of peak value $\left(\frac{2}{\pi}\right)$ ampere flows through the primary coil of the transformer. The coefficient of mutual inductance between primary and secondary coil is 1 henry. The peak e.rn.f induced in secondary coil is (Frequency of AC = 50 Hz)
a) 100 V b) 200 V c) 300 V d) 400 V

29. **Assertion:** A step-up transformer changes a lowvoltage into a high voltage.
Reason : This violate the law of conservation of energy.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

30. A long solenoid has 500 turns. When a current of 2 ampere is passed through it, the resulting magnetic flux linked with each turn of the solenoid is 4 x 10^{-3} Wb. The self-inductance of the solenoid is _________.
a) 2.5 henry b) 2.0 henry c) 1.0 henry d) 40 henry

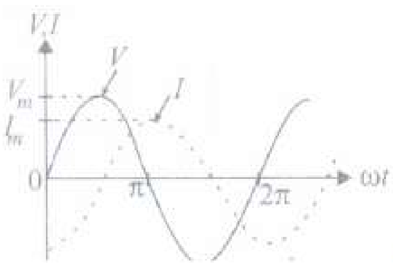
31. The magnetic field of a cylindrical magnet that has a pole-face radius 2.8 cm can be varied sinusoidally between minimum value 16.8 T and maximum value 17.2 T at a frequency of $\frac{60}{\pi}$ Hz. Cross section of the magnetic field created by the magnet is shown. At a radial distance of 2 cm from the axis, find the amplitude of the electric field (in mN C^{-1}) induced by the magnetic field variation.

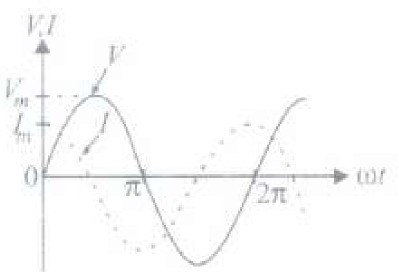


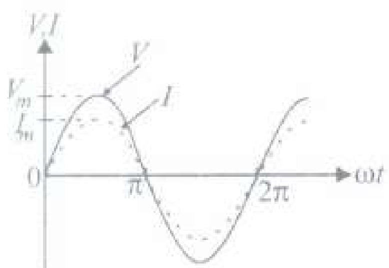
a) 240 mN C^{-1} b) 180 mN C^{-1} c) 110 mN C^{-1} d) 290 mN C^{-1}

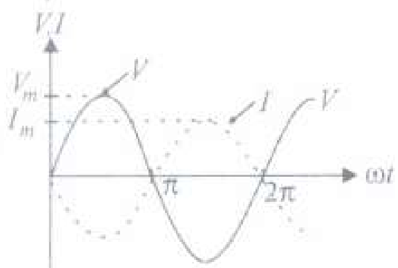
32. **Assertion:** In a purely inductive or capacitive circuit, the current is referred to as wattless current.
Reason: No power is dissipated in a purely inductive or capacitive circuit even though a current is flowing in the circuit.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

33. The phase relationship between current and voltage in a pure resistive circuit is best represented by

a) 

b) 

c) 

d) 

34. Which of the following does not use the application of eddy current?
a) Electric power meters b) Induction furnace c) LED lights d) Magnetic brakes in trains

35. Assertion: The back emf in a de motor is maximum when the motor has just been switched on.
Reason: When motor is switched on it has maximum speed.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

36. **Assertion:** Average value of ac over a complete cycle is always zero.
Reason: Average value of ac is always defined over half cycle.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

37. A rectangular, a square, a circular and an elliptical loop, all in the (x -y) plane, are moving out of a uniform magnetic field with a constant velocity, $\vec{V} = v\hat{i}$ .The magnetic field is directed along the negative z-axis direction. The induced emf, during the passage of these loops, out of the field region, will not remain constant for ______.
a) the circular and the elliptical loops. b) only the elliptical loop. c) any ofthe four loops.
d) the rectangular, circular and elliptical loops.

38. The relation between an ac voltage source and time in SI units is V = 120 sin(100 πt)cos(100 πt) V. The value of peak voltage and frequency will be respectively
a) 120 V and 100 Hz b) $\frac{120}{\sqrt{2}}$ V and 100 Hz c) 60 V and 200 Hz d) 60 V and 100 Hz

39. A coil of self-inductance L is connected in series with a bulb B and an A C source. Brightness of the bulb decreases when____
a) number of turns in the coil is reduced
b) a capacitance of reactance $X_C = X_L$ is included in the sarre circuit
c) an iron rod is inserted in the coil d) Frequency of the A C source is decrensed

40. Two coils of self inductances 2 mH and 8 mH are placed so close together that the effective flux in one coil is completely linked with the other. The mutual inductance between these coils is ______.
a) 6 mH b) 4 mH c) 16 mH d) 10 mH

41. A solenoid has an inductance of 10 henry and a resistance of 2 ohm. It is connected to a 10 volt battery. How long will it take for the magnetic energy to reach 1/4 of its maximum value?
a) 2.142 s b) 3.465 s c) 0.693 s d) 4.345 s

42. A 100 Ω resistor is connected to a 220 V, 50 Hz ac supply. The rms value of current in the circuit is
a) 1.56 A b) 1.56 mA c) 2.2 A d) 2.2 mA

43. In a coil of area 10 cm^2 and 10 turns with a magnetic field directed perpendicular to the plane and is changing at the rate of 10^8 gauss/second. The resistance of the coil is 20 ohm. The current in the coil will be :
a) 5 amp b) 0.5 amp c) 0.05 amp d) 5 x 10^8 amp

44. Lenz's law is a consequence of the law of conservation of
a) charge b) energy c) induced emf d) induced current

45. The average e.m.f. induced in a coil in which the current changes from 2 ampere to 4 ampere in 0.05 second is 8 volt. What is the self-inductance of the coil?
a) 0.1 H b) 0.2 H c) 0.4 H d) 0.8 H

46. A 40 mF capacitor is connected to a 200 V, 50 Hz ac supply. The rms value of the current in the circuit is, nearly ____________ .
a) 25.1 A b) 1.7 A c) 2.05 A d) 2.5 A

47. A coil of area 0.4 m^2 has 100 turns. A magnetic field of 0.04 Wb m^{-2} is acting normal to the coil surface. If this magnetic field is reduced to zero in 0.01 s, then the induced emf in the coil is
a) 160 V b) 250 V c) 270 V d) 320 V

48. In an a.c. circuit the e.m.f. (e) and the current (I) at any instant are given respectively by $e = E_0 \sin \omega t$, $I = I_0 \sin(\omega t - \varphi)$. The average power in the circuit over one cycle of a.c. is :
a) E_0I_0 b) $E_0I_0/2$ c) $(E_0I_0/2) \sin\varphi$ d) $(E_0I_0/2) \cos\varphi$

49. The self-inductance of a coil is 5 henry, a current of 1 amp change to 2 amp within 5 second through the coil. The value of induced e.m.f. will be :
a) 10 Volt b) 0.10 Volt c) 1.0 Volt d) 100 Volt

50. If V= 100sin(100t) V and I = 100 sin $\left(100t + \frac{\pi}{3}\right)$ mA are the instantaneous values of voltage and current, then the rms values of voltage and current are respectively
a) 70.7 V, 70.7 mA b) 70.7 V, 70.7 A c) 141.4 V, 141.4 mA d) 100 V, 100 mA

51. In the figure, galvanometer G gives maximum deflection when

a) magnet is pushed into the coil b) magnet is rotated into the coil
c) magnet is stationary at the centre of the coil d) number of turns in the coil is reduced

52. Assertion: Mutual inductance of a pair of coils depend on their separation as well as their relative orientation.
Reason: Mutual inductance depend upon the length of the coil only.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

53. A conducting circular loop is placed in a uniform magnetic field of 0.04 T with its plane perpendicular to the magnetic field. The radius of the loop starts shrinking at 2 mm/s. The induced emf in the loop when the radius is 2 cm is _____.
a) 4.8 $\pi\mu V$ b) 0.8 $\pi\mu V$ c) 1.6 $\pi\mu V$ d) 3.2 $\pi\mu V$

54. An inductor 20 mH, a capacitor 100 μF and a resistor 50 Ω are connected in series across a source of emf, V = 10 sin 314 t. The power loss in the circuit is :
a) 0.79 W b) 0.43 W c) 2.74 W d) 1.13 W

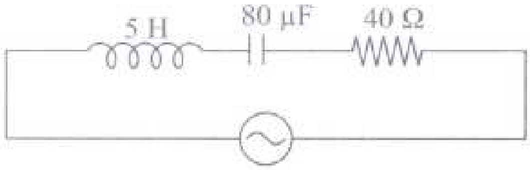
55. The natural frequency of a L-C circuit is equal to :
a) $1/2\pi\sqrt{LC}$ b) $1/2\pi\sqrt{LC}$ c) $1/2\pi\sqrt{L/C}$ d) $1/2\pi\sqrt{C/L}$

56. The peak voltage of an ac supply is 440 V, then its rms voltage is

a) 31.11 V b) 311.1 V c) 41.11 V d) 411.1 V

57. The equivalent inductance of two inductors is 2.4 H when connected in parallel and 10 H when connected in series. What is the value of inductances of the individual inductors?
a) 8 H, 2 H b) 6 H, 4 H c) 5 H, 5 H d) 7 H, 3 H

58. Figure shows a series LCR circuit connected to a variable frequency 230 V source.

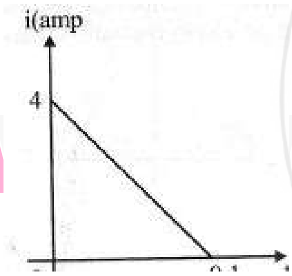


The source frequency which drives the circuit in resonance is
a) 4 Hz b) 5 Hz c) 6 Hz d) 8 Hz

59. A 5μF capacitor is connected to a 200 V, 100 Hz ac source. The capacitive reactance is
a) 212 Ω b) 312 Ω c) 318 Ω d) 412 Ω

60. Power dissipated in an LCR series circuit connected to an ac source of emf ε is
a) $\frac{\varepsilon^2\sqrt{R^2+\left(wL-\frac{1}{wC}\right)^2}}{R}$ b) $\frac{\varepsilon^2\left[R^2+\left(wL-\frac{1}{wC}\right)^2\right]}{R}$ c) $\frac{\varepsilon^2 R}{\sqrt{R^2+\left(wL-\frac{1}{wC}\right)^2}}$ d) $\frac{\varepsilon^2 R}{\left[R^2+\left(wL-\frac{1}{wC}\right)^2\right]}$

61. In a coil of resistance 10 W, the induced current developed by changing magnetic flux through it, is shown in figure as a function of time. The magnitude of change in flux through the coil in Weber is



a) 8 b) 2 c) 6 d) 4

62. A wire loop is rotated in a magnetic field. The frequency of change of direction of the induced e.m.f is ________.
a) twice per revolution b) four times per revolution c) six times per revolution
d) once per revolution

63. When the number of turns and the length of the solenoid are doubled keeping the area of crosssection same, the inductance:
a) Remains the same b) Is halved c) Is doubled d) Becomes four times

64. **Assertion:** The power in an ac circuit is minimum if the circuit has only a resistor.
Reason : Power of a circuit is independent of the phase angle.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

65. Two different coils have self-inductance L_1 = 8 mH, L_2 = 2 mH. The current in one coil is increased at a constant rate. The current in the second coil is also increased at the same rate. At a certain instant of time, the power given to the two coils is the same. At that time the

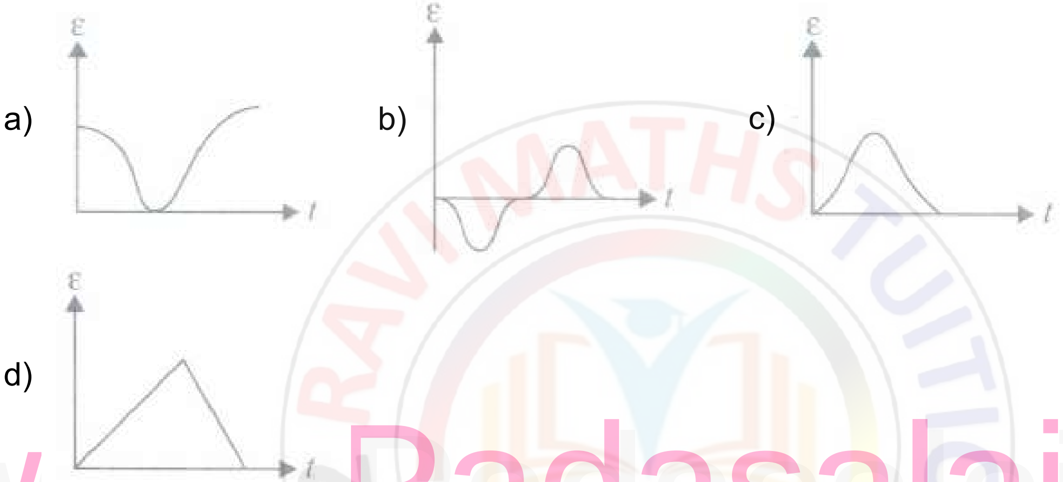
current, the induced voltage and the energy stored in the first coil are i_1, V_1 and W_1 respectively. Corresponding values for the second coil at the same instant are i_2, V_2, and W2 respectively. Then,

a) $\frac{W_2}{W_1}=8$ b) $\frac{W_2}{W_1}=\frac{1}{8}$ c) $\frac{W_2}{W_1}=4$ d) $\frac{W_2}{W_1}=\frac{1}{4}$

66. The current passing through a choke coil of 5 henry is decreasing at the rate of 2 ampere/sec. The e.m.f. developing across the coil is :

a) 10 V b) -10 V c) 2.5 V d) -2.5 V

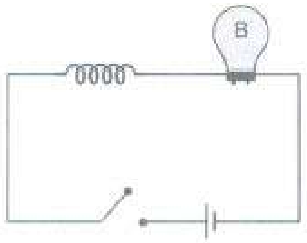
67. The variation of induced emf (ε) with time (t) in a coil if a short bar magnet is moved along its axis with. a constant velocity is best represented as



68. An inductor 200 mH, capacitor 500 μF and resistor 10 Ω are connected in series with a 100 V variable frequency ac source. What is the frequency at which the power factor of the circuit is unity?

a) 10.22 Hz b) 12.4 Hz c) 19.2 Hz d) 15.9 Hz

69. In the following circuit, the bulb will become suddenly bright if :



a) Contact is made or broken b) Contact is made c) Contact is broken

d) Won't become bright at all

70. The line that draws power supply to your house from street has

a) 220 $\sqrt{2}$ V average voltage b) 220 V average voltage.

c) voltage and current out of phase by

d) voltage and current possibly differing in phase ϕ such that $|\phi| < \frac{\pi}{2}$

71. A magnetic field of 2 x 10^{-2} T acts at right angles to a coil of area 100 cm^2 with 50 turns. The average emf induced in the coil is 0.1 V, when it is removed from the field in time t. The value of t is :

a) 0.1 sec b) 0.01 sec c) 1 sec d) 20 sec

72. A coil having 500 square loops each of side 10 cm is placed normal to a magnetic flux which increases at the rate of 1.0 tesla/second. The induced e.m.f. in volts is
a) 0.1 b) 0.5 c) 1 d) 5

73. **Assertion:** In series LCR resonance circuit, the impedance is equal to the ohmic resistance.
Reason : At resonance, the inductive reactance exceeds the capacitive reactance.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

74. In the circuit of figure, the bulb will become suddenly bright, if ____________ .
a) contact is made or broken b) contact is made c) contact is broken
d) None of the above

75. A uniform magnetic field B points vertically up and is slowly changed in magnitude, but not in direction. The rate of change of the magnetic field is α . A conducting ring of radius r and resistance R is held perpendicular to the magnetic field, and is totally inside it. The induced current in the ring is
a) zero b) $\frac{2\pi rB}{R}$ c) $\frac{r\alpha}{R}$ d) $\frac{\pi r^2\alpha}{R}$

76. The Q factor of a series LCR circuit with L = 2 H, C = 32μF and R = 10Ω is
a) 15 b) 20 c) 25 d) 30

77. The core of a transformer is laminated because___
a) the weight of the transformer may be reduced b) rusting of the core may be prevented
c) ratio of voltage in primary and secondary may be increased
d) energy losses due to eddy currents may be minimised

78. In the case of an inductor
a) voltage lags the current by $\frac{\pi}{2}$ b) voltage leads the current by $\frac{\pi}{2}$
c) voltage leads the current by $\frac{\pi}{3}$ d) voltage leads the current by $\frac{\pi}{4}$

79. 200 V ac source is fed to series LCR circuit having X_L = 50 Ω, X_c = 50 Ω and R = 25 Ω. Potential drop across the inductor is
a) 100 V b) 200 V c) 400 V d) 10 V

80. In an ac circuit of capacitance, the current from potential is :
a) Forward b) Backward c) Both are in the same phase d) None of these

81. Which of the following combinations should be selected for better tuning of an LCR circuit used for communication?
a) R = 20 Ω, L = 1.5 H, C = 35 μF b) R = 25 Ω, L = 2.5 H, C = 45 μF
c) R = 15 Ω, L = 3.5 H, C = 30 μF d) R = 25 Ω, L = 1.5 H, C = 45 μF

82. Which of the following statements is not correct?
a)
Whenever the amount of magnetic flux linked with a circuit changes, an emf is induced in the circuit.
b) The induced emf lasts so long as the change in magnetic flux continues.
c) The direction of induced emf is given by Lenz's law.
d) Lenz's law is a consequence of the law of conservation of momentum.

83. **Assertion:** The inductive reactance limits amplitude of the current in a purely inductive circuit.
Reason: The inductive reactance is independent of the frequency of the current.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false d) If both assertion and reason are false

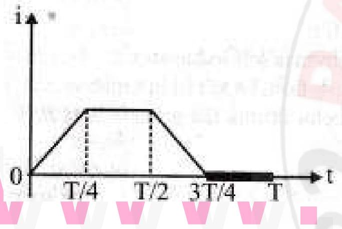
84. The energy stored in an inductor of self inductance L henry carrying a current of I ampere is
a) $\frac{1}{2}L^2I$ b) $\frac{1}{2}LI^2$ c) LI^2 d) L^2I

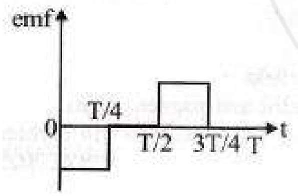
85. The dimensions of magnetic flux are:
a) $[MLT^{-2}A^{-2}]$ b) $[ML^2T^{-2}A^{-2}]$ c) $[ML^2T^{-2}A^{-1}]$ d) $[ML^2T^{-2}A^{-2}]$

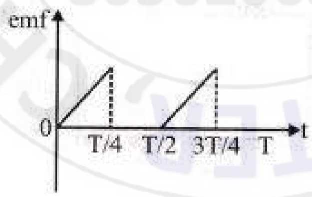
86. An inductor of 30 mH is connected to a 220 V, 100 Hz ac source. The inductive reactance is :
a) 10.58 Ω b) 12.64 Ω c) 18.85 Ω d) 22.67 Ω

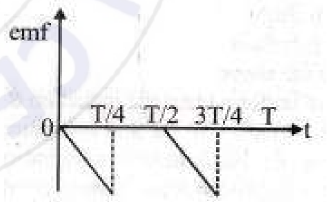
87. A metallic rod of mass per unit length 0.5 kg/m is lying horizontally on a smooth inclined plane which makes an angle of 30° with the horizontal. The rod is not allowed to slide down by flowing a current through it when a magnetic field of induction 0.25 T is acting on it in the vertical direction. The current flowing in the rod to keep is stationary is :
a) 7.14 A b) 5.98 A c) 14.76 A d) 11.32

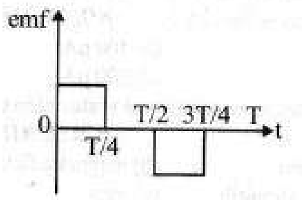
88. The current i in a coil varies with time as shown in the figure, The variation of induced emf with time would be ______.



a)


b)


c)


d)


89. There is a uniform magnetic field directed perpendicular and into the plane of the paper. An irregular shaped conducting loop is slowly changing into a circular loop in the plane of the paper. Then
a) current is induced in the loop in the anti-clockwise direction
b) current is induced in the loop in the clockwise direction. c) ac is induced in the loop.
d) no current is induced in the loop.

90. An inductor may store energy in ______.
a) its electric field b) its coils c) it magnetic field d) Both in electric and magnetic fields

91. As the frequency of an ac circuit increases, the current first increases and then decreases. What combination of circuit elements is most likely to comprise the circuit?
a) Resistor and inductor b) Resistor and capacitor c) Resistor, inductor and capacitor
d) None of these

92. **Assertion:** An ideal transformer does not vary the power.
Reason: A transformer is used to step-up or stepdown ac voltages.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

93. For a series LCR circuit, the power loss at resonance is:
a) $V^2/\omega L-1/\omega C$ b) $I^2C\omega$ c) I^2R d) $V^2/\omega C$

94. A transistor-oscillator using a resonant circuit with an inductor L (of negligible resistance) and a capacitor C in series produce oscillations of frequency f. If L is doubled and C is changed to 4 C, the frequency will be ______
a) 8 f b) $f/2\sqrt{2}$ c) f / 2 d) f / 4

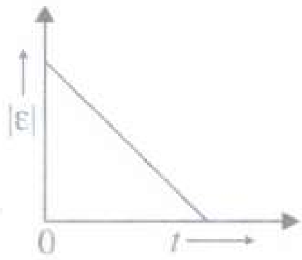
95. A step down transformer converts transmission line voltage from 11000 V to 220 V The primary of the transformer has 6000 turns and efficiency of the transformer is 60 %. If the output power' is 9 kW, then the input power will be.
a) 11kW b) 12kW c) 14kW d) 15kW

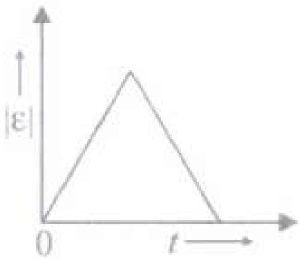
96. A coil of mean area 500 cm^2 and having 1000 turns is held perpendicular to a uniform field of 0.4 gauss. The coil is turned through 180^0 $\frac{1}{10}$ in second. The average induced emf is
a) 0.02 V b) 0.04 V c) 1.4 V d) 0.08 V

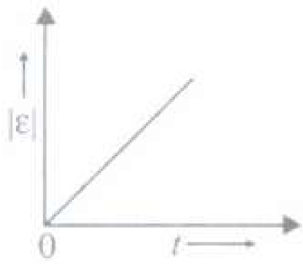
97. What is the mechanical equivalent of spring constant k in LC oscillating circuit
a) $\frac{1}{L}$ b) $\frac{1}{C}$ c) $\frac{L}{C}$ d) $\frac{1}{LC}$

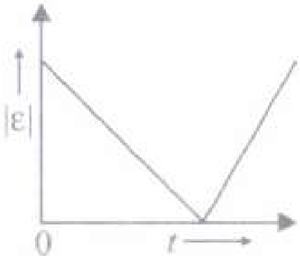
98. In a series resonant circuit, having L, C and R as its elements, the resonant current is i. The power dissipated in the circuit at resonance is____
a) $\frac{i^2R}{\left(\omega L-\frac{1}{\omega C}\right)}$ b) Zero c) $i^2\omega L$ d) i^2R

99. A long solenoid S has n turns per metre, withdiameter a. At the centre of this coil, we place a smaller coil of N turns and diameter b (b < a). If the current in the solenoid increases linearly with time, then the emf will be induced in the smaller coil. Which of the following is the correct graph showing $|\varepsilon|$ verses t if current varies as a function of $mt^2 + C$?

a) 

b) 

c) 

d) 

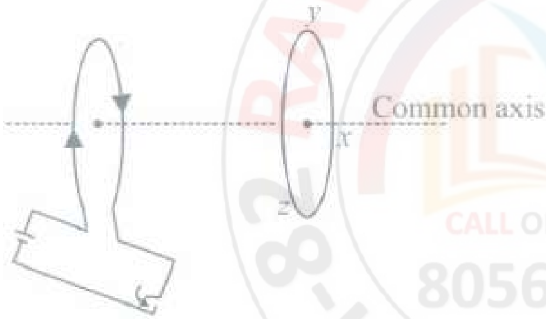
100. When a voltage measuring device is connected to ac mains, the meter shows the steady input voltage of 220 V ThIs means

a) input voltage cannot be ac voltage, but a dc voltage. b) maximum input voltage is 220 V

c) the meter reads not v but v^2 and is calibrated to read $\sqrt{V^2}$.

d) the pointer of the meter is stuck by some mechanical defect.

101. The direction of induced current in the right loop in the situation shown by the given figure is



(Tapping key just closed)

a) along the common axis b) along *xzy* c) along *xyz* d) none of these

102. The self inductance L of a solenoid of length l and area of cross-section A, with a fixed number of turns N increases as

a) l and A increase. b) l decreases and A increases. c) l increases and A decreases.

d) both l and A decrease.

103. A metallic rod of 1 m length is rotated with a frequency of 50 revolution per second, with one end hinged at the centre and the other end at the circumference of a circular metallic ring of radius 1 m about an axis passing through the centre and perpendicular to the plane of the ring. A constant uniform magnetic field of 1 T parallel to the axis is present everywhere. The emf between the centre and the metallic ring is

a) 157 V b) 117 V c) 127 V d) 137 V

104. A coil of inductive reactance 31 W has a resistance of 8 W. It is placed in series with a condenser of capacitative reactance 25 W. The combination is connected to an a.c. source of 110 volt. The power factor of the circuit is____

a) 0.64 b) 0.80 c) 0.33 d) 0.56

105. A 0.2 kΩ resistor and 15 μF capacitor are connected in series to a 220 V, 50 Hz ac source. The impedance of the circuit is
a) 250Ω b) 268Ω c) 29.15Ω d) 291.5Ω

106. In a region of uniform magnetic induction. B = 10^{-2} T, a circular coil of radius 30 cm and resistance p^2 ohm is rotated about an axis which is perpendicular to the direction of Band which forms a diameter of the coil. If the coil rotates at 200 rpm the amplitude of the alternating current induced in the coil is ________.
a) $4p^2$ μA b) 300 μA c) 6 μA d) 200 μA

107. In a series LCR circuit, the phase difference between the voltage and the current is 45°. Then the power factor will be
a) 0.607 b) 0.707 c) 0.808 d) 1

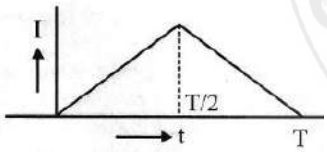
108. The average power dissipated in a pure inductor of inductance L when an ac current is passing through it, is
a) 1/2 LI^2 b) 1/4 LI^2 c) 2 LI^2 d) Zero

109. For high frequency, a capacitor offers:
a) More reactance b) Less reactance c) Zero reactance d) Infinite reactance

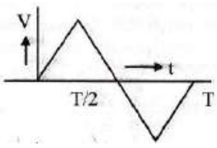
110. A current of 1 A through a coil of inductance of 200 mH is increasing at a rate of 0.5A S^{-1}. The energy stored in the inductor per second is
a) 0.5 J S^{-1} b) 5.0 J S^{-1} c) 0.1 J S^{-1} d) 2.0 J S^{-1}

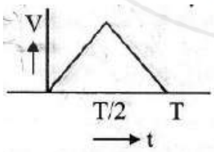
111. In a transformer the transformation ratio is 0.3. If 220 V ac is fed to the primary, then the voltage across the secondary is
a) 44 V b) 55 V c) 60 V d) 66 V

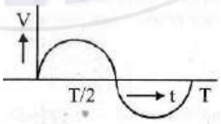
112. The current (f) in the inductance is varying with time according to the plot shown in figure.

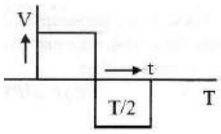


Which one of the following is the correct variation of voltage with time in the coil?

a) 

b) 

c) 

d) 

113. A 100 μH coil carries a current of 1 A. Energy stored in its magnetic field is ______.
a) 0.5 J b) 1 A c) 0.05 J d) 0.1 J

114. **Assertion:** The capacitive reactance limits the amplitude of the current in a purely capacitive circuit.
Reason: Capacitive reactance is proportional to the frequency and the capacitance
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false

115. An ideal inductor is in turn put across 220 V, 50 Hz and 220 V, 100 Hz supplies. The current flowing through it in the two cases will be
a) equal b) different c) zero d) infinite

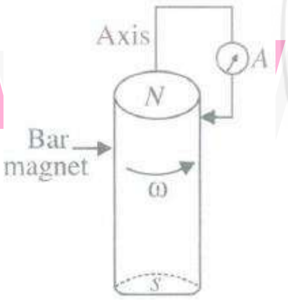
116. A 60 W load is connected to the secondary of an ideal transformer whose primary draws line voltage. If a current of 0.54 A flows in the load, the current in the primary coil is :
a) 0.27 mA b) 2.7 A c) 0.27 A d) 10 A

117. Assertion: Sensitive electrical instruments should not be placed in the vicinity of an electromagnet.
Reason: Electromagnet can damage the instruments.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

118. A conducting loop is placed in a uniform magnetic field with its plane perpendicular to the field. An emf is induced in the loop if
a) it is rotated about its axis. b) it is rotated about a diameter. c) it is not moved.
d) it is given translational motion in the field

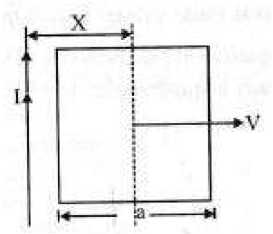
119. A solenoid has 2000 turns wound over a length of 0.30 metre. The area of its cross-section is 1.2×10^{-3} m^2. Around its central section, a coil of 300 turns is wound. If an initial current of 2 A in the solenoid is reversed in 0.25 sec, then the e.m.f. induced in the coil is :
a) 6×10^{-4} V b) 4.8×10^{-3} V c) 6×10^{-2} V d) 48 m V

120. A cylindrical bar magnet is rotated about its axis as shown in figure. A wire is connected from the axis and is made to touch the cylindrical surface through a contact. Then



a) a direct current flows in the ammeter A b) no current flows through the ammeter A.
c) an alternating sinusoidal current flows through the ammeter A with a time period, T= $\frac{2\pi}{\varpi}$
d) a time varying non-sinusoidal current flows through the ammeter A.

121. A conducting square frame of side 'a' and a long straight wire carrying current 1 are located in the same plane as shown in the figure. The frame moves to the right with a constant velocity 'V'. The emf induced in the frame will be proportional to ____________.



a) $\frac{1}{(2x-a)^2}$ b) $\frac{1}{(2x+a)^2}$ c) $\frac{1}{(2x-a)(2x+a)}$ d) $\frac{1}{x^2}$

122. An ac source of voltage V = Vm sinoir is connected across the resistance R as shown in figure. The phase relation between current and voltage for this circuit is

a) both are in phase b) both are out of phase by 90° c) both are out of phase by 120°
d) both are out of phase by 180°

123. The equivalent quantity of mass in electricity is
a) current b) self inductance c) potential d) charge

124. Find the inductance of a unit length of two long parallel wires, each of radius a, whose centers are a distance d apart and carry equal currents in opposite directions. Neglect the flux within the wire.
a) $\frac{\mu_0}{2\pi} 1n\left(\frac{d-a}{a}\right)$ b) $\frac{\mu_0}{\pi} 1n\left(\frac{d-a}{a}\right)$ c) $\frac{3\mu_0}{\pi} 1n\left(\frac{d-a}{a}\right)$ d) $\frac{\mu_0}{3\pi} 1n\left(\frac{d-a}{a}\right)$

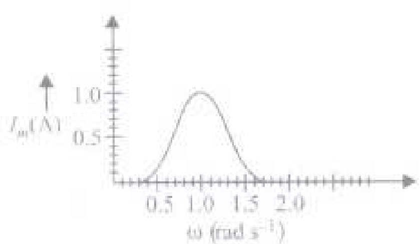
125. Eddy currents are produced when ____________ .
a) a metal is kept in varying magnetic field b) a metal is kept in steady magnetic field
c) a circular coil is placed in a magnetic field d) current is passed through a circular coil

126. Assertion: Inductance coils are made of copper.
Reason: Induced current is more in wire having less resistance.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

127. Assertion: An important application of electromagnetic induction is ac generator.
Reason: The direction of current changes periodically and therefore the current is called alternating current.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

128. If the rms current in a 50 Hz ac circuit is 5 A, the value of the current 1/300 seconds after its value becomes zero is
a) $5\sqrt{2}A$ b) $5\sqrt{\frac{3}{2}}A$ c) $\frac{5}{6}A$ d) $\frac{5}{\sqrt{2}}A$

129. In a series LCR circuit, the plot of I_m vs (j) is shown in the figure. The bandwidth of this plot will be



a) zero b) 0.1 rad s^{-1} c) 0.2 rad s^{-1} d) 0.4 rad s^{-1}

130. A small town with a demand of 800 kW of electric power at 220 V is situated 15 km away from an electric plant generating power at 440 V The resistance of the two wire line carrying power is 0.5 Ω per km. The town gets power from the line through a 4000-220 V step down transformer at a substation in the town. The line power loss in the form of heat is :
a) 400 kW b) 600 kW c) 300 kW d) 800 W

131. The north pole of a bar magnet is rapidly introduced into a solenoid at one end (say A). Which of the following statements correctly depicts the phenomenon taking place?
a) No induced emf is developed. b) The end A of the solenoid behaves like a south pole.
c) The end A of the solenoid behaves like north pole.
d) The end A of the solenoid acquires positive potential.

132. A square loop of side 12 ern and resistance 0.60.Q is placed vertically in the east-west plane. A uniform magnetic field of 0.10 T is set up across the plane in north-east direction. The magnetic field is decreased to zero in 0.6 s at a steady rate. The magnitude of current during this time interval is
a) 1.42×10^{-3} A b) 2.67×10^{-3} A c) 3.41×10^{-3} A d) 4.21×10^{-3} A

133. If N is the number of turns in a coil, the value of self-inductance varies a _______.
a) N^0 b) N c) N^2 d) N^{-2}

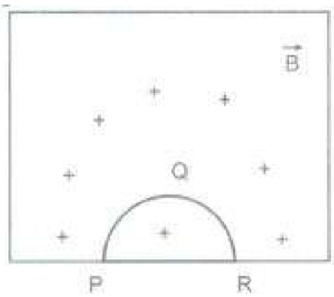
134. Assertion: An ac generator is based on the self inductance of the coil.
Reason: Self inductance involves two coils.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

135. A voltage of peak value 283 V and varying frequency is applied to series LCR combination in which R = 3Ω , L = 25 mH and C = 400 μ F. Then the frequency (in Hz) of the source at which maximum power is dissipated in the above is
a) 51.5 b) 50.7 c) 51.1 d) 50.3

136. The primary and secondary coil of a transformer have 50 and 1500 turns respectively. If the magnetic flux flinked with the primary coil is given by $\phi = \phi_0 + 4t$, where f is in webers, t is time in seconds and f_0 is a constant, the output voltage across the secondary coil is _____
a) 120 volts b) 220 volts c) 30 volts d) 90 volts

137. The magnetic flux linked with a coil of N turns of area of cross section A held with its plane parallel to the field B is
a) $\frac{NAB}{2}$ b) NAB c) $\frac{NAB}{4}$ d) zero

138. A thin semicircular conducting ring (PQR) of radius 'r' is falling with its plane vertical in a horizontal magnetic field B, as shown in figure. The potential difference developed across the ring when its speed is v, is :



a) Zero b) $Bv\pi r^2/2$ and P is at higher potential c) πrBv and R is at higher potential
d) 2rBv and R is at higher potential

139. A coil of resistance 400 W is placed in a magnetic field. If the magnetic flux f, (wb) linked with the coil varies with time t (sec) as f = $50t^2 + 4$. The current in the coil at t = 2 sec is :

a) 0.5 A b) 0.1 A c) 2 A d) 1 A

140. In the question number 3, the net power consumed over a full cycle is

a) 586 W b) 242 W c) 48.4 W d) 484 W

141. **Assertion:** A laminated core is used in transformers to increase eddy currents.

Reason : The efficiency of a transformer increases with increase in eddy currents.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertionand reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

142. Two conducting circular loops of radii R_1 and R_2 are placed in the same plane with their centres coinciding. If $R_1 > R_2$ the mutual inductance M between them will be directly proportional to

a) $\frac{R_1}{R_2}$ b) $\frac{R_2}{R_1}$ c) $\frac{R_1^2}{R_2}$ d) $\frac{R_2^2}{R_1}$

143. A condenser of capacity C is charged to a potential difference of V_1. The plates of the condenser are then connected to an ideal inductor of inductance L. The current through the inductor when the potential difference across the condenser reduces to V_2 is

a) $\left(\frac{C(V_1-V_2)^2}{L}\right)^{1/2}$ b) $\frac{C(V_1^2-V_2^2)}{L}$ c) $\frac{C(V_1^2+V_2^2)}{L}$ d) $\left(\frac{C(V_1^2-V_2^2)}{L}\right)^{1/2}$

144. Transformer is used to

a) convert ac to dc voltage b) convert dc to ac voltage c) obtain desired dc power

d) obtain desired ac voltage and current

145. What is the self-inductance of a coil which produces 5V when the current changes from 3A to 2A in one millisecond?

a) 5000 H b) 5 mH c) 50 H d) 5 H

146. Induction furnace make use of

a) self induction b) mutual induction c) eddy current d) none of these

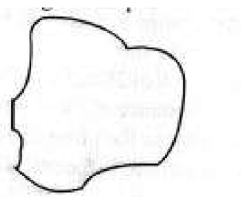
147. A wheel with 20 metallic spokes each of length 0.8 m long is rotated with a speed of 120 revolution per minute in a plane normal to the horizontal component of earth magnetic field H at a place. If H = 0.4×10^{-4} T at the place, then induced emf between the axle and the rim of the wheel is

a) 2.3×10^{-4} V b) 3.1×10^{-4} V c) 2.9×10^{-4} V d) 1.61×10^{-4} V

148. In the question number II, the peak voltage of the source is

a) 305 V b) 310 V c) 311 V d) 315 V

149. As a result of change in the magnetic flux linked to the closed loop shown in the Fig., an e.m.f. V volt is induced in the loop. The work done (oules) in taking a charge e coulomb once along the loop is ______.



a) QV b) 2QV c) QV/2 d) Zero

150. When a wire loop is rotated in a magnetic field, the direction of induced emf changes in every
a) one revolution b) $\frac{1}{2}$revolution c) $\frac{1}{4}$revolution d) 2 revolution

151. Identify the wrong statement.
a) Eddy currents are produced in a steady magnetic field.
b) Eddy currents can be minimized by using laminated core.
c) Induction furnace uses eddy current to produce heat.
d) Eddy current can be used to produce braking force in moving trains.

152. A 2 m long metallic rod rotates with an angular frequency of 200 rad s^{-1} about an axis normal to the rod passing through its one end. The other end of the rod is in contact with a circular metallic ring. A constant magnetic field of 0.5 T parallel to the axis exists everywhere. The emf developed between the centre and the ring is
a) 100 V b) 200 V c) 300 V d) 400 V

153. In the question number 44, the phase difference between the voltage across the source and current is
a) 80.2° b) 31° c) 50.2° d) 38.2°

154. A circuit consists of a resistance of 10 Ω and a capacitance of 0.1 μF If an alternating emf of 100 V, 50 Hz is applied, the current in the circuit is
a) 3.14mA b) 6.28mA c) 1.51mA d) 7.36mA

155. Assertion: Eddy currents heat up the core and dissipate electrical energy in the form of heat.
Reason: Eddy currents are always undesirable.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

156. A circular coil of radius 6 em and 20 turns rotates about its vertical diameter with an angular speed of 40 rad S^{-1} in a uniform horizontal magnetic field of magnitude 2 x 10^{-2} T. If the coil form a closed loop of resistance 8 Ω , then the average power loss due to joule heating is
a) 2.07 x 10^{-3} W b) 1.23 x 10^{-3} W c) 3.14 x 10^{-3} W d) 1.80 x 10^{-3} W

157. An alternating voltage is connected in series with a resistance R and an inductance L If the potential drop across the resistance is 200 V and across the inductance is 150 V, then the applied voltage is :
a) 350 V b) 250 V c) 500 V d) 300 V

158. A boy peddles a stationary bicycle the pedals of the bicycle are attached to a 200 turn coil of area 0.10 m^2. The coil rotates at half a revolution per second and it is placed in a uniform magnetic field of 0.02 T perpendicular to the axis of rotation of the coil. The maximum voltage generated in the coil is :
a) 3.24 V b) 4.12 V c) 1.26 V d) 2.16 V

159. In which of the following circuits the maximum power dissipation is observed?
a) Pure capacitive circuit b) Pure inductive circuit c) Pure resistive circuit
d) None of these

160. Assertion : An electric motor converts electrical energy to mechanical energy.
Reason: The working of the motor is based on mutual induction.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

161. To reduce the resonant frequency in an LCR series circuit with a generator
a) the generator frequency should be reduced.
b) another capacitor should be added in parallel to the first.
c) the iron core of the inductor should be removed.
d) dielectric ill the capacitor should be removed.

162. A square of side x m lies in the x-y plane in a region, where "r"e the magnetic field is given by $\vec{B} = Bb_0(3\hat{i} + 4\hat{j} + 5\hat{k})$T, where Bo is constant. The magnitude of flux passing through the square is:
a) $5B_0$ X^2 Wb b) $3B_0$ X^2 Wb c) $2B_0$ X^2 Wb d) B_0 X^2 Wb

163. A small square loop of wire of side 1 is placed inside a large square loop of wire of side L (>> l). The loops are coplanar and their centres coincide. What is the mutual inductance of the system?
a) $2\sqrt{2}\frac{\mu_0}{\pi}\frac{l^2}{L}$ b) $8\sqrt{2}\frac{\mu_0}{\pi}\frac{l^2}{L}$ c) $2\sqrt{2}\frac{\mu_0}{2\pi}\frac{l^2}{L}$ d) $2\sqrt{2}\frac{\mu_0 L^2}{2\pi l}$

164. A copper ring is held horizontally and a bar magnet is dropped through the ring with its length along the axis of the ring. The acceleration of the falling magnet while it is passing through the ring is :
a) Equal to that due to gravity b) Less than that due to gravity
c) More than that due to gravity
d) Depends on the diameter of the ring and the length of the magnet

165. A resistance ' R ' draws power ' P ' when connected to an A C source. If an inductance is now placed in series with the resistance, such that the impedance of the circuit beoomes ' Z ' the power drawn will be ___________ .
a) $P\sqrt{\frac{R}{Z}}$ b) $P\left(\frac{R}{Z}\right)$ c) P d) $p\left(\frac{R}{Z}\right)^2$

166. The time constant C-R circuit is_____
a) 1/CR b) C/R c) CR d) R/C

167. In a pure inductive circuit or in an ac circuit containing inductance only, the current:
a) Leads the e.m.f. by 90° b) Lags behind the e.m.f. by 90°
c) Sometimes leads and sometime lags behind the e.m.f. d) Is in phase with the e.m.f,

168. In a circuit L, C and R are connected in series with an alternating voltage source of frequency f. The current leads the voltage by 45°.The value of C is
a) 1/2πf(2πfL+R) b) 1/πf(2πfL+R) c) 1/2πf(2πfL-R) d) 1/πf(2πfL-R)

169. If number of turns in primary and secondary coils is increased to two times each, the mutual inductance
a) becomes 4 times b) becomes 2 times c) becomes $\frac{1}{4}$ times d) remains unchanged

170. When an ac voltage of 220 V is applied to the capacitor C, then
a) the maximum voltage between plates is 220 V.
b) the current is in phase with the applied voltage
c) the charge on the plate is not in phase with the applied voltage.
d) power delivered to the capacitor per cycle is zero.

171. A series LCR circuit has R = 5 Ω, L = 40 mH and C = 1 μF, the bandwidth of the circuit is :
a) 10 Hz b) 20 Hz c) 30 Hz d) 40 Hz

172. An alternating voltage (in volts) given by V =200 $\sqrt{2}$sin(100t) is connected to 1 μF capacitor through an ideal ac ammeter in series. The reading of the ammeter and the average power consumed in the circuit shall be
a) 20 mA, 0 b) 20 mA, 4 W c) 20$\sqrt{2}$ A,8W d) 20$\sqrt{2}$ mA, 4$\sqrt{2}$ W

173. In an A.C. circuit containing only capacitance, the current:
a) leads the voltage by 180° b) lags the voltage by 90° c) leads the voltage by 90°
d) remains in phase with the voltage

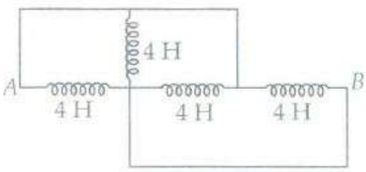
174. A 2 m long solenoid with diameter 2 cm and 2000 turns has a secondary coil of 1000 turns wound closely near its midpoint. The mutual inductance between the two coils is:
a) 2.4 x 10^{-4} H b) 3.9 x 10^{-4} H c) 1.28 x 10^{-3} H d) 3.14 x 10^{-3} H

175. The rms value of current in an ac circuit is 25 A, then peak current is
a) 35.36 mA b) 35.36 A c) 3.536 A d) 49.38 A

176. An L C R series circuit is connected to a source of alternating current. At resonance, the applied voltage and the current flowing through the circuit will have a phase difference of_____
a) π b) $\frac{\pi}{2}$ c) $\frac{\pi}{4}$ d) Zero

177. **Assertion:** Resonance is exhibited by a circuit only if both L and C are present in the circuit.
Reason: Only then the voltage across Land Ccancel each other, both being out of phase.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

178. The equivalent inductance between A and B is



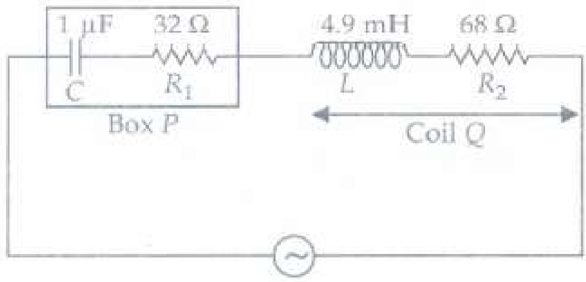
a) 1 H b) 4 H c) 0.8 H d) 16 H

179. In the question number 96, the number of turns in the secondary is
a) 20 b) 80 c) 120 d) 160

180. For an ideal step-down transformer, the quantity which is constant for both the coils is
a) current in the coils b) voltage across the coils c) resistance of coils
d) power in the coils

181. If a capacitor of 8 μF is connected to a 220 V, 100 Hz ac source and the current passing through it is 65 mA, then the rms voltage across it is
a) 129.4 V b) 12.94 V c) 1.294 V d) 15 V

182. A box P and a coil Ω are connected in series with an ac source of variable frequency. The emf of source is constant at 10 V.Box P contains a capacitance of $1 \mu F$ in series with a resistance of 32 Ω. Coil Q has a self inductance 4.9 mH and a resistance 68 Ω in series. The frequency is adjusted so that the maximum current flows in P and Q. At this frequency the voltage across P and Q respectively



a) 9.76 V, 8.92 V b) 6.29 V, 7.96 V c) 7.70 V, 10.92 V d) 7.70 V, 9.76 V

183. In a pure capacitive circuit if the frequency of ac source is doubled, then its capacitive reactance will be

a) remains same b) doubled c) halved d) zero

184. In a uniform magnetic field B a wire in the form of a semicircle of radius r rotates about the diameter of the circle with angular frequency ω. The axis of rotation is perpendicular to the field. If the total resistance of the circuit is R, the mean power generated per period of rotation is

a) $\frac{B\pi r^2}{2R}$ b) $\frac{(B\pi r^2 \omega)^2}{8R}$ c) $\frac{(B\pi r\omega)^2}{2R}$ d) $\frac{(B\pi r\omega^2)^2}{8R}$

185. The rms value of potential difference V shown in the figure is

a) $\frac{V_0}{\sqrt{2}}$ b) $\frac{V_0}{2}$ c) $\frac{V_0}{\sqrt{3}}$ d) V_0

186. In an inductor of self-inductance L = 2 mH. current changes with time according to relation $\hat{i}$ = $t^2 - e^{-1}$. At what time emf is zero?

a) 4s b) 3s c) 2s d) 1s

187. In an experiment, 200 V AC is applied at the ends of an LCR circuit. The circuit consists of an inductive reactance.

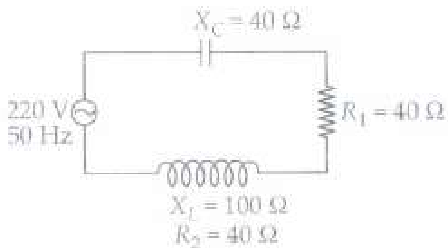
$(X_\nu) = 50$ W, capacitive reactance

$(X_C) = 50$ W and ohmic resistance

(R)=10 W. The impedance of the circuit is____

a) 10 W b) 20 W c) 30 W d) 40 W

188. The power factor of the circuit as shown in figure is



a) 0.2 b) 0.4 c) 0.8 d) 0.6

189. **Assertion:** The only element that dissipates energy in an ac circuit is the resistive element.
Reason: There are no power lossesassociated with pure capacitances and pure inductances in an ac circuit.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertionand reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

190. A rectangular loop of sides 6 cm and 2 ern with a small cut is moving out of a region of uniform magnetic field of magnitude 0.4 T directed normal to the loop. The voltage developed across the cut if velocity of loop is 2 cm s^{-1} in a direction normal to the longer side is
a) 3.8×10^{-4} V b) 4.8×10^{-4} V c) 2.2×10^{-2} V d) 3.2×10^{-2} V

191. In electromagnetic induction, the induced e.m.f. in a coil is independent of
a) Change in the flux b) Time c) Resistance of the circuit d) None of the above

192. An LC circuit contains a 20 mH inductor and a 50 μF capacitor with an initial charge of 10 mC. The resistance of the circuit is negligible. Let the instant at which the circuit which is closed be t = 0. At what time the energy stored is completely magnetic?
a) t = 0 b) t = 1.54 ms c) t = 3.14 ms d) t = 6.28 ms

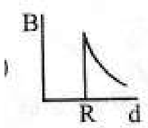
193. A transformer is used to light a 100 W and 110 V lamp from a 220 V mains. If the main current is 0.5 amp, the efficiency of the transformer is approximately______
a) 50% b) 90% c) 10% d) 30%

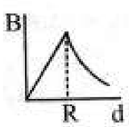
194. The working of a generator is based upon
a) magnetic effect of current b) heating effect of current c) chemical effect of current
d) electromagnetic induction

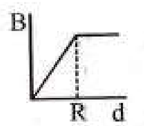
195. A long circular tube of length 10m and radius 0.3 m carries a current I along its curved surface as shown. A wire-loop of resistance 0.005 ohm and of radius 0.1 m is placed inside the tube with its axis coinciding with the axis of the tube.

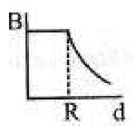
The current varies as $I = I_0\cos(300t)$ where I_0 is constant. If the magnetic moment of the loop is $N\mu_0 I_0 \sin(300t)$, then N is
a) 3 b) 4 c) 5 d) 6

196. A cylindrical conductor of radius R is carrying a constant current. The plot of the magnitude of the magnetic field, B with the distance d from the centre of the conductor is correctly represented by the figure: _____.

a) 

b) 

c) 

d) 

197. By a change of current from 5 A to 10A in 0.1 s, the self induced emf is 10V. The change in the energy of the magnetic field of a coil will be
a) 5 J b) 6 J c) 7.5 J d) 9 J

198. A copper rod of length *l* rotates about its end with angular velocity ro in a uniform magnetic field B. The emf developed between the ends of the rod if the field is normal to the plane of rotation is

a) $B\omega l^2$ b) $\frac{1}{2}B\omega l^2$ c) $2B\omega l^2$ d) $\frac{1}{4}B\omega l^2$

199. A series R-C combination is connected to an AC voltage of angular frequency ω = 500 radian/s. If the impedance of the R-C circuit is $R\sqrt{1.25}$, the time constant (in millisecond) of the circuit is

a) 2 b) 3 c) 4 d) 5

200. The physical quantity which is measured in the unit of Wb A^{-1} is

a) self inductance b) mutual inductance c) magnetic flux d) both (a) and (b)

201. The magnetic flux through a circuit of resistance -R changes by an amount Df in a time Dt. Then the total quantity of electric charge e that passes any point in the circuit during the time Dt is represented by _______.

a) $Q = R \cdot \frac{\Delta\phi}{\Delta t}$ b) $Q = \frac{1}{R} \cdot \frac{\Delta\phi}{\Delta t}$ c) $Q = \frac{\Delta\phi}{R}$ d) $Q = \frac{\Delta\phi}{\Delta t}$

202. An air cored solenoid with length 20 cm, area of cross section 20 cm^2 and number of turns 400 carries a current 2 A. The current is suddenly switched off within 10^{-3} s. The average back emf induced across the ends of the open switch in the circuit is (ignore the variation in magnetic field near the ends of the solenoid)

a) 2 V b) 4 V c) 3 V d) 5 V

203. Two coils have self-inductance L_1 = 4 mH and L_2 = 1 mH respectively. The currents in the two coils are increased at the same rate. At a certain instant of time both coils are given the same power. If I_1 and I_2 are the currents in the two coils at that instant of time respectively, then the value of $\frac{I_1}{I_2}$ is

a) $\frac{1}{8}$ b) $\frac{1}{4}$ c) $\frac{1}{2}$ d) 1

204. An alternating voltage E = 200 $\sqrt{2}$ sin 100t is connected to a 1 microfarad capacitor through an ac ammeter. The reading of the ammeter shall be :

a) 10 mA b) 20 mA c) 40 mA d) 80 mA

205. The instantaneous values of alternating curfent and voltages in a circuit are given as

$i = \frac{1}{\sqrt{2}}\sin(100\pi t)$ ampere

$e = \frac{1}{\sqrt{2}}\sin(100\pi t + \pi/3)$ volt

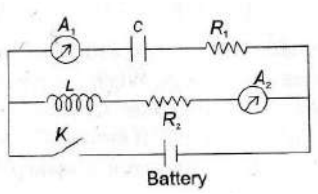
The average power in Watts consumed in the circuit is____

a) 1/4 b) $\frac{\sqrt{3}}{4}$ c) 1/2 d) 1/8

206. A power transmission line feeds input power at 2400 V to a step down transformer with its primary windings having 4000 turns. What should be the number of turns in the secondary windings in order to get output power at 240 V?

a) 400 b) 420 c) 424 d) 436

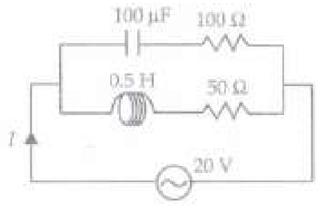
207. In a circuit inductance L and capacitance C are connected as shown in figure. A_1 and A_2 are ammeters. When key K is pressed to complete the circuit, then just after closing key (K), the reading of current will be ____________ .



a) zero in both A_1 and A_2 b) maximum in both A_1 and A_2 c) zero in A_1 and maximum in A_2
d) maximum in A_1 and zero in A_2

208. In the question number 30, the net power absorbed by the circuit in one complete cycle is
a) 5 W b) 10 W c) 15 W d) zero

209. In the given circuit, the ACsource has w = 100 rad/s. Considering the inductor and capacitor to be ideal, the correct choice is



a) the current through the circuit, I is 0.3 A b) the current through the circuit, I is $0.3\sqrt{2}$ A
c) the voltage across 100 Ω resistor = 10 V. d) the voltage across 50 Ω resistor = 10 V.

210. Choke coil is used to control:
a) ac b) dc c) Both ac and de d) Neither ac nor dc

211. The mutual inductance M_{12} of a coil 1 with respect to coil 2
a) increases when they are brought nearer.
b) depends on the current passing through the coils.
c) increases when one of them is rotated about an axis. d) both (a) and (b) are correct.

212. A solenoid of length 30 cm with 10 turns per centimetre and area of cross-section 40 cm^2 completely surrounds another co-axial solenoid of same length, area of cross-section 20 cm^2 with 40 turns per centimetre. The mutual inductance of the system is
a) 10 H b) 8 H c) 3 mH d) 30 mH

213. The self inductance of a coil having 400 turns is 10 m/I. The magnetic flux through the cross section of the coil corresponding to current 2 mA is :
a) 4×10^{-5} Wb b) 2×10^{-3} Wb c) 3×10^{-5} Wb d) 8×10^{-3} Wb

214. A circuit area 0.01 m^2 is kept inside a magnetic field which is normal to its plane. The magnetic field changes from 2 tesla to 1 tesla in 1 millisecond. If the resistance of the circuit is 2 Ω. The rate of heat evolved is
a) 5 J/s. b) 50 J/s c) 0.05 J/s d) 0.5 J/s

215. A metal conductor of length 1 m rotates vertically about one of its ends with an angular velocity 5 rad S^{-1}. If the horizontal component of earth's magnetic field is 0.2×10^{-4} T, then the emf developed between the ends of the conductor is
a) 5 μV b) 5 mV c) 50 μV d) 50 mV

216. An alternating current generator has an internal 5. resistance Rg and an internal reactance X_g- It is used to supply power to a passive load consisting of a resistance Rg and a reactance X_L For maximum power to be delivered from the generator to the load, the value of X_L is equal to
a) zero b) Xg c) -Xg d) Rg

217. An ac voltage is applied to a resistance R and an inductor L in series. If R and the inductive reactance are both equal to 3 W, the phase difference between the applied voltage and the current in the circuit is____

a) $\pi/6$ b) $\pi/4$ c) $\pi/2$ d) zero

218. In a series L-R circuit (L = 35 mH and R = 11 Ω), a variable emf source (V = Vo sin rot) of Vrms = 220 V and frequency 50 Hz is applied. The current amplitude in the circuit is

a) 10 A b) 20 A c) 30 A d) 40 A

219. The magnetic potential energy stored in a certain inductor is 25 mJ, when the current in the inductor is 60 mA. This inductor is of inductance.

a) 1.389H b) 138.88H c) 0.138H d) 13.89H

220. A current of 2.5 A flows through a coil of inductance 5 H. The magnetic flux linked with the coil is ________.

a) 2 wb b) 0.5 wb c) 12.5 wb d) Zero

221. In an electrical circuit, R, L, C and ac voltage source are all connected in series. When L is removed from the circuit, the phase difference between the voltage and the current in the circuit is $\frac{\pi}{3}$. If instead, C is removed from the circuit, the phase difference is again $\frac{\pi}{3}$. The power factor of the circuit is

a) $\frac{1}{2}$ b) $\frac{1}{\sqrt{2}}$ c) 1 d) $\frac{\sqrt{3}}{2}$

222. A circular loop of radius 0.3 cm lies parallel to a much bigger circular loop of radius 20 cm. The centre of the small loop is on the axis of the bigger loop. The distance between their centres is 15 cm. If a current of 2.0 A flows through the smaller loop, then the flux linked with bigger loop is

a) 6.6×10^{-9} weber b) 9.1×10^{-11} weber c) 6×10^{-11} weber d) 3.3×10^{-11} weber

223. A choke coil should have:

a) high resistance and low inductance b) high resistance and high inductance

c) low resistance and high inductance d) low resistance and low inductance

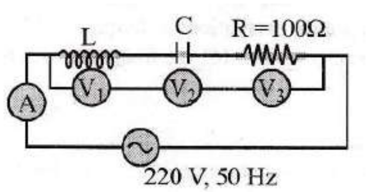
224. A rod of length l rotates with a uniform angular velocity co about an axis passing through its middle point but normal to its length in a uniform magnetic field of induction B with its direction parallel to the axis of rotation. The induced emf between the two ends of the rod is

a) $\frac{Bl^2\omega}{2}$ b) zero c) $\left(\frac{Bl^2\omega}{8}\right)$ d) $2Bl^2\omega$

225. The loss of energy in the form of heat in the iron core of a transformer is

a) iron loss b) copper loss c) mechanical loss d) none of these

226. In the given circuit the reading of voltmeter V_1 and V_2 are 300 volts each. The reading of the voltmeter V_3 and ammeter A are respectively____



a) 150V, 2.2A b) 220V, 2.0A c) 220V, 2.2A d) 100V, 2.0A

227. The quality factor of LCR circuit having resistance (R) and inductance (L) at resonance frequency (ω) is given by:

a) ωL/R b) R/ωL c) $(\omega L/R)^{1/2}$ d) $(\omega L/R)^2$

228. A metal plate can be heated by

a) passing either a direct or alternating current through the plate.

b) placing in a time varying magnetic field.

c) placing in a space varying magnetic field, but does not vary with time.

d) both (a) and (b) are correct.

229. An LC circuit contains a 40 mH inductor and a 25 μF capacitor. The resistance of the circuit is negligible. The time is measured from the instant the circuit is closed. The energy stored in the circuit is completely magnetic at times (in milliseconds)

a) 0,3.14,6.28 b) 0,1.57,4.71 c) 1.57,4.71,7.85 d) 1.57,3.14,4.71

230. Quality factor and power factor both have the dimensions of

a) time b) frequency c) work d) angle

231. A rectangular coil of 20 turns and area of crosssection 25 sq ern has a resistance of 100 ohm. If a magnetic field which is perpendicular to the plane of the coil changes at the rate of 1000 Tesla per second, the current in the coil is :

a) 1.0 ampere b) 50 ampere c) 0.5 ampere d) 5.0 ampere

232. A thin ring of radius R meter has charge q coulomb uniformly spread on it. The ring rotates about its axis with a constant frequency of f revolutions/so The value of magnetic induction in Wb/m^2 at the centre of the ring is :

a) $\mu_0 qf/2\pi R$ b) $\mu_0 q/2\pi fR$ c) $\mu_0 q/2fR$ d) $\mu_0 qf/2R$

233. **Assertion :** A transformer cannot work on de supply.

Reason : dc changes neither in magnitude nor in direction.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertionand reason are true but reason is not the correct explanation of assertion.

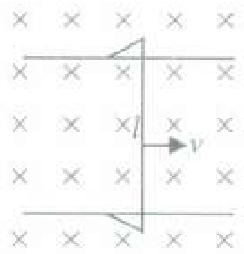
c) If assertion is true but reason is false. d) If both assertion and reason are false

234. The coefficient of mutual inductance of two coils depends on

a) medium between the coils b) distance between the two coils

c) orientation of the two coils d) all of these

235. The figure shows a wire sliding on two parallel conducting rails placed at a separation *l*. A magnetic field B exists in a direction perpendicular to the plane of the rails. The force required to keep the wire moving at a constant velocity *v* will be



a) *evB* b) $\frac{\mu_0 Bv}{4\pi l}$ c) *Blv* d) zero

236. When the number of turns in a coil is doubled without any change in the length of the coil, its self inductance becomes:

a) Four times b) Doubled c) Halved d) Unchanged

237. A resistor of 500 Ω and an inductance of 0.5 H are in series with an ac source which is given by V = $100\sqrt{2}$ sin(1000t). The power factor of the combination is

a) $\frac{1}{\sqrt{2}}$ b) $\frac{1}{\sqrt{3}}$ c) 0.5 d) 0.6

238. A 10 Y battery connected to 5 Ω resistance coil having inductance 10 H through a switch drives a constant current in the circuit. The switch is suddenly opened and the time taken to open it is 2 ms. The average emf induced across the coil is :

a) 4×10^4V b) 2×10^4V c) 2×10^2V d) 1×10^4V

239. A rectangular coil of 100 turns and size 0.1 m x 0.05 m is placed perpendicular to a magnetic field of 0.1 T. If the field drops to 0.05 T in 0.05 second, the magnitude of the e.m.f induced in the coil is

a) 2 b) 3 c) 0.5 d) 6

240. In LCR-circuit if resistance increases, quality factor

a) increases finitely b) decreases finitely c) remains constant d) none of these

241. The phase difference between the current and voltage of LCR circuit in series combination at resonance is

a) 0^0 b) π/2 c) π d) -π

242. A 220 volts input is supplied to a transformer. The output circuit draws a current of 2.0 ampere at 440 volts. If the efficiency of the transformer is 80 %, the current drawn by the primary windings of the transformer is_____

a) 3.6 ampere b) 2.8 ampere c) 2.5 ampere d) 5.0 ampere

243. A conducting metal circular-wire-loop of radius r is placed perpendicular to a magnetic field which varies with time as $B = B_o e^{\frac{t}{\tau}}$ where B_o and τ are constants, at time t = 0. If the resistance of the loop is R then the heat generated in the loop after a long time ($t \rightarrow \infty$) is

a) $\frac{\pi^2 r^4 B_0^4}{2\tau R}$ b) $\frac{\pi^2 r^4 B_0^2}{2\tau R}$ c) $\frac{\pi^2 r^4 B_0^4 R}{\tau}$ d) $\frac{\pi^2 r^4 B_0^2}{\tau R}$

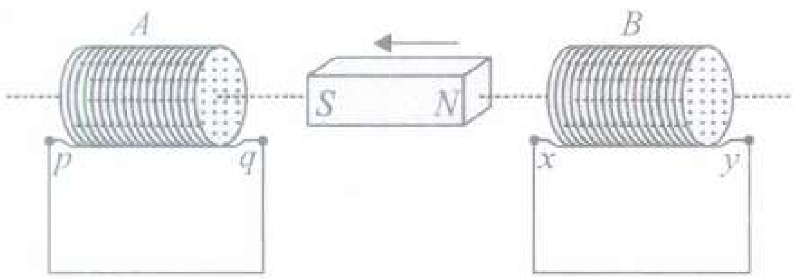
244. A transformer has 100 turns in the primary coil and carries 8 A current. If input power is 1 kW, the number of turns in secondary coil to have 500 V output will be

a) 100 b) 200 c) 400 d) 300

245. The magnetic flux linked with a coil, in webers, is given by the equations $\varphi=3t^2+4t+9$. Then the magnitude of induced e.m.f. at t = 2 second will be:

a) 2 volt b) 4 volt c) 8 volt d) 16 volt

246. The direction of induced current in the coils A and B in the situation shown in the figure is



a) p to q in coil A and x to y in coil B b) q to p in coil A and x to y in coil B

c) P to q in coil A and y to x in coil B d) q to p in coil A and y to x in ceil B

247. An electron is accelerated through a potential difference of 10,000 V. Its de Broglie wavelength is,(nearly) : ($m_c = 9 \times 10^{31}$kg)

a) 12.2×10^{-12}m b) 12.2×10^{-14} m c) 12.2nm d) 12.2×10^{-13} m

248. Assertion: When two coils are wound on each other, the mutual induction between the coils is maximum.
Reason: Mutual induction is independent of the orientation of the coils.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

249. An LCR series ac circuit is at resonance with 10 V each across L, C and R. If the resistance is halved, the respective voltages across L, C and R are
a) 10 V,10 V and 5 V b) 10 V,10 V and 10 V c) 20 V, 20 V and 5 V
d) 20 V, 20 V and 10 V

250. Two solenoids of equal number of turns have their lengths and the radii in the same ratio 1 : 2. The ratio of their self inductances will be
a) 1:2 b) 2:1 c) 1:1 d) 1:4

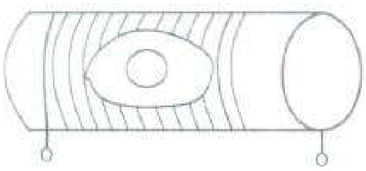
251. The current in self-inductance L = 40 mH is to be increased uniformly from 1 A to 11 A in 4 milliseconds. The emf induced in inductor during the process is __________.
a) 100 V b) 0.4 V c) 4 V d) 440 V

252. In a step up transformer the turn ratio is 1 : 2. A Leclanche cell (emf = 1.5 V) is connected across the primary. The voltage across the secondary is :
a) 3 V b) 1.5 V c) 0.75 V d) zero

253. In an alternating current circuit consisting of elements in series, the current increases on increasing the frequency of supply. Which of the following elements are likely to constitute the circuit?
a) Only resistor b) Resistor and inductor c) Resistor and capacitor d) Only inductor

254. An LC circuit contains a 20 mH inductor and a 25 μF capacitor with an initial charge of 5 mC. The total energy stored in the circuit initially is :
a) 5 J b) 0.5 J c) 50 J d) 500 J

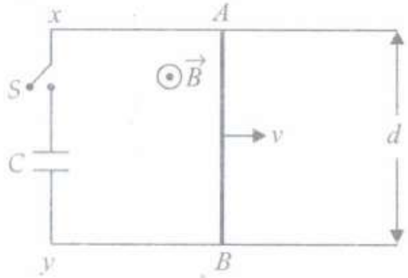
255. A circular coil with a cross-sectional area of 4 cm^2 has 10 turns. It is placed at the centre of a long solenoid that has 15 turns/cm and a cross-sectional area of 10 cm^2 , as shown in the figure. The axis of the coil coincides with the axis of the solenoid. What is their mutual inductance?



a) 7.54 μH b) 8.54 μH c) 9.54 μH d) 10.54 μH

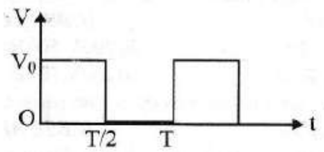
256. An alternating voltage given by V = 140 sin 314t is connected across a pure resistor of 50 Ω, the rms current through the resistor is
a) 1.98 A b) 5.63 A c) 8.43 A d) 2.39 A

257. A sliding rod AB of resistance R is shown in the figure. Here magnetic field B is constant and is out of the paper. Parallel wires have no resistance and the rod is moving with constant velocity v. The current in the sliding rod AB when switch S is closed at time t = 0 is



a) $\frac{vBd}{R}e^{-t/C}$ b) $\frac{vBd}{R}e^{-t/RC}$ c) $\frac{vBd}{R}e^{RtC}$ d) $\frac{vBd}{R}e^{t/RC}$

258. The r.m.s. value of potential difference V shown in the figure is___



a) V_0 b) $V_0\sqrt{2}$ c) $V_0/2$ d) $V_0\sqrt{3}$

259. The primary of a transformer when connected to a de battery of 10 volt draws a current of 1 m. The number of turns of the primary and secondary windings are 50 and 100 respectively. The voltage in the secondary and the current drawn by the circuit in the secondary are respectively____

a) 20 V and 0.5 m A b) 20 V and 2.0 mA c) 10V and 0.5 mA

d) Zero and therefore no current

260. A circular coil of radius 8 cm, 400 turns and resistance 2 Ω is placed with its plane perpendicular to the horizontal component of the earth's magnetic field. It is rotated about its vertical diameter through 1800 in 0.30 s. Horizontal component of earth magnetic field at the place is 3 x 10^{-5} T. The magnitude of current induced in the coil is approximately

a) 4×10^{-2}A b) 8×10^{-4}A c) 8×10^{-2}A d) 1.92×10^{-3}A

261. A transformer works on the principle of

a) self induction b) electrical inertia c) mutual induction

d) magnetic effect of the electrical current

262. Mutual inductance of two coils can be increased by:

a) decreasing the number of turns in the coils b) increasing the number of turns in the coils

c) winding the coils on wooden cores d) none of these

263. The voltage over a cycle varies as

V = V_0 sin ωt for $0 \leq t \leq \frac{\pi}{\omega}$

= - V_o sinωt for $\frac{\pi}{\omega} \leq t \leq \frac{2\pi}{\omega}$

The average value of the voltage for one cycle is

a) $\frac{V_0}{\sqrt{2}}$ b) $\frac{V_0}{2}$ c) Zero d) $\frac{2V_0}{\pi}$

264. If the number of turns per unit length of a coil of solenoid is doubled, the self-inductance of the solenoid will _______.

a) remain unchanged b) be halved c) be doubled d) become four times

265. **Assertion:** When a current flows in the coil of a transformer then its core becomes hot.

Reason : The core of transformer is made of softiron.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertionand reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

266. A fully charged capacitor C with initial charge Q_0 is connected to a coil of self inductance L at t = 0. The time at which the energy is stored equally between the electric and the magnetic field is

a) $\frac{\pi}{4}\sqrt{LC}$ b) $2\pi\sqrt{LC}$ c) $\frac{1}{\sqrt{LC}}$ d) $\sqrt{LC}$

267. **Assertion:** A given transformer can be used to stepup or step-down the voltage.

Reason : The output voltage depends upon the ratio of the number of turns of the two coils of the transformer

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertionand reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

268. Quantity that remains unchanged in a transformer is

a) voltage b) current c) frequency d) none of these

269. In an ac circuit an alternating voltage $\varepsilon = 200\sqrt{2}\sin 100$ t volts is connected to a capacitor of capacity $1\mu\mathrm{F}$. The r.m.s. value of the current in the circuit is___

a) $10\mu\mathrm{A}$ b) $100\mu\mathrm{A}$ c) $200\mu\mathrm{A}$ d) $20\mu\mathrm{A}$

270. A circular coil expands radially in a region of magnetic field and no electromotive force is produced in the coil. This is because

a) the magnetic field is constant.

b) the magnetic field is in the same plane as the circular coil and it may or may not vary.

c)
the magnetic field has a perpendicular (to the plane of the coil) component whose magnitude is decreasing suitably.

d) both (b) and (c)

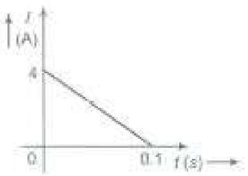
271. A circuit containing a 20 Ω resistor and 0.1 μF capacitor in series is connected to 230 V ac supply of angular frequency 100 rad s^{-1}. The impedance of the circuit is

a) $10^5\Omega$ b) $10^4\Omega$ c) $10^6\Omega$ d) $10^{10}\Omega$

272. The average e.m.f. induced in a coil in which a current changes from 0 to 2 A in 0.05 s is 8 V. The self inductance of the coil is :

a) 0.1 H b) 0.2 H c) 0.4 H d) 0.8 H

273. In a coil of resistance 10Ω the induced current developed by changing magnetic flux through it, is shown in figure as a function of time. The magnitude of change in flux through the coil in Weber is :



a) 2 b) 6 c) 4 d) 8

274. A circular copper disc 10 cm in diameter rotates at 1800 revolution per minute about an axis through its centre and at right angles to disc. A uniform field of induction B of 1 Wb m^{-2} is perpendicular to disc. What potential difference is developed between the axis of the disc and

the rim?

a) 0.023 V b) 0.23 V c) 23 V d) 230 V

275. A pair of adjacent coils has a mutual inductance of 2.5 H. If the current in one coil changes from 0 to 40 A in 0.8 s, then the change in flux linked with the other coil is

a) 100 Wb b) 120 Wb c) 200 Wb d) 250 Wb

276. A jet plane is travelling west at the speed of 1600 km h^{-1}. The voltage difference developed between the ends of the wing having a span of 20 m, if the earth's magnetic field at the location has a magnitude of 5 x 10^{-4} T and the dip angle is 30° is :

a) 4.1 V b) 2.2 V c) 3.2 V d) 3.8 V

277. A coil of inductance 300 mH and resistance 2 Ω is connected to a source of voltage 2 V. The current reaches half of its steady state value in :

a) 0.05 s b) 0.1 s c) 0.15 s d) 0.2 s

278. In an AC circuit, the rms value of current, i_{rms} is related to the peak current, i_0 by the relation_____

a) $i_{\text{rms}} = \sqrt{2} i_0$ b) $i_{\text{rms}} = \pi i_0$ c) $i_{\text{rms}} = \frac{i_0}{\pi}$ d) $i_{\text{rms}} = \frac{1}{\sqrt{2}} i_0$

279. **Assertion:** An alternating current does not show any magnetic effect.

Reason : Alternating current does not vary with time.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertionand reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

280. Two coils A and B are separated by a certain distance. If a current of 4 A flows through A, a magnetic flux of 10^{-3} Wb passes through B (no current through B). If no current passes through A and a current of 2 A passes through B, then the flux through A is

a) $5x10^{-3}$Wb b) $4x10^{-4}$Wb c) $5x10^{-4}$Wb d) $2x10^{-3}$Wb

281. 1MW power is to be delivered from a power station to a town 10 km away. One uses a pair of Cu wires of radius 0.5 em for this purpose. Calculate the fraction of ohmic losses to power transmitted if a step-up transformer is used to boost the voltage to 11000 V, power transmitted, then a step-down transformer is used to bring voltage to 220 V.

(ρCu=1.7x10^{-8} SI unit)

a) 1.8% b) 1.5% c) 3.6% d) 7.2%

282. The output of a step-down transformer is measured to be 24 V when connected to a 12 watt light bulb. The value of the peak current is

a) $\sqrt{2}A$ b) 2 A c) $2\sqrt{2}A$ d) $\frac{1}{\sqrt{2}}A$

283. Assertion: The direction of induced emf is always such as to oppose the change that causes it.

Reason: Conservation of energy applies to know the direction of induced emf.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

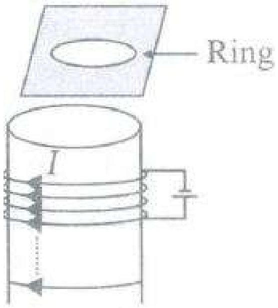
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

284. Faraday's laws are consequence of conservation of:

a) Energy b) Energy and magnetic field c) Charge d) Magnetic field

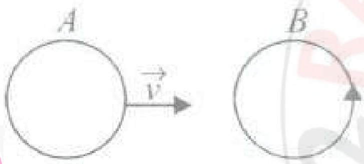
285. A metal ring kept (supported by a card board) on the top of a fixed solenoid carry a current I as shown in figure. The centre of the ring coincides with the axis of the solenoid. If the current in the solenoid is switched off, then



a) magnetic flux linked with the metal ring increases.
b) current induced in the metal ring in clockwise direction.
c) metal ring will not remain on the cardboard d) both (a) and (b) are correct

286. A series LCR circuit is comected to an ac voltage source. When L is removed from the circuit, the phase difference between current and voltage is $\frac{\pi}{3}$ between current and woltage. The power factor of the circuit is______
a) -1.0 b) zero c) 0.5 d) 1.0

287. There are two coils A and B as shown in the figure. A current starts flowing in B as shown, when A is moved towards B and stops when A stops moving. The current in A is counterclockwise. B is kept stationary when A moves. We can infer that



a) there is a constant current in the clockwise direction of A.
b) there is a varying current in A. c) there is no current in A.
d) there is a constant current in the counterclockwise direction in A.

288. In an ac circuit, V and I are given by V = 150sin(150t) V and 1= 150sin$\left(150t + \frac{\pi}{3}\right)$A The power dissipated in the circuit is
a) 106 W b) 150 W c) 5625 W d) zero

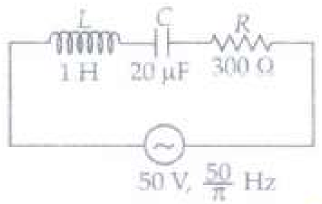
289. The north pole of a long bar magnet was pushed slowly into a short solenoid connected to a galvanometer. The magnet was held stationary for a few seconds with the north pole in the middle of the solenoid and then withdrawn rapidly. The maximum deflection of the galvanometer was observed when the magnet was
a) moving towards the solenoid b) moving towards the solenoid
c) at rest inside the solenoid d) moving out of the solenoid

290. A transformer having efficiency of 90 % is working on 200 V and 3 kW power supply. If the current in the secondary coil is 6 A, the woltage across the secondary coil and the current in the primary coil respectively are ___________ .
a) 300 V, 15 A b) 450 V, 15 A c) 450 V, 13.5A d) 600 V, 15 A

291. A sinusoidal voltage of peak value 293 V and frequency 50 Hz is applied to a series LCR circuit in which R = 6 Ω, L = 25 mH and C = 750 μF.The impedance of the circuit is
a) 7.0Ω b) 8.9Ω c) 9.9Ω d) 10.0Ω

292. A conductor of length 0.4 m is moving with a speed of 7 m/s perpendiculars to a magnetic field of intensity 0.9 Wb/ m^2. The induced emf across the conductor is ______.
a) 1.26 V b) 2.52 V c) 5.04 V d) 25.2 V

293. In the series LCR circuit shown the impedance is



a) 200 Ω b) 100 Ω c) 300 Ω d) 500 Ω

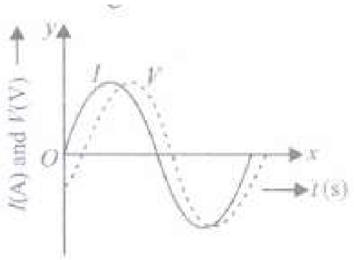
294. An electrical device draws 2 kW power from ac mains voltage 223 V(rms). The current differs lag in phase by $\phi = \tan^{-1}\left(-\frac{3}{4}\right)$ as compared to voltage. The resistance R in the circuit is
a) 15 Ω b) 20 Ω c) 25 Ω d) 30 Ω

295. In the question number 40, if velocity is normal in the shorter side then the voltage developed is
a) 2.3 x 10^{-4} V b) 2.4 x 10^{-2} V c) 4.8 x 10^{-2} V d) 1.6 x 10^{-4} V

296. The total charge induced in a conducting loop when it is moved in magnetic field depends on ______.
a) the rate of change of magnetic flux b) initial magnetic flux
c) the total change in magnetic flux d) final magnetic flux

297. A pure resistive circuit element X when connected to an ac supply of peak voltage 200 V gives a peak current of 5 A which is in phase with the voltage. A second circuit element Y, when connected to the same ac supply also gives the same value of peak current but the current lags behind by 90°. If the series combination of X and Y is connected to the same supply, what will be the rms value of current?
a) $\frac{10}{\sqrt{2}}A$ b) $\frac{10}{\sqrt{2}}A$ c) $\frac{5}{2}A$ d) 5A

298. When an ac source of voltage V = V_0 sin100t is connected across a circuit, the phase difference between the voltage V and current I in the circuit is observed to be $\pi/4$, as shown in figure. If the circuit consists possibly only of RC or RL or LC in series, find possible values of two elements.



a) $R = 1k\Omega, C = 10\mu F$ b) $R = 1k\Omega, C = 1\mu F$ c) $R = 1k\Omega, L = 10mH$
d) $R = 10k\Omega, L = 10mH$

299. A 100mH coil carries a current of 1A. Energy stored in its magnetic field is
a) 0.5 J b) 0.05 J c) 1 J d) 0.1 J

300. The self inductance of a long solenoid cannot be increased by
a) increasing its area of cross section b) decreasing its length
c) increasing the current through it d) increasing the number of turns in it

301. Phase difference between voltage and current in a capacitor in an ac circuit is
a) π b) $\pi/2$ c) 0 d) $\pi/3$

302. The self inductance of an inductor coil having 100 turns is 20 mH. The magnetic flux through the cross-section of the coil corresponding to a current of 4 mA is:
a) 2 x 10^{-5} Wb b) 4 x 10^{-7} Wb c) 8 x 10^{-7} Wb d) 8 x 10^{-5} Wb

303. A coil of 40 henry inductance is connected in series with a resistance of 8 ohm and the combination is joined to the terminals of a 2 volt battery. The time constant of the circuit is___
a) 20 Seconds b) 5 Seconds c) 1 / 5 Seconds d) 40 Seconds

304. Two identical coaxial coils P and Q carrying equal amount of current in the same direction are brought nearer. The current in
a) P increases while in Q decreases b) Q increases while in P decreases
c) both P and Q increases d) both P and Q decreases

305. A closed iron ring is held horizontally and a bar magnet is dropped through the ring with its length along the axis of the ring. The acceleration of the falling magnet is
a) equal to g b) less than g c) more than g
d) depends on the diameter of the ring and length of magnet

306. Energy in a current carrying coil is stored in the form of ______.
a) electric field b) magnetic field c) dielectric strength d) heat

307. A series resonant LCR circuit has a quality factor (Q-factor) = 0.4. If R = 2 kΩ, C = 0.1 μF, then the value of inductance is :
a) 0.1 H b) 0.064 H c) 2 H d) 5 H

308. A 60 μF capacitor is connected to a 110 V (rms), 60 Hz ac supply. The rms value of current in the circuit is
a) 1.49 A b) 14.9 A c) 2.49 A d) 24.9 A

309. In a LCR circuit having L = 8.0 henry, C = 0.5 μF and R = 100 ohm in series. The resonance frequency in per second is :
a) 600 radian b) 600 Hz c) 500 radian d) 500 Hz

310. Alternating voltage (V) is represented by the equation, where V_m is the peak voltage
a) V(t) = $V_m e^{\omega t}$ b) V(t) = $V_m sin\omega t$ c) V(t) = $V_m cot\omega t$ d) V(t) = $V_m tan\omega t$

311. When the rate of change of current is unity, the induced emf is equal to
a) thickness of coil b) number of turns in coil c) coefficient of self inductance
d) total flux linked with coil

312. The primary winding of transformer has 500 turns whereas its secondary has 5000 turns. The primary is connected to an A C supply of 20 V-50 Hz. The secondary will have an output of_____
a) $2\ \mathrm{V}, 5\ \mathrm{Hz}$ b) $200\ \mathrm{V}, 500\ \mathrm{Hz}$ c) $2\ \mathrm{V}, 50\ \mathrm{Hz}$ d) $200\ \mathrm{V}, 50\ \mathrm{Hz}$

313. A charged 30 μ Fcapacitor is connected to a 27 mH inductor. The angular frequency of free oscillations of the circuit is :
a) 1.1 x 10^3 rads^{-1} b) 2.1 x 10^3 rads^{-1} c) 3.1 x 10^3 rad s^{-1} d) 4.1 x 10^3 rad s^{-1}

314. A long solenoid with 10 turns per cm has a small loop of area 3 cm^2 placed inside, normal to the axis of the solenoid. If the current carried by the solenoid changes steadily from 2 A to 4 A in 0.2 s, what is the induced voltage in the loop, while the current is changing?
a) 4.2×10^{-8} V b) 2.8×10^{-8} V c) 7.3×10^{-6} V d) 3.8×10^{-6} V

315. An alternating supply of 220 V is applied across a circuit with resistance 22 Ω and impedance 44 Ω. The power dissipated in the circuit is
a) 1100W b) 550W c) 2200W d) (2200/3)W

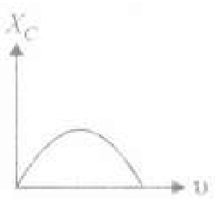
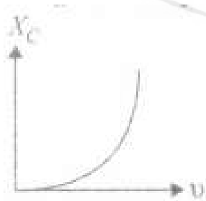
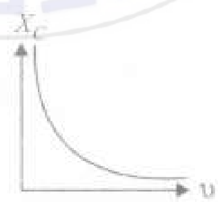
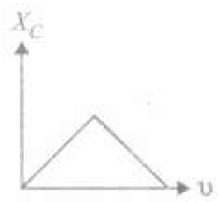
316. A capacitor has capacity C and reactance X. If capacitance and frequency become double, then reactance will be_____
(where ω is the angular resonance frequency).
a) 4 X b) X / 2 c) X / 4 d) 2 X

317. Two coils have a mutual inductance of 0.005H. The current changes in the first coil according to equation i = i_0 sin ωt, i_0 = 10 A and w = 100π rad/s. The maximum value of emf in the second coil is _______.
a) 2π b) 5π c) π d) 4π

318. Assertion: In the phenomenon of mutual induction, self induction of each of the coil persists.
Reason: Self induction arises when strength of current in one coil changes. In mutual induction, current is changing in both the individual coils.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

319. A varying current in a coil changes from 10 A to zero in 0.5s. If the average emf induced in the coil is 220 V, the self-inductance of the coil is _______.
a) 5 H b) 6 H c) 11 H d) 12 H

320. Which of the following graphs represents the correct variation of capacitive reactance Xc with frequency υ?

a) 
b) 
c) 
d) 

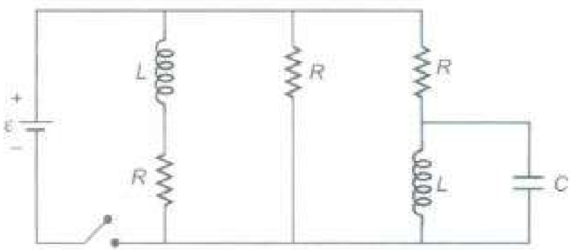
321. An inductor of reactance 1 Ω and a resistor of 2 Ω are connected in series to the terminals of a 6 V (rms) ac source. The power dissipated in the circuit is
a) 8 W b) 12 W c) 14.4 W d) 18 W

322. A series LCR-circuit with R = 20 Ω, L = 1.5 Hand C = 35 μF is connected to a variable frequency 200 V ac supply. When the frequency of the supply equals the natural frequency of the circuit, the average power transferred to the circuit in one complete cycle is
a) 200W b) 2000W c) 100W d) 4000W

323. The current drawn by the primary of a transformer, which steps down 200 V to 20 V to operate a device of resistance 20 Ω is (Assume the efficiency of the transformer to be 80 %)
a) 0.125 A b) 0.225 A c) 0.325 A d) 0.425 A

324. An e.m.f. of 5 volt is produced by a self inductance, when the current changes at a steady rate from 3A to 2A in 1millisecond. The value of self inductance is:
a) Zero b) 5 H c) 5000 H d) 5 mH

325. Figure shows a circuit that contains three identical resistors with resistance R = 9.0 Ω each, two identical inductors with inductance L = 2.0 mH each, and an ideal battery with emf e = 18 V. The current'i' through the battery just after the switch closed is, ...:



a) 2 mA b) 0.2 A c) 2 A d) 4 A

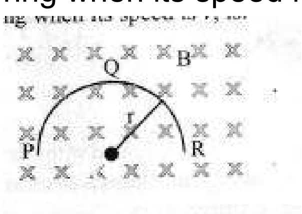
326. The natural frequency (ωo) of oscillations in LC circuit is given by
a) $\frac{1}{2\pi}\frac{1}{\sqrt{LC}}$ b) $\frac{1}{\pi}\frac{1}{\sqrt{2LC}}$ c) $\frac{1}{\sqrt{LC}}$ d) $\sqrt{LC}$

327. What is the value of inductance L for which the current is a maximum in a series LCR circuit with C = 10 μF and ω= 1000/s?
a) 10 mH b) 100 mH c) 1 mH d) cannot be calculated unless R is known

328. A series LCR circuit with R = 22 Ω, L = 1.5 H and C = 40 μF is connected to a variable frequency 220 V ac supply. When the frequency of the supply equals the natural frequency of the circuit, what is the average power transferred to the circuit in one complete cycle?
a) 2000W b) 2200W c) 2400W d) 2500W

329. An ac source is connected to a resistive circuits. Which of the following is true?
a) Current leads the voltage and both are in same phase
b) Current lags behind the voltage and both are in same phase
c) Current and voltage are in same phase
d) Any of the above may be true depending upon the value of resistance

330. A thin semicircular conducting ring (PQR) of radius 'r' is falling with its plane vertical in a horizontal magnetic field B, as shown in figure. The potential difference developed across the ring when its speed is v, is

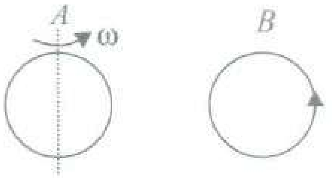


a) Zero b) Bvπr^2/2 and P is at higher potential c) PrBv and R is at higher potential
d) 2rBv and R is at higher potential

331. A transformer is used to light 140 W, 24 V lamp from a 240 V ac mains. If the main current is 0.7 A, the efficiency of the transformer is
a) 63.8% b) 74% c) 83.3% d) 48%

332. A coil has resistance 30ohm and inductive reactance 20 ohm at 50 Hz frequency. If an ac source of 200 volt, 100 Hz, is connected across the coil, the current in the coil will be____
a) 4.0 A b) 8.0 A c) $\frac{20}{\sqrt{13}}$ A d) 2.0 A

333. Same as problem 4 except the coil A is made to rotate about a vertical axis. No current flows in B if A is at rest. The current in coil A, when the current in B (at t = 0) is counterclockwise and the coil A is as shown at this instant, t = 0, is



a) constant current clockwise. b) varying current clockwise.
c) varying current counterclockwise. d) constant current counterclockwise.

334. A 100 μF capacitor in series with a 40 Ω resistor is connected to a 100 V, 60 Hz supply. The maximum current in the circuit is
a) 2.65A b) 2.75A c) 2.85A d) 2.95A

335. The unit of inductance is equivalent to
a) $\frac{volt \times ampere}{second}$ b) $\frac{second}{volt \times second}$ c) $\frac{volt}{ampere \times second}$ d) $\frac{volt \times second}{ampere}$

336. A particle of mass m, charge Q and kinetic energy T enters a transverse uniform magnetic field of induction B. After 3 seconds the kinetic energy of the particle will be :
a) 4 T b) 3 T c) 2 T d) T

337. 1.5 μF capacitor is charged of 60 V. The charging battery is then disconnected and a 15 mH coil is connected in series with the capacitor so that LC oscillations occur. Assuming that the circuit contains no resistance, the maximum current in this coil shall be close to :
a) 0.8 A b) 0.6 A c) 1.4 A d) 1.2 A

338. A solenoid is connected to a battery so that a steady current flows through it. If an iron core is inserted into the solenoid, the current will
a) increase b) decrease c) remains same d) first increase then decrease

339. Direction of current induced in a wire moving in a magnetic field is found using
a) Fleming's left hand rule b) Fleming's right hand rule c) Ampere's rule
d) Right hand clasp rule

340. A current carrying infinitely long wire is kept along the diameter of a circular wire loop, without touching it. The correct statement(s) is (are)
a) the emf induced in the loop is finite if the current is constant
b) the emf induced in the loop is zero if the current is constant
c) the emf induced in the loop is zero if the current decreases at a steady state
d) both (b) and (c).

341. For an LCR circuit, the power transferred from the driving source to the driven oscillator is P $=I^2 Z \cos \phi$. Then
a) the power factor $\cos \phi \leq 0$, $P \geq 0$.
b) the driving force can give no energy to the oscillator (P = 0) in some cases.
c) the driving force cannot syphon out (P < 0) the energy out of oscillator. d) all of these.

342. Assertion: The presence of large magnetic flux through a coil maintains a current in the coil if the circuit is continuous.
Reason: Magnetic flux is essential to maintain an induced current in the coil.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

343. A cylindrical bar magnet is kept along the axis of a circular coil. If the magnet is rotated about its axis, then:
a) A current will be induced in a coil b) No current will be induced in a coil
c) Only an e.m.f. will be induced in the coil
d) An e.m.f. and a current both will be induced in the coil

344. A short solenoid of radius a, number of turns per unit length nl' and length L is kept coaxially inside a very long solenoid of radius b, number of turns per unit length n_2. What is the mutual inductance of the system?
a) $\mu_0\pi b^2 n_1 n_2 L$ b) $\mu_0\pi a^2 n_1 n_2 L^2$ c) $\mu_0\pi a^2 n_1 n_2 L$ d) $\mu_0\pi b^2 n_1 n_2 L^2$

345. A circuit draws a power of 550 W from a source of 220 V, 50 Hz. The power factor of the circuit is 0.8 and the current lags in phase behind the potential difference. To make the power factor of the circuit as 1.0, what capacitance will have to be connected with it?
a) $\frac{1}{42\pi}\times 10^{-2}$F b) $\frac{1}{41\pi}\times 10^{-2}$F c) $\frac{1}{5\pi}\times 10^{-2}$F d) $\frac{1}{84\pi}\times 10^{-2}$F

346. A loop, made of straight edges has six corners at A(0, 0, 0), B(L, 0, 0), C(L, L, 0), D(0, L, 0), E(0, L, L) and F(0, 0, L). A magnetic field $\vec{B} = B_0\left(\hat{i} + \hat{k}\right)T$ is present in the region. The flux passing through the loop ABCDEFA (in that order) is
a) B_0L^2Wb b) $2B_0L^2$Wb c) $\sqrt{2}\,B_0L^2$Wb d) $4B_0L^2$Wb

347. A rectangular coil of 20 tums and area of cross-section 25 sq cm has a resistance of 100W. If a magnetic field which is perpendicular to the plane of coil changes at a rate of 1000 T/s, the current in the coil is ________.
a) 1 A b) 50 A c) 0.5 A d) 5 A

348. Two inductors of inductance L each are connected in series with opposite magnetic fluxes. The resultant inductance is (Ignore mutual inductance)
a) zero b) L c) 2L d) 3L

349. A coil of 40 henry inductance is connected in series with a resistance of 8 ohm and the combination is joined to the terminals of a 2 volt battery. The time constant of the circuit is :
a) 1/5seconds b) 40 seconds c) 20 seconds d) 5 seconds

350. A light bulb is rated at 100W for a 220 V ac supply. The resistance of the bulb is
a) 284 Ω b) 384 Ω c) 484 Ω d) 584 Ω

351. In a series LCR circuit having L = 30 mH, R = 8 Ω and the resonant frequency is 50 Hz. The quality factor of the circuit is
a) 0.118 b) 11.8 c) 118 d) 1.18

352. In the question number 42, the time lag between the current maximum and the voltage maximum is
a) 15.5ms b) 155ms c) 1.55ms d) 1.55s

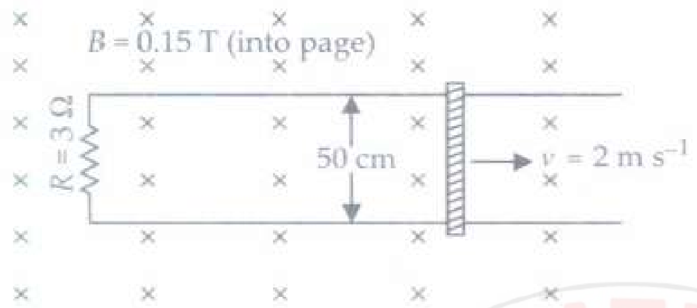
353. Assertion: When the current in a coil changes, it induces a back emf in the same coil.
Reason: Emf is a measure of the inertia of the coil against the change of current through it.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

354. As shown in the figure, a metal rod makes contact with a partial circuit and completes the circuit. The circuit area is perpendicular to a magnetic field with B = 0.15 T. If the resistance of the total circuit is 3 Ω, the force needed to move the rod as indicated with a constant speed of 2 m s^{-1} will be equal to



a) 3.75 x 10^{-3} N b) 2.75 x 10^{-3}N c) 6.57 x 10^{-4} N d) 4.36 x 10^{-4}N

355. An inductor 20 mH, a capacitor 50 μF and a resistor 40 Ω are connected in series across a source of emf V = 10 sin 340 t. The power loss in A.C. circuit is :
a) 0.51 W b) 0.67 W c) 0.76 W d) 0.89 W

356. In a series LCR circuit the voltage across an inductor, capacitor and resistor are 20 V, 20 V and 40 V respectively. The phase difference between the applied voltage and the current in the circuit is
a) 30° b) 45° c) 60° d) 0°

357. A conductor is moving with the velocity v in the magnetic field and induced current is 1. If the velocity of conductor becomes double, the induced current will be
a) 0.5 I b) 1.5 I c) 2 I d) 2.5 I

358. A 30 μlF capacitor is connected to a 150 V, 60 Hz ac supply. The rms value of current in the circuit is
a) 17 A b) 1.7 A c) 1.7 mA d) 2.7 A

359. If the self inductance of 500 turns coil is 125 mH, then the self inductance of the similar coil of 800 turns is
a) 48.8 mH b) 200 mH c) 290 mH d) 320 mH

360. An alternating current of frequency 'f' is flowing in a circuit containing a resistance R and a choke L in series. The impedance of this circuit is
a) R+2πfL b) $\sqrt{R^2+4\pi f^2 L^2}$ c) $\sqrt{R^2+L^2}$ d) $\sqrt{R^2+2\pi f L}$

361. The self inductance of the motor of an electric fan is 10 H. In order to impart maximum power at 50 Hz, it should be connected to a capacitor of capacitance:
a) 4 μF b) 8 μF c) 1 μF d) 2 μF

362. When the plane of the armature of an a.c. generator is parallel to the field, in which it is rotating

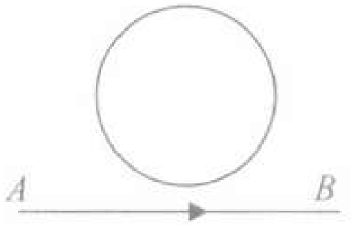
a) both the flux linked and induced emf in the coil are zero.

b) the flux linked with it is zero, while induced emf is maximum.

c) flux linked is maximum while induced emf is zero.

d) both the flux and emf have their respective maximum values.

363. In the given figure current from A to B in the straight wire is decreasing. The direction of induced current in the loop is



a) clockwise b) anticlockwise c) changing d) nothing can be said

Ravi Maths Tuition Centre

Time : 1 Mins **ELECTROMAGNETIC WAVES 1** **Marks : 494**

1. An infinitely long thin wire carrying a uniform linear static charge density A is placed along the z-axis. The wire is set into motion along its length with a uniform velocity v = $v\vec{k}z$. Find the poynting vector.
   a) $\frac{-\lambda^2 v}{4\pi^2\epsilon_0 a^2}\hat{k}$ b) $\frac{\lambda^2 v}{4\pi^2\epsilon_0 a^2}\hat{i}$ c) $\frac{\lambda^2 v}{4\pi^2\epsilon_0 a^2}\hat{k}$ d) $\frac{-\lambda^2 v}{4\pi^2\epsilon_0 a^2}\hat{i}$
2. The frequency of electromagnetic wave which is best suitable to observe a particle of radius 3 x 10^{-4} cm is of the order of
   a) 10^{15} Hz b) 10^{14} Hz c) 10^{13} Hz d) 10^{13} Hz
3. In order to establish an instantaneous displacement current of 1 mA in the space between the plates of 2 μ F parallel plate capacitor, the rate of change of potential difference is
   a) 100 V s^{-1} b) 200 V s^{-1} c) 300 V s^{-1} d) 500 V s^{-1}
4. X-rays, gamma rays and microwaves travelling in vacuum have
   a) same wavelength but different velocities b) same frequency but different velocities
   c) same velocity but different wavelengths d) same velocity and same frequency
5. In the question number 38, the frequency corresponding to the given part of electromagnetic wave is:
   a) 5.4 x 10^8 Hz b) 8.6 x 10^7 Hz c) 3.2 x 10^8 Hz d) 4.8 x 10^7 Hz
6. Which among the following does not represent Maxwell's equation?
   a) $\oint \vec{E}.\vec{dA} = \frac{q}{\varepsilon_0}$ b) $\oint \vec{B}.\vec{dA} = 0$ c) $\oint \vec{E}.\vec{dl} = \frac{-dB}{dt}$ d) $\oint \vec{B}.\vec{dl} = \mu_0$ $I_C + \mu_0\varepsilon_0 \frac{d\phi_E}{dt}$
7. **Assertion :** The radio and TV signals from broadcasting stations carry energy.
   Reason: Electromagnetic waves are capable to carry energy from one place to another.
   a)
   If both assertion and reason are true and reason is the correct explanation of assertion.
   b)
   If both assertionand reason are true but reason is not the correct explanation of assertion.
   c) If assertion is true but reason is false. d) If both assertion and reason are false.
8. If λ_2, λ_x and λ_m represent the wavelengths of visible light, X-rays and microwaves respectively, then ______
   a) $\lambda_m > \lambda_x > \lambda_v$ b) $\lambda_m > \lambda_v > \lambda_r$ c) $\lambda_v > \lambda_x > \lambda_w$
   d) $\lambda_v > \lambda_w > \lambda_{x_x}$

9. One requires 11 eV of energy to dissociate a carbon monoxide molecule into carbon and oxygen atoms. The minimum frequency of the appropriate electromagnetic radiation to achieve the dissociation lies in :
a) visible region. b) infrared region. c) ultraviolet region. d) microwave region.

10. The crystal structure can be studied by using
a) UV rays b) X-rays c) IR radiation d) Microwaves

11. In an electromagnetic wave in free space the root mean square value of the electric field is E_{rms} = 6 V/m. The peak value of the magnetic field is:
a) 1.41 x 10^{-8} T b) 2.83 x 10^{-8} T c) 0.70 x 10^{-8} T d) 4.23 x 10^{-s} T

12. **Assertion:** Electromagnetic waves exert radiation pressure.
Reason: Electromagnetic waves carry energy.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertionand reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

13. 'The amplitude of the magnetic field of a harmonic electromagnetic wave in vacuum is B_0 = 510 nT. The amplitude of the electric field part of the wave is
a) 120 N C^{-1} b) 134 N C^{-1} c) 510 N C^{-1} d) 153 N C^{-1}

14. The electric field part of an electromagnetic wave in a medium is represented by E_x=0, E_y=2.5$\frac{N}{C}cos[(2\pi \times 10^6 \frac{rad}{m})r - (\pi \times 10^{-2} \frac{rad}{s})x]$, E_z=0.The wave is
a) moving along x direction with frequency 10^6 Hz and wavelength 100 m
b) moving alone x direction with frequency 10^6 Hz and wavelength 200 m
c) moving along -x direction with frequency 10^6 Hz and wavelength 200 m
d) moving along y direction with frequency $2\pi \times 10^6$ Hz and wavelength 200 m

15. The charge on a parallel plate capacitor varies as q = q_0 cos$\pi\upsilon$ t. The plates are very large and close together (area = A, separation = d). The displacement current through the capacitor is
a) q_0 $2\pi\upsilon$ sin $\pi\upsilon$ t b) -q_0 $2\pi\upsilon$ sin2 $\pi\upsilon$ t c) q_0 2π sin $\pi\upsilon$ t d) q_0 $\pi\upsilon$ sin $2\pi\upsilon$ t

16. An electromagnetic wave of intensity I falls on a surface kept in vacuum and exerts radiation pressure P on it. Which of the following statement is not true?
a) Radiation pressure is I/c if the wave is totally absorbed.
b) Radiation pressure is I/c if the wave is totally reflected.
c) Radiation pressure is 2 I/c if the wave is totally reflected.
d) Radiation pressure is in the range I/c < P < 2 I/c for real surfaces.

17. Which of the following is the longest wave?
a) X-rays b) gamma-rays c) Microwaves d) Radiowaves

18. The magnetic field of a beam emerging from a filter facing a flood light as given by B = 12 x 10^{-8} sin (1.20 x 10^{7}z - 3.60 x 10^{15} t) T. The average intensity of the beam is :
a) 1.71 W rn^{-2} b) 2.1 W m^{-2} c) 3.2 W m^{-2} d) 2.9 W m^{-2}

19. A plane EM wave travelling along z-direction is described by
$\vec{E} = E_0 sin(kz - \omega t)\hat{i}$ and $B = B_0 sin(kz - \omega t)\vec{j}$.
a) The average energy density of the wave is given by $u_{av} = \frac{1}{4}\epsilon_0 E_0^2 + \frac{1}{4}\frac{B_0^2}{\mu_0}$
b) The time averaged intensity of the wave is given by $I_{av}=\frac{1}{2}c\epsilon_0 E_0^2$. c) Both (a) and (b)
d) None of these

20. The refractive index and permeability of a medium are 1.5 and 5 $\times$ 10^{-7} H m^{-1} respectively. The relative permittivity of the medium is nearly
a) 25 b) 15 c) 10 d) 6

21. **Assertion:** Microwaves are better carrier of signals than optical waves.
Reason : Microwaves move faster than optical waves.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertionand reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

22. An electromagnetic wave propagating along north has its electric field vector upwards. Its magnetic field vector point towards
a) north b) east c) west d) downwards

23. Ozone layer blocks the radiations of wave length______
a) less than 3×10^{-7} m b) equal to 3×10^{-7} m c) more then 3×10^{-7} m
d) All of the above

24. Which of the following electromagnetic wave is used in high precision application like LASIK eye surgery?
a) Microwave b) Ultraviolet rays c) Gamma rays d) X-rays

25. **Assertion:** The electromagnetic wave is transverse in nature.
Reason : Electromagnetic wave propagates parallel to the direction of electric and magnetic fields.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertionand reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

26. A linearly polarized electromagnetic wave given as $\vec{E} = E_0 \hat{i} \cos(kz - \omega t)$ is incident normally on a perfectly reflecting infinite wall at z = a. Assuming that the material of the wall is optically inactive, the reflected wave will be given as :

a) $\vec{E_r} = -E_0 \hat{i} \cos(kz - \omega t)$ b) $\vec{E_r} = E_0 \hat{i} \cos(kz + \omega t)$ c) $\vec{E_r} = -E_0 \hat{i} \cos(kz + \omega t)$

d) $\vec{E_r} = E_0 \hat{i} \sin(kz - \omega t)$

27. A plane electromagnetic wave propagating along x direction can have the following pairs of $\vec{E}$ and $\vec{B}$

a) E_y, B_z b) E_z, B_y c) E_x, B_y d) both (a) and (b)

28. The decreasing order of wavelength of infrared, microwave, ultraviolet and gamma rays is

a) microwave, infrared, ultraviolet, gamma rays

b) gamma rays, ultraviolet, infrared, microwaves

c) microwaves, gamma rays, infrared, ultraviolet

d) infrared, microwave, ultraviolet, gamma rays

29. Assume a bulb of efficiency 2.5% as a point source. The peak values of electric and magnetic fields produced by the radiation coming from a 100 W bulb at a distance of 3 m is respectively

a) 2.5 V m^{-1}, 3.6 x 10^{-8} T b) 4.2 V m^{-1}, 2.8 x 10^{-8} T c) 4.08 V m^{-1}, 1.36 x 10^{-8} T

d) 3.6 V m^{-1}, 4.2 x 10^{-8} T

30. Which of the following electromagnetic radiations has the least wavelength?

a) gamma rays b) infra-red c) ultraviolet d) X-rays

31. The electric and the magnetic field, associated with an e.m. wave, propagating along the +z-axis, can be represented by

a) $E = E_0\hat{i}, B = B_0\hat{j}$ b) $E = E_0\hat{k}, B = B_0\hat{i}$ c) $E = E_0\hat{j}, B = B_0\hat{i}$

d) $E = E_0, B = B_0\hat{k}$

32. A parallel plate capacitor with plate area A and separation between the plates d, is charged by a constant current I. Consider a plane surface of area A/2 parallel to the plates and drawn between the plates. The displacement current through the area is

a) I b) $\frac{I}{2}$ c) $\frac{I}{4}$ d) $\frac{I}{8}$

33. Which one of the following rays is not electromagnetic Wave?

a) heat rays b) X-rays c) $\gamma - rays$ d) $\beta - rays$

34. The oscillating electric and magnetic field vectors of electromagnetic wave are oriented along________

a) the same direction and in phase

b) the same direction but have a phase difference of 90°

c) mutually perpendicular directions and are in phase

d) mutually perpendicular directions but has a phase difference of 90°

35. A radiation of energy 'E' ' falls normally on a perfectly reflecting surface. The momentum transferred to the surface is (C= Velocity of light)_____

a) $\frac{2E}{C}$ b) $\frac{2E}{C^2}$ c) $\frac{E}{C^2}$ d) $\frac{E}{C}$

36. Poynting vectors $\vec{s}$ is defined as $\vec{s} = \frac{1}{\mu_0}\vec{E} \times \vec{B}$. The average value of $\vec{s}$' over a single period "I" is given by :
a) $E_0^2/2c\mu_0$ b) $E_0^2/c\mu_0$ c) $2E_0^2/2c\mu_0$ d) $E_0^2/c\mu_0^2$

37. The waves used by artificial satellites for communication is
a) microwaves b) infrared waves c) radio waves d) X-rays

38. Displacement current goes through the gap between the plates of a capacitor when the charge on the capacitor
a) is changing with time b) decreases c) does not change d) decreases to zero

39. The conduction current is same as displacement current when source is
a) ac only b) dc only c) either ac or dc d) neither dc nor ac

40. A. Wavelength of microwaves is greater than that of ultraviolet rays.
B. The wavelength of infrared rays is lesser than that of ultraviolet rays.
C. The wavelength of microwaves is lesser than that of infrared rays
D. Gamma ray has shortest wavelength in the electromagnetic spectrum
Choose the correct option.
a) A and B are true b) B and C are true c) C and D are true d) A and D are true

41. A wave travelling in the +ve x-direction having displacement along y-direction as 1 m, wavelength 27 Tm and frequency of 1/πHz is represented by:
a) y = sin (x - 2t) b) y= sin (2π x- 2πt) c) y = sin (10πx - 20πt)
d) y = sin (27πX + 2πt)

42. **Assertion:** Electromagnetic waves are transverse in nature.
Reason : The electric and magnetic fields in electromagnetic waves are perpendicular to each other and to the direction of propagation
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertionand reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

43. Which of the following is the infrared wavelength?
a) 10^{-4} cm b) 10^{-5} cm c) 10^{-6} cm d) 10^{-7} cm

44. In the question number 20, the electromagnetic waves
a) will have same frequency b) will have a wavelength of 0.3 m
c) fall in the region of radiowaves d) all of these

45. Sea water at frequency D = 4 X 10^8 Hz has permittivity ε = 80 ε_0, permeability $\mu \approx \mu_0$ and resistivity p = 0.25 Ω-m. Imagine a parallel plate capacitor immersed in sea water and driven by an alternating voltage source V(t) = V_o sin (zπvt). The ratio of amplitude of the

conduction current density to the displacement current density is

a) 2/3 b) 4/9 c) 9/4 d) 2

46. The rms value of the electric field of the light coming from the sun is 720 N C^{-1}. The average total energy density of the electromagnetic wave is :

a) 3.3 x 10^{-3} J m^{-3} b) 4.58 x 10^{-6} J m^{-3} c) 6.37 x 10^{-9} J m^{-3} d) 81.35 x 10^{-12} J m^{-3}

47. Which one of the following is the property of a monochromatic, plane electromagnetic wave in free space?

a) Electric and magnetic fields have a phase difference of π/12

b) The energy contribution of both electric and magnetic fields are equal

c) The direction of propagation is in the direction of $\vec{B}$ x $\vec{E}$

d) The pressure exerted by the wave is the product of its speed and energy density

48. Light with an energy flux of 25 x 104 Wm^{-2} falls on a perfectly reflecting surface at normal incidence. If the surface area is 15 Cm^2, the average force exerted on the surface is :

a) 1.20 x 10^{-6} N b) 3.0 x 10^{-6} N c) 1.25 x 10^{-6} N d) 2.50 x 10^{-6} N

49. The frequency of y-rays, X-rays and ultraviolet rays are a, band c respectively, then

a) a < b > c b) a > b > c c) a> b < c d) a < b < c

50. **Assertion:** Radio waves are diffracted by buildings.

Reason: Radio waves are high energy waves.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertionand reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

51. If λ_v, λ_x and λ_m , represent the wavelengths of visible light, X-rays and microwaves respectively, then:

a) $\lambda_, > \lambda_x > \lambda_v$ b) $\lambda_v > \lambda_m > \lambda_x$ c) $\lambda_v > \lambda_x > \lambda_m$ d) $\lambda_m > \lambda_v > \lambda_x$

52. A charged particle oscillates about its mean equilibrium position with a frequency of 10^9 Hz. The frequency of electromagnetic waves produced by the oscillator is

a) 10^6 Hz b) 10^7 Hz c) 10^8 Hz d) 10^9 Hz

53. The ionization energy of the electron in the hydrogen atom in its ground state is 13.6 eV. The atoms are excited to higher energy levels to emit radiations of 6wavelengths. Maximum wavelength of emitted radiation corresponds to the transition between:

a) n = 3 to n = 1 states b) n = 2 to n = 1 states c) n = 4 to n = 3 states

d) n = 3 to n = 2 states

54. An accelerated electron would produce

a) α rays b) γ-rays c) β-rays d) E.M. rays

55. The ultra high frequency band of radiowaves in electromagnetic wave is used as in

a) television waves b) cellular phone communication c) commercial FM radio

d) both (a) and (c)

56. Which of the following electromagnetic wave play an important role in maintaining the earth's warmth or average temperature through the greenhouse effect?

a) Visible rays b) Infrared waves c) Gamma rays d) Ultraviolet rays

57. Radio waves diffract around buildings, although light waves do not. The reason is that radio waves

a) travel with speed larger than c b) have much larger wave length than light

c) are not electromagnetic waves d) none of these

58. Light with an energy flux of 18 W cm^{-2} falls on a non-reflecting surface at normal incidence. If the surface has an area of 20 cm^2, the average force exerted on the surface during a 30 minute time span is :

a) 2.1 x 10^{-6} N b) 1.2 x 10^{-6} N c) 1.2 x 10^6 N d) 2.1 x 10^6 N

59. If $\vec{E}$ and $\vec{B}$ represent electric and magnetic field vectors of the electromagnetic waves, then the direction of propagation of the waves will be along___

a) $\vec{B} \times \vec{E}$ b) $\vec{E}$ c) $\vec{B}$ d) $\vec{E} \times \bar{B}$

60. The ratio of contributions made by the electric field and magnetic field components to the intensity of an electromagnetic wave is

a) c:1 b) c^2:1 c) 1:1 d) $\sqrt{c} : 1$

61. A signal emitted by an antenna from a certain point can be received at another point of the surface in the form of ____________ .

a) sky wave b) ground wave c) sea wave d) Both (a) and (b)

62. The ratio of amplitude of magnetic field to the amplitude of electric field for an electro-magnetic wave propagating in vacuum is equal to______

a) the speed of light in vacuum b) reciprocal of speed of light in vacuum

c) the ratio of magnetic permeability to the electric susceptibility of vacuum d) unity

63. Light with an energy flux of $25 \times 10^4 \mathrm{Wm}^{-2}$ falls on a perfectly reflecting surface at normal incidence. If the surface area is $15 \mathrm{~cm}^2$, the average force exerted on the surface is_____

a) 1.25×10^{-6} N b) 2.50×10^{-6} N c) 1.20×10^{-6} N

d) 3.0×10^{-6} N

64. Maxwell in his famous equations of electromagnetism introduced the concept of

a) ac current b) displacement current c) impedance d) reactance

65. A plane electromagnetic wave is incident on a material surface. The wave delivers momentum p and energy E. Then

a) p≠0,E≠0 b) p=0,E=0 c) p=0,E≠0 d) p≠0,E=0

66. **Assertion:** One should not use metal containers in a microwave oven.

Reason : Only because metal may melt from heating.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertionand reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

67. The velocity of electromagnetic radiation in a medium of permittivity e_0 and permeability m_0 is given by_______

a) $\sqrt{\frac{\epsilon_0}{\mu_0}}$ b) $\sqrt{\mu_0 \in_0}$ c) $\frac{1}{\sqrt{\mu_0 \in_0}}$ d) $\sqrt{\frac{\mu_0}{\epsilon_0}}$

68. The electric and magnetic field of an electromagnetic wave are_____
a) in opposite phase and perpendicular to each other
b) in opposite phase and parallel to each other
c) in phase and perpendicular to each other d) in phase and parallel to each other

69. The structure of solids is investigated by using______
a) cosmic keys b) X - rays c) p-rays d) infrared radiations

70. The electric field of a plane electromagnetic wave varies with time of amplitude 2 Vm^{-1} propagating along z-axis. The average energy density of the magnetic field (in J m^{-3}) is :
a) 13.29×10^{-12} b) 8.86×10^{-12} c) 17.72×10^{-12} d) 4.43×10^{-12}

71. The electromagnetic radiations are caused by___
a) a stationary charge b) uniformly moving charges c) accelerated charges
d) All of the above

72. X-rays and γ-rays of same energies are distinguished by their
a) frequency b) charges c) ionising power d) method of production

73. The photon energy in units of eV for electromagnetic waves of wavelength 2 cm is :
a) 2.5×10^{-19} b) 5.2×10^{16} c) 3.2×10^{-16} d) 6.2×10^{-5}

74. **Assertion:** The basic difference between various types of electromagnetic waves lies in their wavelength or frequencies.
Reason : Electromagnetic waves travel through vacuum with the same speed.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertionand reason are true but reason is not the correct explanation of assertion.

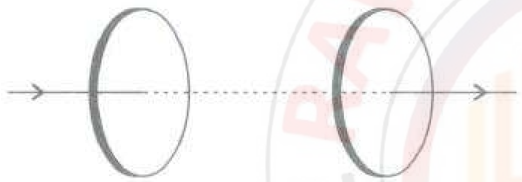
c) If assertion is true but reason is false. d) If both assertion and reason are false.

75. A plane electromagnetic wave travels in vacuum along z-direction, If the frequency of the wave is 40 MHz then its wavelength is
a) 5 m b) 7.5 m c) 8.5 m d) 10 m

76. **Assertion:** Microwaves are heat waves which is used to heat up food in ovens.
Reason : In ovens, microwaves heat up the vessel first and food inside gets heated up by the transfer of energy from the vessel.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertionand reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

77. Which of the following statement is wrong?
a) Infrared photon has more energy than the photon of visible light
b) Photographic plates are sensitive to ultraviolet rays
c) Photographic plates can be made sensitive to infrared rays
d) Infrared rays are invisible but can cast shadows like visible light rays

78. A capacitor made of two circular plates each of radius 12 ern and separated by 5 mm. The capacitor is being charged by an external source. The charging current is constant and equal to 0.15 A. The capacitance of the parallel plate capacitor is



a) 40 pF b) 45 pF c) 70 pF d) 80 pF

79. A plane electromagnetic wave travels in free space along X-direction. If the value of $\vec{B}$ (in tesla) at a f particular point in space and time is 1.2 x 10^{-8} k, the value of $\vec{E}$ (in V m $^{-1}$) at that point is :
a) $1.2\hat{j}$ b) $3.6\hat{k}$ c) $1.2\hat{k}$ d) $3.6\hat{j}$

80. If μ_0 be the permeability and ε_0 be the permittivity of a medium, then its refractive index is given by
a) $\frac{1}{\sqrt{\mu_0\varepsilon_0}}$ b) $\frac{1}{\mu_0\varepsilon_0}$ c) $\sqrt{\mu_0\varepsilon_0}$ d) $\mu_0\varepsilon_0$

81. Which of the following is positively charged?
a) a-particle b) β-particle c) y-rays d) X-rays

82. **Assertion:** Electromagnetic waves carry energy and momentum.
Reason: Electromagnetic waves can be polarised.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertionand reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

83. An electromagnetic wave of frequency v=3.0 MHz passes from vacuum into a dielectric medium with relative permittivity $\varepsilon = 4.0$. Then_____

a) wavelength is doubled and frequency is unchanged

b) wavelength is doubled and frequency becomes half

c) wavelength is halved and frequency remains unchanged

d) wavelength and frequency both remain unchanged

84. A long straight cable of length 1 is placed symmetrically along z-axis and has radius a(< <1). The cable consists of a thin wire and a coaxial conducting tube. An alternating current I(t) = I_0 sin (2πvt) flows down the central thin wire and returns along the co-axial conducting tube. The induced electric field at a distance 5 from the wire inside the cable is E(s,t) = $\mu_0 I_0$ vcos(2πvt) In ($\frac{s}{a}$)$\hat{k}$. The displacement current density inside the cable is :

a) $\frac{2\pi}{\lambda^2} I_0\ In\ (\frac{a}{s}) sin(2\pi vt)\hat{k}$ b) $\frac{1}{\lambda^2} I_0\ In\ (\frac{a}{s}) sin(2\pi vt)\hat{k}$ c) $\frac{\pi}{\lambda^2} I_0\ In\ (\frac{a}{s}) sin(2\pi vt)\hat{k}$ d) Zero

85. **Assertion:** Electromagnetic waves interact with matter and set up oscillations.

Reason : Interaction is independent of the wavelength of the electromagnetic wave.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertionand reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

86. Out of the following options which one can be used to produce a propagating electromagnetic wave?

a) Achargeless particle b) An accelerating charge

c) Acharge moving at constant velocity d) A stationary charge

87. Which of the following statement is false for the properties of electromagnetic waves?

a)

Both electric and magnetic field vectors attain the maxima and minima at the same place and same time

b)

The energy in electromagnetic wave is divided equally between electric and magnetic vector's

c)

Both electric and magnetic field vectors are parallel to each other and perpendicular to the direction of propagation of wave

d) These waves do not require any material medium for propagation

88. Which waves are used in sonography?

a) Microwaves b) Infrared rays c) Radio waves d) Ultrasonic waves

89. **Assertion:** Infrared radiation plays an important role in maintaining the average temperature of earth.

Reason: Infrared radiations are sometimes referred to as heat waves.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertionand reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

90. Which of the following has/have zero average value in a plane electromagnetic wave?

a) Both magnetic and electric fields b) Electric field only c) Magnetic field only

d) None of these

91. If E and B denote electric and magnetic fields respectively, which of the following is dimensionless?

a) $\sqrt{\mu_0\varepsilon_0}\frac{E}{B}$ b) $\mu_0\varepsilon_0\frac{E}{B}$ c) $\mu_0\varepsilon_0\left(\frac{B}{E}\right)^2$ d) $\frac{E}{\varepsilon_0}\frac{\mu_0}{B}$

92. A plane electromagnetic wave of frequency 50 MHz travels in free space along the x-direction. At a particular point in space and time, $\vec{E}$ = 6.3$\hat{j}$ V m-1 At this point $\vec{B}$ is equal to

a) 8.33 x $10^{-8}\hat{k}$ T b) 18.9 x $10^{-8}\hat{k}$ T c) 4.1 x $10^{-8}\hat{k}$ T d) 2.1 x $10^{-8}\hat{k}$ T

93. The condition under which a microwave oven heats up a food item containing water molecules most efficiently is :

a)

The frequency of the microwaves must match the resonant frequency of the water molecules

b)

The frequency of the microwaves has no relation with natural frequency of water mole

c) Microwaves are heat waves, so always produce heating

d) Infra-red waves produce heating in a microwave oven

94. Electromagnetic wave consists of periodically oscillating electric and magnetic vectors:

a) in mutually perpendicular planes but vibrating with a phase difference of π

b) in mutually perpendicular planes but vibrating with a phase difference of $\frac{\pi}{2}$

c) in randomly oriented planes but vibrating in phase

d) in mutually perpendicular planes but vibrating in phase.

95. The electric field part of an electromagnetic wave in a medium is represented by

$E_x = 0$;

$E_y = 2.5\frac{N}{C}\cos\left[\left(2\pi \times 10^6\frac{\text{rad}}{\text{m}}\right)t - \left(\pi \times 10^{-2}\frac{\text{rad}}{\text{s}}\right)X\right]$

$E_x = 0$. The wave is_____

a) moving along x direction with frequency 10^6 Hz and wave length 100 m

b) moving along x direction with frequency 10^6 Hz and wave length 200 m

c) moving along -x direction with frequency 10^6 Hz and wave length 200 m

d) moving alongy direction with frequency 2p x 10^6 Hz and wave length 200 m

96. The part of the spectrum of the electromagnetic radiation used to cook food is

a) ultraviolet rays b) cosmic rays c) X rays d) microwaves

97. We consider the radiation emitted by the human body. Which of the following statements is true?

a) the radiation emitted lies in the ultraviolet region and hence is not visible

b) the radiation emitted is in the infra-red region

c) the radiation is emitted only during the day

d) the radiation is emitted during the summers and absorbed during the winters

98. An electromagnetic radiation has an energy of 13.2 keV. Then the radiation belongs to the region of:

a) visible light b) ultraviolet c) infrared d) X-ray

99. If a variable frequency ac source is connected to a capacitor then with decrease in frequency the displacement current will

a) increase b) decrease c) remains constant d) first decrease then increase

100. **Assertion:** If earth did not have atmosphere, its average surface temperature would be lower than what it is now.

Reason : Green house effect of the atmosphere would be absent, if earth did not have atmosphere.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertionand reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

101. During the production of X-rays, if voltage is increased, then the

a) wavelength decreases b) minimum wavelength increases c) intensity decreases

d) intensity increases

102. The 21 em radio wave emitted by hydrogen in interstellar space is due to the interaction called the hyperfine interaction is atomic hydrogen. the energy of the emitted wave is nearly

a) 10^{-17} Joule b) 1 Joule c) 7 x 10^{-8} Joule d) 10^{-24} Joule

103. Pick out the longest wavelength from the following types of radiation:

a) blue light b) gamma rays c) X-rays d) red light

104. In the question 38, the amplitude of magnetic field part of the given wave is:

a) 2 x 10^{-8} T b) 1.03 x 10^{-8} T c) 4.22 x 10^{-8} T d) 5 x 10^{-8} T

105. Which of the following electromagnetic waves is used in medicine to destroy cancer cells?

a) IR-rays b) Visible rays c) Gamma rays d) Ultraviolet rays

106. About 6% of the power of a 100 W light bulb is converted to visible radiation. The average intensity of visible radiation at a distance of 8 m is (Assume that the radiation is emitted isotropically and neglect reflection.

a) 3.5×10^{-3} W m^{-2} b) 5.1×10^{-3} W m^{-2} c) 7.2×10^{-3} W m^{-2} d) 2.3×10^{-3} W m^{-2}

107. If $v_g > v_x$ and vm are the speeds of gamma rays, X-rays and microwaves respectively in vacuum, then

a) $v_g < v_X < v_m$ b) $v_g > v_X > v_m$ c) $v_g > vX < v_m$ d) $v_g = v_X = v_m$

108. Suppose that the electric field amplitude of an electromagnetic wave propagating along x-direction is E_0 = 120 NC^{-1} and that its frequency is v = 50.0 MHz.

a) The expression of electric field is $\vec{E} = 120 sin(\frac{\pi}{3}x - 100\pi \times 10^6 t)\hat{j}$

b) The expression of electric field is $\vec{E} = 60 sin(\frac{\pi}{3}x - 100\pi \times 10^6 t)\hat{j}$

c) The expression of magnetic field is $\vec{B} = 40 \times 10^{-8} sin(\frac{\pi}{3}x - \pi \times 10^8 t)\hat{k}$

d) Both (a) and (c)

109. The electric field of an electromagnetic wave travelling through vacuum is given by the equation E = E_o sin (kx - ωt). The quantity that is independent of wavelength is

a) kω b) $\frac{k}{\omega}$ c) $k^2\omega$ d) ω

110. An electromagnetic wave travelling along z-axis is given as E = Eo cos(kz-ωt).Choose the correct options from the following:

a) The associated magnetic field is given as $\vec{B} = \frac{1}{2}\hat{k} \times \vec{E} = \frac{1}{\omega}(\vec{k} \times \vec{E})$

b)

The electromagnetic field can be written in terms of the associated magnetic field as $\vec{E} = c(\vec{B} \times \hat{j})$

c) $\hat{k}.\vec{E} = 0.\hat{k}, \vec{B} \neq 0$ d) $\hat{k}.\vec{E} = 0, \hat{k} \times \vec{B} = 0$

111. Which of the following electromagnetic waves has smallest wavelength?

a) X-rays b) Microwaves c) γ-rays d) Radiowaves

112. An electromagnetic wave can be produced, when charge is

a) moving with a constant velocity b) moving in a circular orbit

c) falling in an electric field d) both (b) and (c)

113. Which rays contain (+ ve) charged particle:

a) α - rays b) β - rays c) γ-rays d) X-rays

114. Green-house effect is the heating up of Earth's atmosphere due to

a) green plants b) infra-red rays c) X-rays d) β-rays

115. The electric field part of an electromagnetic wave in vacuum is

$E = 3.1\frac{N}{C} cos[(1.8\frac{rad}{m})y + (5.4 \times 10^8 \frac{rad}{s}t)]\hat{i}$. The wavelength of this part of electromagnetic wave is :

a) 1.5 m b) 2 m c) 2.5 m d) 3.5 m

116. The electric field intensity produced by the radiations coming from 100 W bulb at a 3 m distance is E. The electric field intensity produced by the radiations coming from 50 W bulb at the same distance is

a) $\frac{E}{2}$ b) **2E** c) $\frac{E}{\sqrt{2}}$ d) $\sqrt{2}E$

117. In the question 3, the ratio of conduction current and the displacement current is
a) $(\frac{a\pi}{\lambda})^2$ b) $(\frac{a\pi}{\lambda})$ c) $(\frac{\lambda}{a\pi})^2$ d) $(\frac{\lambda}{a\pi})$

118. The amplitude of an electromagnetic wave in vacuum is doubled with no other changes made to the wave. As a result of this doubling of the amplitude, which of the following statement is correct?
a) The speed of wave propagation changes only
b) The frequency of the wave changes only
c) The wavelength of the wave changes only d) None of these.

119. **Assertion:** The velocity of electromagnetic waves depends on electric and magnetic properties of the medium.
Reason: Velocity of electromagnetic waves in free space is constant.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertionand reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

120. Aradiation of energy E falls normally on a perfectly reflecting surface. The momentum transferred to the surface is : (e = Velocity of light)
a) E/c^2 b) E/c c) 2E/c d) $2E/c^2$

121. Frequency of radiations ansmg from two close energy levels in hydrogen, known as lamb shift is 1057 MHz. This frequency falls in which range of electromagnetic wave?
a) Infrared rays b) X-rays c) γ-rays d) Radio waves

122. An electromagnetic wave radiates outwards from a dipole antenna, with E_0 as the amplitude of its electric field vector. The electric field E_0 which transports Significant energy from the source falls off as
a) $\frac{1}{r^3}$ b) $\frac{1}{r^2}$ c) $\frac{1}{r}$ d) remains constant.

123. The electric field associated with an electromagnetic wave in vacuum is given by $\vec{E}$ = 40 cos (kz-6 $\times$ 10^8t) $\hat{i}$, where E, z and t are in volt per meter, meter and second respectively. The value of wave vector k is :
a) 2 m^{-1} b) 0.5 m^{-1} c) 6 m^{-1} d) 3 m^{-1}

124. A radio can tune to any station in 7.5 MHz to 12 MHz band. The corresponding wavelength band is
a) 40 m to 25 m b) 30m to 25m c) 25m to 10m d) 10m to 5m

125. **Assertion :** Displacement current goes through the gap between the plates of a capacitor when the charge of the capacitor does not change.

Reason : The displacement current arises in the region in which the electric field is constant with time.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertionand reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

126. Light with an energy flux of 20 W/cm^2 falls on a non-reflecting surface at normal incidence. If the surface has an area of 30 cm^2, the total momentum delivered (for complete absorption) during 30 minutes is :

a) 36 x 10^{-5} kg m/s b) 36 x 10^{-4} kg m/s c) 108 x 10^{-4} kg m/s d) 1.08 x 10^{7} kg m/s

127. Which of the following is not true for electromagnetic waves?

a) They transport energy. b) They have momentum.

c) They travel at different speeds in air depending on their frequency.

d) They travel at different speeds in medium depending on their frequency.

128. Which of the following rays is not an electromagnetic wave?

a) X-rays b) γ-rays c) β-rays d) α-rays

129. In the question number 7, the rate of change of potential difference between the plates is :

a) 2.41 x 10^{9} V s^{-1} b) 1.87 x 10^{9} V s^{-1} c) 3.2 x 10^{-4} V s^{-1} d) 4.5 x 10^{-4} V s^{-1}

130. An EM wave is propagating in a medium with a velocity $\vec{v} = v\hat{i}$. The instantaneous oscillating electric field of this EM wave is along +y axis. Then the direction of oscillating magnetic field of the em wave will be along:

a) - y direction b) + z direction c) - z direction d) - x direction

131. A plane electromagnetic wave of frequency 25 MHz travels in free space along x-direction. At a particular point in space and time, electric field E = 6.3 V m^{-1}. The magnitude of magnetic field B at this point is :

a) 1.2 x 10^{-6} T b) 1.2 x 10^{-8} T c) 2. 1 x 10^{-6} T d) 2.1 x 10^{-8} T

132. Radiations of intensity 0.5 W m^{-2} are striking a metal plate. The pressure on the plate is

a) 0.166 x 10^{-8} N m^{-2} b) 0.332 x 10^{-8} N m^{-2} c) 0.111 x 10^{-8} N m^{-2}

d) 0.083 x 10^{-8} N m^{-2}

133. A microwave and an ultrasonic sound wave have the same wavelength. Their frequencies are in the ratio (approximately)

a) 10^{2} b) 10^{4} c) 10^{6} d) 10^{8}

134. An electromagnetic wave is propagating along x-axis, At x = 1 m and t = 10 s, its electric vector $|\vec{E}|$= 6 V/m then the magnitude of its magnetic vector is :

a) 2×10^{-8} T b) 3×10^{-7} T c) 6×10^{-8} T d) 5×10^{-7} T

135. Light with an average flux of $20 \mathrm{w/cm^2}$ falls on a nonreflecting surface at normal incidence having surface area $20\ \mathrm{cm}^2$. The energy receieved by the surface during the time span of 1 minute is___

a) 48×10^3 J b) 10×10^3 J c) 12×10^3 J d) 24×10^3 J

136. If ε_0 and μ_0 are respectively the electric permittivity and magnetic permeability of free space, e and m are the corresponding quantities in a medium, the index of refraction of the medium is___

a) $\sqrt{\frac{\varepsilon_0\mu_0}{\varepsilon\mu}}$ b) $\sqrt{\frac{\varepsilon\mu}{\varepsilon_0\mu_0}}$ c) $\sqrt{\frac{\varepsilon_0\mu}{\varepsilon\mu_0}}$ d) $\sqrt{\frac{\varepsilon}{\varepsilon_0}}$

137. If V_{gt} V_x and V_m are the speeds of gamma rays, X-rays and microwaves respectively in vacuum then:

a) $V_g < V_x < V_m$ b) $V_g > V_x > V_m$ c) Vg > Vx d) $V_g = V_x = V_m$

Ravi Maths Tuition Centre

Time : 1 Mins **OPTICS 1** **Marks : 785**

1. In the propagation of electromagnetic waves the angle between the direction of propagation and plane of polarisation is
   a) 0° b) 45° c) 90° d) 180°
2. When ordinary light is made incident on a quarter wave plate, the emergent light is
   a) linearly polarised b) circularly polarised c) unpolarised d) elliptically polarised
3. In total internal reflection when the angle of incidence is equal to the critical angle for the pair of media in contact, what will be angle of refraction?
   a) 0° b) Equal to angle of incidence c) 90° d) 180°
4. Two identical glass (μ_g = 3/2) equiconvex lenses of focal length f each are kept in contact. The space between the two lenses is filled with water (μ_w = 4/3). The focal length of the combination is :
   a) f/3 b) f c) 4f/3 d) 3f/4
5. Diffraction and interference of light suggest
   a) Nature of light is electro-magnetic b) Wave nature c) Nature is quantum
   d) Nature of light is transv
6. The periodic waves of intensities I_1 and I_2 pass through a region at the same time in the same direction. The sum of the maximum and minimum intensities is_____
   a) $I_1 + I_2$ b) $\left(\sqrt{I_1} + \sqrt{I_2}\right)^2$ c) $\left(\sqrt{I_1} - \sqrt{I_2}\right)^2$ d) $2\left(I_1 + I_2\right)$
7. In Young's double slit experiment using sodium light (A = 5898 A), 92 fringes are seen. If given colour (A = 5461A) is used, how many fringes will be seen
   a) 62 b) 67 c) 85 d) 99
8. When a biconvex lens of glass having refractive index 1.47 is dipped in a liquid, it acts as a plane sheet of glass. This implies that the liquid must have refractive index____
   a) equal to that of glass b) less than one c) greater than that of glass
   d) less than that of glass
9. The two coherent sources with intensity ratio β produce interference. The fringe visibility will be
   a) $\frac{2\sqrt{\beta}}{1+\beta}$ b) 2β c) $\frac{2}{(1+\beta)}$ d) $\frac{\sqrt{\beta}}{1+\beta}$
10. In Young's double slit experiment the distance between the slits and the screen is doubled. The separation between the slits is reduced to half. As a result the fringe width____

a) is doubled b) is halved c) becomes four times d) remains unchanged

11. The wavelength of light diminishes Jltimes (μ= 1.33 for water) in a medium. A diver from inside water looks at an object whose natural colour is green. He sees the object as :
a) Green b) Blue c) Yellow d) Red

12. Yellow light of wavelength 6000 $\mathring{A}$ produces fringes of width 0.8 mm in Young's double slit experiment. If the source is replaced by another monochromatic source of wavelength 7500$\mathring{A}$ and the separation between the slits is doubled then the fringe width becomes
a) 0.1mm b) 0.5mm c) 4.3mm d) 1mm

13. The refractive index of glass is 1.5 for light waves of λ = 6000 $\mathring{A}$ in vacuum. Its wavelength in glass is
a) 2000 $\mathring{A}$ b) 4000 $\mathring{A}$ c) 1000 $\mathring{A}$ d) 3000 $\mathring{A}$

14. A ray of light is incident at an angle of incidence, i, on one face of prism of angle A (assumed to be small) and emerges normally from the opposite face. If the refractive index of the prism is μ , the angle of incidence i, is nearly equal to_____
a) μA b) $\frac{\mu A}{2}$ c) $\frac{A}{\mu}$ d) $\frac{A}{2\mu}$

15. A narrow slit of width 2 mm is illuminated by monochromatic light of wavelength 500 nm. The distance between the first minima on either side on a screen at a distance of 1 m is
a) 5mm b) 0.5mm c) 1mm d) 10mm

16. Light travels through a glass plate of thickness t and refractive index μ . If c is the speed of light in vacuum, the time taken by light to travel this thickness of glass is_____
a) μtc b) $\frac{tc}{\mu}$ c) $\frac{1}{\mu f}$ d) $\frac{\mu t}{c}$

17. Colours of thin soap bubbles are due to __________ .
a) refraction b) dispersion c) interference d) diffraction

18. A body is located on a wall. Its image of equal size is to be obtained on a parallel wall with the help of a convex lens. The lens is placed at a distance 'd' ahead of second wall, then the required focal length will be___
a) only d/4 b) only d/2 c) more than d/4 but less than d/2 d) less than d/4

19. In a double slit experiment, the distance between slits is increased ten times whereas their distance from screen is halved then the fringe width is
a) becomes $\frac{1}{20}$ b) becomes $\frac{1}{90}$ c) it remains same d) becomes

20. The refractive index of the material of a prism is $\sqrt{2}$ and its refracting angle is 30°, One of the refracting surfaces of the prism is made a mirror inwards. A beam of monochromatic light enters the prism from the mirrored surface if its angle of incidence of the prism is_____
a) 30° b) 45° c) 60° d) 0°

21. Two similar thin equi-convex lenses, of focal length f each, are kept coaxially in contact with each other such that the focal length of the combination is F_1. When the space between the two lenses is filled with glycerine (which has the same refractive index

$(\mu = 1.5)$ as that of glass) then the equivalent focal length is F_2. The ratio F_1: F_2 will be_____

a) 1: 2 b) 2: 3 c) 3: 4 d) 2: 1

22. Abeam of light from a source Lis incident normally on a plane mirror fixed at a certain distance x from the source. The beam is reflected back as a spot on a scale placed just above the source I. When the mirror is rotated through a small angle 9, the spot of the light is found to move through a distance y on the scale. The angle 9 is given by

a) y/x b) x/2y c) x/y d) y/2x

23. The colours seen in the reflected white light from a thin oil film are due to

a) Diffraction b) Interference c) Polarisation d) Dispersion

24. A parallel beam of light of wavelength 600 nm is incident normally on a slit of width d. If the distance between the slits and the screen is 0.8 m and the distance of 2^{nd} order maximum from the centre of the screen is 15 mm. The width of the slit is

a) 40μm b) 80 c) 160 d) 200

25. If the speed of light in vacuum is e m/sec, then the velocity of light in a medium of refractive index 1.5

a) Is 1.5 x c b) Is c c) Is c/1.5 d) Can have any velocity

26. A beam of light composed of red and green rays is incident obliquely at a point on the face of rectangular glass slab. When coming out on the opposite parallel face, the red and green rays emerge from____

a) one point propagating in the same direction

b) two points propagating in two different non-parallel directions

c) two points propagating in two different parallel directions

d) one point propagating in two different directions

27. A microscope is focussed on a mark on a piece of paper and then a slab of glass of thickness 3 cm and refractive index 1.5 is placed over the mark. How should the microscope be moved to get the mark in focus again?

a) 4.5 cm downward b) 1 cm downward c) 2 cm upward d) 1 cm upward

28. The intensity ratio of the maxima and minima in an interference pattern produced by two coherent sources of light is 9 : 1. The intensities of the used light sources are in ratio

a) 3:1 b) 4:1 c) 9:1 d) 10:1

29. In Young's double slit experiment the separation d between the slits is 2 mm, the wavelength I.. of the light used is 5896 Å and distance D between the screen and slits is 100 em. It is found that the angular width of the fringes is 0.20°. To increase the fringe angular width to 0.2r (with same λ.. and D) the separation between the slits needs to be changed to:

a) 2.1 mm b) 1.9 mm c) 1.8 mm d) 1.7 mm

30. Velocity of light in glass whose refractive index with respect to air is 1.5 is 2 x 108 m/s and in certain liquid the velocity of light found to be 2.5 x 108 m/s. The refractive index of the liquid with respect to air is :

a) 0.64 b) 0.80 c) 1.20 d) 1.44

31. In the case oflinearly polarized light, the magnitude of the electric field vector
a) is parallel to the direction of propagation b) does not change with time
c) increases linearly with time d) varies periodically with time

32. A linear aperture whose width is 0.02 cm is placed immediately in front of a lens of focal length 60 cm. The aperture is illuminated normally by a parallel beam of wavelength 5 x 10^{-5} cm. The distance of the first dark band of the diffraction pattern from the center of the screen is _____________ .
a) 0.10 cm b) 0.25 cm c) 0.20 cm d) 0.15 cm

33. A paper, with two marks having separation d, is held normal to the line of sight of an observer at a distance of 50m. The diameter of the eye-lens of the observer is 2 mm, Which of the following is the least value of d, so that the marks can be seen as separate? The mean wavelength of visible light may be taken as $5000\ \mathrm{A}^{\circ}$ ____
a) 1.25 cm b) 2.5 mm c) 1.25 m d) 12.5 cm

34. A parallel beam of fast moving electrons is incident normally on a narrow slit. A fluorescent screen. is placed at a large distance from the slit. If the speed of the electron's is increased, which of the following statements is correct?
a) The angular width of the central maximum of the diffraction pattern will increase
b) The angular width of the central maximum will decrease
c) The angular width of the central maximum will be unaffected
d) Diffraction pattem is not observed on the screen in case of electrons

35. A beam of monochromatic light is refracted from vacuum into a medium of refractive index 1.5. The wavelength of refracted light will be___
a) dependent on intensity of refracted light b) same c) smaller d) larger

36. When light is refracted from air into glass
a) Its wavelength and frequency both in
b) Its wavelength increases but frequency remains unchanged
c) Its wavelength decreases but frequency remains unchanged
d) Its wavelength and frequency both decrease

37. The fringe width in a Young's double slit interference pattern is 2.4 x 10^{-4} m, when red light of wavelength 6400$\mathring{A}$ is used. How much will it change, if blue light of wavelength 4000$\mathring{A}$ is used?
a) 9 x 10^{-4} m b) 0.9 x 10^{-4} m c) 4.5 x 10^{-4} m d) 0.45 x 10^{-4} m

38. A polariser is used to
a) Reduce intensity of light b) Produce polarised light c) Increase intensity of light
d) Produce unpolarised light

39. Spherical wavefronts, emanating from a point source, strike a plane reflecting surface. What will happen to these wave fronts, immediately after reflection?

a) They will remain spherical with the same curvature, both in magnitude and sign.

b) They will become plane wave fronts.

c) They will remain spherical, with the same curvature, but sign of curvature reversed.

d) They will remain spherical, but with different curvature, both in magnitude and sign.

40. Young's double slit experiment uses a monochromatic source of light. The shape of interference fringes formed on the screen is
a) parabola b) straight line c) circle d) hyperbola

41. Time taken by the sunlight to pass through a window of thickness 4 mm whose refractive index is 1.5, is :
a) 2 x 10^8 sec b) 2 x 10^8sec c) 2 x 10^{-11} sec d) 2 x 10^{11} sec

42. A ray of light travelling in a transparent medium of refractive index μ , falls on a surface separating the medium from air at an angle of incidence of 45° . For which of the following value of m the ray can undergo total internal reflection?
a) $\mu = 1.33$ b) $\mu = 1.40$ c) $\mu = 1.50$ d) $\mu = 1.25$

43. A convex lens is dipped in a liquid whose refractive index is equal to the refractive index of the lens. Then its focal length will______
a) remain unchanged b) become zero c) become infinite
d) become small, but non-zero

44. In a double slit experiment, the angular width of a fringe is found to be 0.2° on a screen placed 1m away. The wavelength of light used is 600 nm. The angular width of the fringe if entire experimental apparatus is immersed in water is $\left(Take \quad \mu_{water} = \frac{4}{3}\right)$
a) 0.15° b) 1° c) 2° d) 0.3°

45. The focal lengths of a converging lens measured for violet, green and red colours are f_V, f_G, f_R respectively. We will find ____________ .
a) $f_G > f_R$ b) $f_V < f_R$ c) $f_V > f_R$ d) $f_V = f_R$

46. A boy is trying to start a fire by focusing sunlight on a piece of paper using an equiconvex lens of focal length 10 cm. The diameter of the Sun is 1.39×10^9 m and its mean distance from the earth is 1.5×10^{11} m . What is the diameter of the Sun's image on the paper?
a) 9.2×10^{-4} m b) 6.5×10^{-4} m c) 6.5×10^{-5} m
d) 12.4×10^{-4} m

47. In the Young's double-slit experiment, the intensity of light at a point on the screen where the path difference is l is K, (1 being the wavelength of light used). The intensity at a point where the path difference is 1/4, will be ______________ .
a) K b) K/4 c) K/2 d) Zero

48. In Young's double slit experiment, if the separation between coherent sources is halved and the distance of the screen from the coherent source is doubled, then the fringe width becomes____
a) one-fourth b) double c) half d) four times

49. Light enters at an angle of incidence in a transparent rod of refractive index m. For what value of the refractive index of the material of the rod the light once entered into it will not leave it through its lateral face whatsoever be the value of angle of incidence?
a) $\mu > \sqrt{2}$ b) $\mu - 1$ c) $\mu = 1.1$ d) $\mu = 1.3$

50. A slit of width a is illuminated by white light. For red light (λ.= 6500Å), the first minima is obtained at θ= 30°. Then the value of a will :
a) 3250 Å b) 6.5 x 10^{-4} mm c) 1.24 microns d) 2.6 x 10^{-4}

51. Light propagates rectilinearly, due to
a) wave nature b) wavelengths c) velocity d) frequency

52. A concave shaving mirror has a radius of curvature of 35.0 cm. It is positioned so that the (upright) image of a man's face is 2.50 times the size of the face. How far is the mirror from the face?
a) 5.25 cm b) 21.0 cm c) 10.5 cm d) 42 cm

53. A mark at the bottom of a liquid appears to rise by 0.1m. The depth of the liquid is 1 m. The refractive index of the liquid is :
a) 1.33 b) 9/10 c) 10/9 d) 1.5

54. Two polaroids P_2 and P_2 are placed with their axis perpendicular to each other. Unpolarised light I_0 is incident on P_1. A third polaroid P3 is kept in between P_1 and P_2 such that its axis makes an angle 45° with that of P_1' The intensity of transmitted light through P_2 is:
a) $I_o/4$ b) $I_o/8$ c) $I_o/6$ d) $I_o/2$

55. A parallel beam of light of wavelength 500 nm falls on a narrow slit and the resulting diffraction pattern is observed on a screen 1m away. It is observed that the first minima is at a distance of 2.5 mm from the centre of the screen. The width of the slit is :
a) 0.2 mm b) 1 mm c) 2 mm d) 1.5 mm

56. Electromagnetic radiation of frequency v, velocity v and wavelength λ, in air, enters a glass slab of refractive index μ. The frequency, wavelength and velocity of light in the glass slab will be, respectively_______
a) $\frac{v}{\mu}, \frac{\lambda}{\mu}, v$ b) $v, \lambda, \frac{v}{\mu}$ c) $v, \frac{\lambda}{\mu}, \frac{v}{\mu}$ d) $\frac{v}{\mu}, \frac{\lambda}{\mu}, \frac{v}{\mu}$

57. Two slits in Young's double slit experiment have widths in the ratio 81 : 1. The ratio of the amplitudes of light waves is
a) 3:1 b) 3:2 c) 9:1 d) 6:1

58. A beam of light consisting of two wavelengths, 650 nm and 520 nm is used to obtain interference fringes in a Young's double-slit experiment. What is the least distance from the central maximum where the bright fringes due to both the wavelengths coincide?
a) 1.77 mm b) 2.52 mm c) 1.56 mm d) 3.14 mm

59. A single slit is illuminated by light of wavelength 6000 $\mathring{A}$. The slit width is 0.1 cm and the screen is placed 1 m away. The angular position of 10^{th} minimum in radian is :
a) 2 x 10^{-4} b) 6 x 10^{-3} c) 3 x 10^{-3} d) 1 x 10^{-4}

60. From Brewster's law, except for polished metallic surfaces, the polarising angle
a) depends on wavelength and is different for different colours
b) independent of wavelength and is different for different colours
c) independent of wavelength and is same for different colours
d) depends on wavelength and is same for different colours

61. Which of the following phenomenon is not common to sound and light waves?
a) Interference b) Diffraction c) Coherence d) Polarisation

62. The reddish appearance of the sun at sunrise and sunset is due to___
a) the colour of the sky b) the scattering of light c) the polarisation of light
d) the colour of the sun

63. On introducing a thin film in the path of one of the two interfering beam, the central fringe will shift by one fringe width. If μ = 1.5, the thickness of the film is (wavelength of monochromatic light is λ)
a) 4λ b) 3λ c) 2λ d) λ

64. To an observer on the earth the stars appear to twinkle. This can be described to :
a) the fact that stars do not emit light continuously
b) frequent absorption of star light by their own atmosphere
c) frequent absorption of star light by the earth's atmosphere
d) the refractive index fluctuations in the earth's atmosphere

65. In a Young's double slit experiment, let s_1 and s_2 be the two slits, and C be the centre of the screen. If $\angle S_1CS_2 = \theta$ and λ is the wavelength, the fringe width will be :
a) $\frac{\lambda}{\theta}$ b) $\lambda\theta$ c) $\frac{2\lambda}{\theta}$ d) $\frac{\lambda}{2\theta}$

66. Refractive index for a material for infrared light is
a) equal to that of ultraviolet light b) less than for ultraviolet light
c) equal to that for red colour of light d) greater than that for ultraviolet light

67. Light waves can be polarised as they are
a) Transverse b) of high frequency c) Longitudinal d) Reflected

68. If $_i\mu_j$ represents refractive index when a light ray goes from medium i to mediumj, then the product $_2\mu_1$ x $_3\mu_2$ X $_4\mu_3$ is equal to
a) $_3\mu_1$ b) $3\mu 2$ c) $1/_1\mu_4$ d) $_4\mu_2$

69. In Young's double slit experiment using monochromatic light of wavelengths λ the intensity of light at a point on the screen with path difference λ is M units. The intensity of light at a point where path difference is λ/3 is :
a) $\frac{M}{2}$ b) $\frac{M}{4}$ c) $\frac{M}{8}$ d) $\frac{M}{16}$

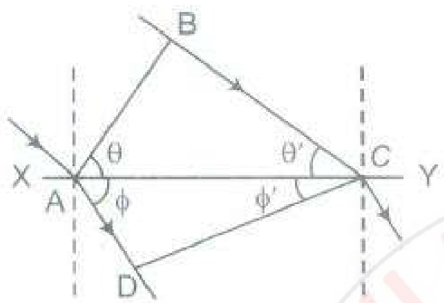
70. Light from two coherent sources of the same amplitude A and wavelength λ illuminates the screen. The intensity of the central maximum is I_o. If the sources were incoherent, the intensity at the same point will be
a) $4I_0$ b) $2I_0$ c) I_0 d) $\frac{I_0}{2}$

71. The $6563 \mathring{A} H_{\alpha}$ line emitted by hydrogen in a star is found to be red-shifted by 15 $\mathring{A}$. The speed with which the star is receding from the earth is :
a) 3.2 x 10^5 m S^{-1} b) 6.87 x 10^5 m S^{-1} c) 2 x 10^5 m S^{-1} d) 12.74 x 10^5 m S^{-1}
72. In a Fresnel biprism experiment the two positions of lens give separation between the slits as 16 cm and 9 cm respectively. The actual distance of separation is
a) 12 cm b) 12.5 cm c) 13 cm d) 14 cm
73. An air bubble in a glass slab with refractive index 1.5 (near normal incidence) is 5 cm deep when viewed from one surface and 3 em deep when viewed from the opposite face. The thickness (in em) of the slab is
a) 8 b) 10 c) 12 d) 16
74. There is a prism with refractive index equal to $\sqrt{2}$ and the refracting angle equal to 30°. One of the refracting surface of the prism is polished. Abeam of monochromatic will retrace its path if its angle of incidence over the refracting surface of the prism is ___________ .
a) 0° b) 30° c) 45° d) 60°
75. The transverse nature of light is shown by
a) Interference of light b) Refraction of light c) Polarisation of light
d) Dispersion of light
76. For the same objective, what is the ratio of the least separation between two points to be distinguished by a microscope for light of $5000 \mathring{A}$ and electrons accelerated through 100 V used as an illuminating substance?
a) 3075 b) 3575 c) 4075 d) 5075
77. When the angle of incidence is 60° on the surface of a glass slab, it is found that the reflected ray is completely polarized. The velocity of light in glass is
a) $\sqrt{2} \times 10^8 \quad ms^{-1}$ b) $\sqrt{3} \times 10^8 \quad ms^{-1}$ c) $2 \times 10^8 \quad ms^{-1}$ d) $3 \times 10^8 \quad ms^{-1}$
78. A telescope is used to resolve two stars separated by 4.6 x 10^{-6} rad. If the wavelength of light used is 5460 $\mathring{A}$ what should be the aperture of the objective of the telescope?
a) 0.1488 m b) 0.567 m c) 1 m d) 2 m
79. Unpolarised light of intensity 32 W m^{-2} passes through three polarisers such that transmission axis of first is crossed with third. If intensity of emerging light is 2 W m^{-2}, what is the angle of transmission axis between the first two polarisers?
a) 30^0 b) 45^0 c) 22.5^0 d) 60^0
80. A parallel beam of light of wavelength lis incident normally on a narrow slit. A diffraction pattern is formed on a screen placed perpendicular to the direction of the incident beam. At the second minimum of the diffraction pattern, the phase difference between the rays coming from the two edges of slit is_____
a) πl b) 2π c) 3π d) 4π
81. An astronaut in a spaceship see the outer space as
a) White b) Black c) Blue d) Red

82. In Young's double slit experiment the slits are separated by 0.28 mm and the screen is placed 1.4 m away. The distance between the central and fourth bright fringe is measured to be 1.2 cm. The wavelength of light used in the experiment is :
a) 6×10^{-7}m b) 3×10^{-7}m c) 1.5×10^{-7} m d) 5×10^{-6} m

83. The penetration of light into the region of geometrical shadow is call :
a) Polarization b) Interference c) Diffraction d) Refraction

84. In the adjoining diagram, a wavefront AB, moving in air is incident on a plane glass surface XY. Its position CD after refraction through a glass slab is shown also along with the normals drawn at A and D. The refractive index of glass with respect to air (μ = 1) will be equal to:



a) sin θsinθ' b) sin θ/sinɸ c) sin ɸ'/sinθ d) AB/CD

85. For a normal eye, the cornea of eye provides a converging power of 40D and the least converging power of the eye lens behind the cornea is 20D. Using this information, the distance between the retina and the eye lens of the eye can be estimated to be___
a) 2.5 cm b) 1.67 cm c) 1.5 cm d) 5 cm

86. Two light waves superimposing at the mid-point of the screen are coming from coherent sources of light with phase difference 3π rad. Their amplitudes are 1cm each. The resultant amplitude at the given point will be,
a) 5cm b) 3cm c) 2cm d) zero

87. Out of the following statements which is not correct?
a)
When unpolarised light passes through a Nic prism, the emergent light is elliptically polarized
b) Nicol's prism works on the principle of double refraction and total internal reflection
c) Nicol's prism can be used to produce and analyze polarized lig
d) Calcite and Quartz are both doubly refracting crystals

88. A ray of light is incident on the surface of a glass plate at an angle of incidence equal to Brewster's angle <p. If 11 represents the refractive index of glass with respect to air, then the angle between reflected and refracted rays is
a) 90 + φ b) $\sin^{-1}$ (μ cos <φ) c) 90° d) 90°- $\sin^{-1}$(sinφ/μ)

89. In a Fraunhofer diffraction at single slit of width d with incident light of wavelength 5500 $\mathring{A}$, the first minimum is observed, at angle 30°. The first secondary maximum is observed at an angle θ

a) $\sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$ b) $\sin^{-1}\left(\frac{1}{4}\right)$ c) $\sin^{-1}\left(\frac{3}{4}\right)$ d) $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$

90. The refractive index of a certain glass is 1.5 for light whose wavelength in vacuum is 6000 Å. The wavelength of this light when it passes through glass is:
a) 4000 Å b) 6000 Å c) 9000 Å d) 15000 Å

91. Two identical thin plano-convex glass lenses (refractive index 1.5) each having radius of curvature of 20 cm are placed with their convex surfaces in contact at the centre. The intervening space is filled with oil of refractive index 1.7. The focal length of the combination is __________ .
a) -25 cm b) -50 cm c) 50 cm d) 10 cm

92. A plano convex lens is made of material ofrefractive index 1.6. The radius of curvature of the curved surface is 60 cm. The focal length of the lens is___
a) 50 cm b) 100 cm c) 200 cm d) 400 cm

93. Red light is generally used to observe diffraction pattern from single slit. If blue light is used instead of red light, then diffraction pattern :
a) Willbe clearer b) Will contract c) Will expanded d) Will not be visualiaes

94. A ray is incident at angle of incidence i on one surface of a prism of small angle. A and emerge normally from opposite surface. If the refractive index of the material of prism is μ , the angle of incidence i is nearly equal to____
a) $\frac{A}{\mu}$ b) $\frac{A}{2\mu}$ c) μA d) $\frac{\mu A}{2}$

95. Two thin lenses of focal lengths f_1 and f_2 are in contact and coaxial. The power of the combination is____
a) $\sqrt{\frac{f_1}{f_2}}$ b) $\sqrt{\frac{f_2}{f_1}}$ c) $\frac{f_1+f_2}{2}$ d) $\frac{f_1+f_2}{f_1 f_2}$

96. The human eye has an approximate angular resolution of $\phi = 5.8 \times 10^{-4}$ rad and typical photoprinter prints a minimum of 300 dpi (dots per inch, 1 inch = 2.54 cm), At what minimal distance z should a printed page be held so that one does not see the individual dots?
a) 14.5 cm b) 20.5 cm c) 29.5 cm d) 28 cm

97. In Young's double slit experiment, the slits are 2 mm apart and are illuminated by photons of two wavelengths $l_1 = 12000 A^o$ and $I_2 = 10000 A^o$. At what minimum distance from the common central bright fringe on the screen 2m from the slit will a bright fringe from one interference pattern coincide with a bright fringe from the other?
a) 6 mm b) 4 mm c) 3 mm d) 8 mm

98. An astronomical refracting telescope will have large angular magnification and high angular resolution, when it has an objective lens of __________ .
a) large focal length and large diameter b) large focal length and small diameter
c) small focal length and large diameter d) small focal length and small diameter

99. In Young's double slit experiment two disturbances arriving at a point P have phase difference of $\frac{\pi}{3}$ The intensity of this point expressed as a fraction of maximum intensity I_0 is

a) $\frac{3}{2}I_0$ b) $\frac{1}{2}I_0$ c) $\frac{4}{3}I_0$ d) $\frac{3}{4}I_0$

100. Two slits are made one millimetre apart and the screen is placed one metre away. The fringe separation when blue green light of wavelength 500 nm is used is

a) 5×10^{-4} m b) 2.5×10^{-3} m c) 2×10^{-4} m d) 10×10^{-4} m

101. The angular resolution of a 10 cm diameter telescope at a wavelength 5000Å is of the order

a) 10^{6} rad b) 10^{-2} rad c) 10^{-4} rad d) 10^{-6} rad

102. The bending of beam of light around corners of obstacles is called:

a) Reflectio b) Diffraction c) Refraction d) Interference

103. The angular resolution of a 10 cm diameter telescope at a Wavelength of 5000 is of the order of ______

a) 10^{6}rad b) 10^{-2}rad c) 10^{-4}rad d) 10^{-6}rad

104. A plane wave passes through a convex lens. The geometrical shape of the wavefront that emerges is

a) plane b) diverging spherical c) converging spherical d) none of these

105. An air bubble in a glass slab (μ = 1.5) is 5 cm deep when viewed from one face and 2 cm deep when viewed from the opposite face. The thickness of the slab is______

a) 7.5 cm b) 10.5 cm c) 7 cm d) 10 cm

106. The refractive index of a medium is $\sqrt{3}$. If the unpolarized light is incident on it at the polarizing angle of the medium, the angle of refraction is :

a) 60° b) 70° c) 30° d) 0°

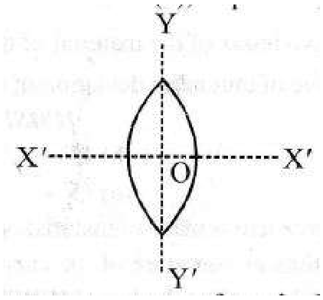
107. To ensure almost 100 percent transmissivity, photographic lenses are often coated with a thin layer of dielectric material. The refractive index of this material is intermediated between that of air and glass (which makes the optical element of the lens). A typically used dielectric film is MgF_2 (n = 1.38). What should the thickness of the film be so that at the center of the visible spectrum (5500 $\mathring{A}$) there is a maximum transmission?

a) 5000 $\mathring{A}$ b) 2000 $\mathring{A}$ c) 1000 $\mathring{A}$ d) 3000 $\mathring{A}$

108. A telescope has an objective lens of 10 cm diameter and is situated at a distance of one kilometre from two objects. The minimum distance between these two objects, which can be resolved by the telescope, when the mean wavelength of light is 5000 A^{o}, is of the order of ____________ .

a) 5 cm b) 0.5 m c) 5 m d) 5 mm

109. An equiconvex lens is cut into two halves along (i) X O X' and (ii) YOY' as shown in the figure. Let f, f', f'' be the focal lengths of the complete lens of each half in case (i), and of each half in case (ii), respectively.



Choose the correct statement, from the following

a) $f' = 2f, f'' = 2f$ b) $f' = f, f'' = 2f$ c) $f' = 2f, f'' = f$

d) $f' = f, f'' = f$

110. When a low flying aircraft passes overhead, we sometimes notice a slight shaking of the picture on our TV screen. This is because of between the direct signal and reflected signal

a) interference b) diffraction c) polarisation of direct signal d) Both (b) and (c)

111. Stars are twinkling due to

a) Diffraction b) Reflection c) Refraction d) Scattering

112. In a Young's double slit experiment, the angular width of a fringe formed on a distant screen is 1°. The slit separation is 0.01 mm. The wavelength of : the light is :

a) 0.174 nm b) 0.174 $\mathring{A}$ c) 0.174 μm d) 0.174 x 10^{-4} m

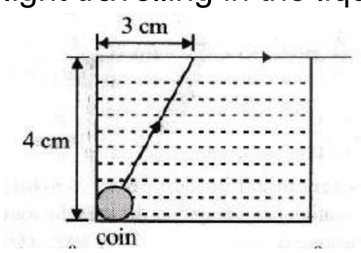
113. The refractive index of water is 1.33. What will be the speed of light in water :

a) 3 x 10^8 m/s b) 2.25 x 10^8 m/s c) 4 x 10^8 m/s d) 1.33 x 10^8 m/s

114. The frequency of a light wave in a material is 2 x 10^{14} Hz and wavelength is 5000 Å. The refractive index of material will be ________ .

a) 1.50 b) 3.00 c) 1.33 d) 1.40

115. A small coin is resting on the bottom of a beaker filled with liquid. A ray of light from the coin travels upto the surface of the liquid and moves along its surface. How fast is the light travelling in the liquid?



a) 2.4 x 10^8 m/s b) 3.0 x 10^8 m/s c) 1.2 x 10^8 m/s d) 1.8 x 10^8 m/s

116. In a double slit experiment, the distance between the slits is d. The screen is at a distance D from the slits. If a bright fringe is formed opposite to one of the slits, its order is

a) $\frac{d}{\lambda}$ b) $\frac{\lambda^2}{dD}$ c) $\frac{D^2}{2\lambda d}$ d) $\frac{\lambda_2}{2\lambda_1}$

117. In a double slit experiment using light of wavelength 600 nrn, the angular width of a fringe on a distant screen is 0.1^0. The spacing between the two slits is :

a) 3.44 x 10^{-4} m b) 1.54 x 10^{-4} m c) 1.54 x 10^{-3} m d) 1.44 x 10^{-3} m

118. A beam of light of 1=600 nm from a distant source falls on a single slit 1 mm wide and the resulting diffraction patt is observed on a screen 2 m away. The distance betwc n first dark fringes on either side of the central bright fringc is___
a) 12 cm b) 1.2 mm c) 2.4 cm d) 2.4 mm

119. At what angle of incidence will the light reflected from glass (μ = 1.5) be completely polarised :
a) 72.8° b) 51.6° c) 40.3° d) 56.3°

120. The refracting angle of a prism is ' A ', and refractive index of the material of the prism is cot (A / 2). The angle of minimum deviation is_____
a) $180^{\circ}-2 \mathrm{~A}$ b) $90^{\circ}-\mathrm{A}$ c) $180^{\circ}+2 \mathrm{~A}$ d) $180^{o}-3 A$

121. One face of a rectangular glass plate 6 cm thick is silvered. An object held 8 cm in front of the first face, forms an image 12 cm behind the silvered face. The refractive index of the glass is_______
a) 0.4 b) 1.2 c) 0.8 d) 1.6

122. The ratio of resolving powers of an optical microscope for two wavelengths λ_1 = 4000 Å and λ_2 = 6000 Å is:
a) 9: 4 b) 3: 2 c) 16: 81 d) 8: 27

123. The phenomena which is not explained by Huygen's construction of wavefront
a) reflection b) diffraction c) refraction d) origin of spectra

124. In a double slit experiment, when light of wavelength 400 nm was used, the angular width of the first minima formed on a screen placed 1 m away, was found to be 0.2°. What will be the angular width of the first minima, if the entire experimental apparatus is immersed in water? ($\mathrm{m}_{\text{water}} = 4/$ 3)____
a) 0.15° b) 0.05° c) 0.1° d) 0.266°

125. The magnifying power of a telescope is 9. When it is adjusted for parallel rays the distance between the objective and eyepiece is 20 cm. The focal length of lenses are ___________ .
a) $10 \mathrm{~cm}, 10 \mathrm{~cm}$ b) 15 cm, 5 cm c) 18 cm, 2 cm d) 11 cm, 9 cm

126. A galaxy moves with respect to us so that sodium light of 589.0 nm is observed at 589.6 nm.The speed of the galaxy is:
a) 206 km S^{-1} b) 306 km S^{-1} c) 103 km S^{-1} d) 51 km S^{-1}

127. If f_V and f_R are the focal lengths of a convex lens for violet and red light respectively and F_V and F_R are the focal lengths of concave lens for violet and red light respectively, then we have ___________.
a) $f_V < f_R$ and $F_V > F_R$ b) $f_V < f_R$ and $F_V < F_R$ c) $f_V > f_R$ and $F_V > F_R$
d) $f_V > f_R$ and $F_V < F_R$

128. Two plane mirrors are inclined at 70°. A ray incident on one mirror at angle θ after reflection falls on second mirror and is reflected from there parallel to first mirror. The value of θ is_______
a) 50° b) 45° c) 30° d) 55°

129. Assume that light of wavelength 600 nm is coming from a star. The limit of resolution of telescope whose objective has a diameter of 2 m is____

a) $6.00 \times 10^{-7}\mathrm{rad}$ b) $3.66 \times 10^{-7}\mathrm{rad}$ c) $1.83 \times 10^{-7}\mathrm{rad}$
d) $7.32 \times 10^{-7}\mathrm{rad}$

130. Two points separated by a distance of 0.1 mm can just be inspected in a microscope when light of wavelength 6000$\mathring{A}$ is used. If the light of wavelength 4800$\mathring{A}$ is used then limit of resolution will become :

a) 0.8 mm b) 0.12 mm c) 0.1 mm d) 0.08 mm

131. Interference is possible in_____

a) light waves only b) sound waves only c) Both light and sound waves
d) Neither light nor sound waves

132. If the angle between the pass axis of the polarizer and the analyzer is 45°, the ratio of the intensities of original light and the transmitted light after passing through the analyzer is

a) $\frac{1}{2}$ b) $\frac{1}{3}$ c) 1 d) $\frac{1}{4}$

133. The wavelength of light of frequency 100 Hz is ____________ .

a) 2 x 10^6m b) 3 x 10^6m c) 4 x 10^6m d) 5 x 10^6m

134. The idea of the quantum nature of light has emerged in an attempt to explain

a) Interference b) Diffraction c) Radiation spectrum of a black body d) Polarisation

135. In Young's double slit experiment, the fringe width with light of wavelength 6000 $\mathring{A}$ is 3 mm . The fringe width, when the wavelength of light is changed to 4000$\mathring{A}$ is

a) 3 mm b) 1 mm c) 2 mm d) 4 mm

136. A convex lens of focal length 80 cm and a concave lens of focal length 50 cm are combined together. What will be their resulting power?

a) +6.5 D b) -6.5 D c) +7.5 D d) -0.75 D

137. The refractive index of the material of the prism is $\sqrt{3}$, then the angle of minimum deviation of the prism is______

a) 30^o b) 45^o c) 60^o d) 75^o

138. A lens having focal length f and aperture of diameter d forms an image of intensity I. Aperture of diameter d/2 in central region of lens is covered by a black paper. Focal length of lens and intensity of image now will be respectively____

a) f and $\frac{I}{4}$ b) 3f/4 and $\frac{I}{2}$ c) f and 3I/4 d) f/2 and I/2

139. Which of the following shows particle nature of light?

a) refraction b) interference c) polarization d) photoelectric effect

140. Immiscible transparent liquids A, B, C, D and E are placed in a rectangular container of glass with the liquids making layers according to their densities. The refractive index of the liquids are shown. The container is illuminated from the side and a small piece of glass having refractive index 1.61 is gently dropped into the liquid layer. The glass piece as it descends downwards will not be visible in :

A	1.51

B	1.53
C	1.61
D	1.52
E	1.65

a) Liquid A and B only b) Liquid C only c) Liquid D and E only
d) Liquid A, B, D and E

141. The interference pattern is obtained with two coherent light sources of intensity ratio n. In the interference pattern, the ratio (I_{max} - I_{min}) / (I_{max} + I_{min}) will be:
a) $\sqrt{n}/n+1$ b) $2\sqrt{n}/(n+1)$ c) $\sqrt{n}/(n+1)^2$ d) $2\sqrt{n}/(n+1)^2$

142. Angle of deviation (d) by a prism (refractive index = m, and supposing the angle of prism A to be small) can be given by ______________ .
a) $\delta=(\mu-1)A$ b) $\delta=(\mu+1)A$ c) $\delta=\frac{\sin\frac{A+\delta}{2}}{\sin\frac{A}{2}}$ d) $\delta=\frac{\mu-1}{\mu+1}A$

143. Two sources of light of wavelength 2500$\mathring{A}$ and 3500$\mathring{A}$ are used in Young's double slit experiment simultaneously. Which orders of fringes of two wavelength patterns coincide?
a) 3rd order of 1st source and 5th of the 2nd b) 7th order of 1st and 5th order of 2nd
c) 5th order of 1st and 3rd order of 2nd d) 5th order of 1st and 7th order of 2nd

144. The earth is moving towards a fixed star with a velocity of 30 km S^{-1}. An observer on the earth observes a shift of 0.58 $\mathring{A}$ in the wavelength of light coming from the star. The actual wavelength of light emitted by the star is
a) 5800$\mathring{A}$ b) 2400$\mathring{A}$ c) 12000$\mathring{A}$ d) 6000$\mathring{A}$

145. Pick the wrong answer in the context with rainbow____
a) The order of colours is reversed in the secondary rainbow
b) An observer can see a rainbow when his front is towards the sun
c) Rainbow is a combined effect of dispersion refraction and reflection of sunlight
d)
When the light rays undergo two internal reflections in a water drop, a secondary rainbow is formed

146. In a Young's double slit experiment, (slit distance d) monochromatic light of wavelength λ is used and the fringe pattern observed at a distance D from the slits. The angular position of the bright fringes are:
a) $\sin^{-1}\left(\frac{N\lambda}{d}\right)$ b) $\sin^{-1}\left(\frac{\left(N+\frac{1}{2}\right)\lambda}{d}\right)$ c) $\sin^{-1}\left(\frac{N\lambda}{D}\right)$ d) $\sin^{-1}\left(\frac{\left(N+\frac{1}{2}\right)\lambda}{D}\right)$

147. Which colour of the light has the longest wavelength?
a) Blue b) Green c) Violet d) Red

148. In a double slit interference pattern, the first maxima for infrared light would be
a) at the same place as the first maxima for green light
b) closer to the centre than the first maxima for green light
c) farther from the centre than the first maxima for green light
d) infrared light does not produce an interference pattern

149. The hypermetropia is a_____
a) short-sight defect b) long-sight defect c) bad vision due to old age
d) None of the above

150. A ray of light travelling inside a rectangular glass block of refractive index Y2 is incident on the glass-air surface at an angle of incidence of 45°. The refractive index of air is 1. Under these conditions the ray
a) will emerge into the air without any deviation b) will be reflected back into the glass
c) will be absorbed d) will emerge into the air with an angle of refraction equal to 90°

151. A transparent cube of 15 cm edge contains a small air bubble. Its apparent depth when viewed through one face is 6 em and when viewed through the opposite face is 4 em. Then the refractive index of the material of the cube is
a) 2.0 b) 2.5 c) 1.6 d) 1.5

152. A boy of height 1 m stands in front of a convex mirror. His distance from the mirror is equal to its focal length. The height of his image is:
a) 0.25 m b) 0.33 m c) 0.5 m d) 0.67 m

153. A parallel beam of sodium light of wavelength 5890 $\AA$ is incident on a thin glass plate of refractive index 1.5 such that the angle of refraction in the plate is 60°. The smallest thickness of the plate which will make it dark by reflection
a) 3926 $\AA$ b) 4353 $\AA$ c) 1396 $\AA$ d) 1921 $\AA$

154. The angle of a prism is 'A'. One of its refracting surfaces is silvered. Light rays falling at an angle of incidence 2 A on the first surface returns back through the same path after suffering reflection at the silvered surface. The refractive index μ_2 of the prism is_____.
a) $2 \sin A$ b) $2 \cos A$ c) $\frac{1}{2} \cos A$ d) $\tan A$

155. A rod of length 10 cm lies along the axis of a concave mirror of focal length 10 cm in such a way that its end closer to the pole is 20 cm away from the mirror. The length of the image is _____________ .
a) 10 cm b) 15 cm c) 2.5 cm d) 5 cm

156. A calcite crystal is placed over a dot on a piece of paper and rotated, on seeing through the calcite one will see
a) One dot b) Two stationary dots c) Tworotating dots
d) One dot rotating about the other

157. Which of the following is correct for light diverging from a point source?
a) The intensity decreases in proportion for the distance squared.
b) The wavefront is parabolic.
c) The intensity at the wavelength does not depend on the distance. d) None of these.

158. The diameter of the pupil of human eye is about 2 mm. Human eye is most sensitive to the wavelength of 555 nm. The limit of resolution of human eye is
a) 1.2 min b) 2.4 min c) 0.6 min d) 0.3 min

159. The wavelength of spectral line coming from a distant star shifts from 600 nm to 600.1 nm. The velocity of the star relative to earth is
a) 50 kms^{-1} b) 100 kms^{-1} c) 25 kms^{-1} d) 200 kms^{-1}

160. A laser beam is used for locating distant objects because
a) it is monochromatic b) it is not chromatic c) it is not observed
d) it has small angular spread

161. For the angle of minimum deviation of a prism to be equal to its refracting angle, the prism must be made of a material whose refractive index __________ .
a) lies between $\sqrt{2}$ and 1 b) lies between 2 and $\sqrt{2}$ c) is less than 1
d) is greater than 2

162. An astronomical telescope of ten-fold angular magnification has a length of 44 cm. The focal length of the objective is ____
a) 440 cm b) 44 cm c) 40 cm d) 4 cm

163. A biconvex lens has a radius of curvature of magnitude 20 cm. Which one of the following options best describe the image formed of an object of height 2 cm placed 30 cm from the lens?
a) Virtual, upright, height =1 cm b) Virtual, upright, height =0.5 cm
c) Real, inverted, height =4 cm d) Real, inverted, height =1 cm

164. A luminous object is placed at a distance of 30 cm from the convex lens of focal length 20 cm. On the other side of the lens, at what distance from the lens, a convex mirror of radius of curvature 10 cm, be placed in order to have an upright image of the object coincident with it?
a) 12 cm b) 30 cm c) 50 cm d) 60 cm

165. In a double slit experiment, the two slits are 1 mm apart and the screen is placed 1 m away. A monochromatic light of wavelength 500 nm is used. What will be the width of each slit for obtaining ten maxima of double slit within the central maxima of single slit pattern?
a) 0.5 mm b) 0.02 mm c) 0.2 mm d) 0.1 mm

166. The idea of secondary wavelets for the propagation of a wave was first given by
a) Newton b) Huygens c) Maxwell d) Fresnel

167. In Young's double slit experiment distance between two sources is 0.1 mm. The distance of screen from the source is 20 cm. Wavelength of light used is 5460 $\mathring{A}$. Then, angular position of the first dark fringe is
a) 0.08° b) 0.16° c) 0.20° d) 0.31°

168. Ray optics is valid, when chracteristic dimensions are______
a) of the same order as the wavelength of light
b) much smaller than the wavelength of light c) of the order of one millimetre
d) much larger than the wavelength of light

169. Pick out the longest wavelength from the following types of radiations _________ .
a) blue light b) gamma rays c) X-rays d) red light

170. A concave mirror of focal length ${}^{2}f_1'$ is placed at a distance of ' d ' from a convex lens of focal length ' f_2 '. A beam of light coming from infinity and falling on this convex lensconcave mirror combination returns to infinity. $[2012]$ The distance ' d ' must equal_____

a) $f_1 + f_2$ b) $-f_1 + f_2$ c) $2f_1 + f_2$ d) $-2f_1 + f_2$

171. An achromatic combination of lenses is formed by joining______

a) 2 convex lenses b) 2 concave lenses c) 1 convex, 1 concave lens

d) 1 convex and 1 plane mirror

172. When interference of light takes place

a) energy is created in the region of maximum intensity

b) energy is destroyed in the region of maximum intensity

c) conservation of energy holds good and energy is redistributed

d) conservation of energy does not hold good

173. Which of the following phenomenon is not explained by Huygen's construction of wavefront?

a) Refraction b) Reflection c) Diffiraction d) Origin of spectra

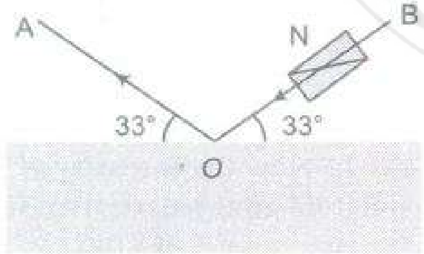
174. What can be the largest distance of an image of a real object from a convex mirror of radius of curvature is 20 cm?

a) 10 cm b) 20 cm c) Infinity d) zero

175. Focal length of a convex lens will be maximum for ___________.

a) blue light b) yellow light c) green light d) red light

176. A beam of light AD is incident on a glass slab (11 = 1.54) in a direction as shown in figure. The reflected ray DB is passed through a Nicol prism on viewing through a Nicol prism, we find on rotating the prism that



a) The intensity is reduced down to zero and remains zero

b) The intensity reduces down somewhat and rises again

c) There is no change in intensity

d) The intensity gradually reduces to zero and then again increases

177. When a light wave goes from air into water, the quality that remains unchanged is its :

a) Speed b) Amplitude c) Frequency d) Wavelength

178. The ratio of the refractive index of red light to blue light in air is :

a) Less than unity b) Equal to unity c) Greater than unity

d) Less as well as greater than unity depending upon the experimental arrangement

179. In Young's double slit experiment the ratio of intensity of the maxima and minima in the interference experiment is 25: 9. The ratio of widths of two slits is :
a) 18:3 b) 4:1 c) 8:1 d) 16:1

180. Focal length of a convex lens of refractive index 1.5 is 2 cm. Focal length of lens when immersed in a liquid of refractive index 1.25 will be__
a) 10 cm b) 2.5 cm c) 5 cm d) 7.5 cm

181. A polaroid is placed at 45° to an incoming light of intensity 10. Now the intensity of light passing through polaroid after polarization would be :
a) 1_0 b) $I_0/2$ c) I_04 d) Zero

182. To observe diffraction the size of an obstacle
a) Should be of the same order as wavelength
b) Should be much larger than the wavelength c) Have no relation to wave
d) Should be exactly λ/2

183. For a parallel beam of monochromatic light of wavelength '1', diffraction is produced by a single slit whose width ' a ' is of the wavelength of the light. If ' D' ' is the distance of the screen from the slit, the width of the central maxima will be____
a) $\frac{D\lambda}{a}$ b) $\frac{Da}{\lambda}$ c) $\frac{2Da}{\lambda}$ d) $\frac{2D\lambda}{a}$

184. The angle between pass axis of polarizer and analyser is 45°. The percentage of polarized light passing through analyser is
a) 75% b) 25% c) 50% d) 100%

185. Unpolarized light is incident on a plane glass surface. The angle of incidence so that reflected and refracted rays are perpendicular to each other, then
a) $\tan i_\beta = \frac{\mu}{2}$ b) $\tan i_\beta = \mu$ c) $\sin i_\beta = \mu$ d) $\cos i_\beta = \mu$

186. Time taken by sunlight to pass through a window of thickness 4 mm whose refractive index is 3/2, is_____
a) 2×10^{-4} s b) 2×10^{8} s c) 2×10^{-11} s d) 2×10^{6} s

187. The critical angle of a certain medium is $\sin^{-1}\left(\frac{3}{5}\right)$. The polarizing angle of the medium is
a) $\sin^{-1}\left(\frac{4}{5}\right)$ b) $\tan^{-1}\left(\frac{5}{3}\right)$ c) $\tan^{-1}\left(\frac{3}{4}\right)$ d) $\tan^{-1}\left(\frac{4}{3}\right)$

188. Unpolarised light is incident from air on a plane surface of a material of refractive index 'fl'. At a particular angle of incidence 'i', it is found that the reflected and refracted rays are perpendicular to each other. Which of the following options is correct for this situation?
a) $i=\sin^{-1}(1/\mu)$
b)
Reflected light is polarised with its electric vector perpendicular to the plane of incidence
c) Reflected light is polarised with its electric vector parallel to the plane of incidence
d) $i = \tan^{-1}(1/\mu)$

189. Light of wavelength 600 nm is incident on an aperture of size 2 mm. The distance upto which light can travel such that its spread is less than the size of the aperture is

a) 12.13 m b) 6.67 m c) 3.33 m d) 2.19 m

190. A screen is placed 50 cm from a single slit which is illuminated with light of wavelength 6000 $\mathring{A}$. If the distance between the first and third minima in the diffraction pattern is 3.0 mm. The width of the slit is

a) 1 x 10^{-4} m b) 2 x 10^{-4} m c) 0.5 x 10^{-4} m d) 4 x 10^{-4} m

191. A ray is incident at an angle of incidence i on one surface of a prism of small angle A and emerges normally from opposite surface. If the refractive index of the material of prism is μ , the angle of incidence i is nearly equal to

a) $\frac{A}{\mu}$ b) $\frac{A}{2\mu}$ c) μA d) $\frac{\mu A}{2}$

192. Polarised glass is used in sun glasses because

a) It reduces the light intensity to half on account of polarisation b) It is fashionable

c) It has good colou d) It is cheaper

193. If ε_o and μ_o are respectively, the electric permittivity and the magnetic permeability of free space, E and ~ the corresponding quantities in a medium, the refractive index of the medium is

a) $\sqrt{\mu e/\mu_0\varepsilon_0}$ b) $\mu\varepsilon/\mu_0\varepsilon_0$ c) $\sqrt{\mu_0\varepsilon_0/\mu\epsilon}$ d) $\sqrt{\mu\mu_0/\varepsilon\varepsilon_0}$

194. If the focal length of objective lens is increased then magnifying power of_____

a) misrocene will inereace but that of telescope decrease

b) microscope and telescope both will increase

c) microscope and telescope both will decrease

d) microscope will decrease but that of telescope increase

195. Which of the following is not due to total internal reflection?

a) Working of optical fibre b) Difference between apparent and real depth of pond

c) Mirage on hot summer days d) Brilliance of diamond

196. In Young's double slit experiment, light waves of wavelength 5.4 x 10^2 nm and 68.5 x 10^1 nm are used in turn, keeping the same geometry of the set up. The ratio of the fringe widths in two cases is :

a) 1.3 b) 4.3 c) 7.9 d) 9.5

197. The index of refraction of diamond is 2.0, velocity of light in diamond in em/second is approximate :

a) 6 x 10^{10} b) 3.0 x 10^{10} c) 2 x 10^{10} d) 1.5 x 10^{10}

198. An unpolarized light beam is incident on a surface at an angle of incidence equal to Brewster's angle. Then,

a) the reflected and the refracted beam are both partially polarized

b)

the reflected beam is partially polarized and the refracted beam is completely polarized and are at right angles to each other

c)
the reflected beam is completely polarized and the refracted beam is partially polarized and are at right angles to each other

d)
both the reflected and the refracted beams are completely polarized and are at right angles to each other.

199. If two mirrors are kept inclined at 60^o to each other and a body is placed at the middle, then total number of images formed, is ____________ .
a) six b) five c) four d) three

200. A thin prism having refracting angle 10° is made of glass of refractive index 1.42. This prism is combined with another thin prism of glass of refractive index 1.7. This combination produces dispersion without deviation. The refracting angle of second prism should be
a) 6° b) 8° c) 10° d) 4°

201. A person can see clearly objects only when they lie between 50 cm and 400 cm from his eyes. In order to increase the maximum distance of distinct vision to infinity, the type and power of the correcting lens, the person has to use, will be_____
a) convex, +2.25 diopter b) concave, -2.25 diopter c) concave, -0.25 diopter
d) convex, +0,15 diopter

202. The slits in Young's double slit experiment are illuminated by light of wavelength 6000 $\mathring{A}$. If the path difference at the central bright fringe is zero, what is the path difference for light from the slits at the fourth bright fringe?
a) 2.4×10^{-6} m b) 1.2×10^{-6} m c) 10^{-6} m d) 0.5×10^{-6} m

203. The spectral line for a given element of light received from a distant star is shifted towards longer wavelength side by 0.025%. The velocity of star in the line of light is:
a) 7.5×10^4 m S^{-1} b) -7.5×10^4 m S^{-1} c) 3.7×10^4 m S^{-1} d) -3.7×10^4 m S^{-1}

204. Through which character we can distinguish the light waves from sound waves
a) Interference b) Refraction c) Polarisation d) Reflection

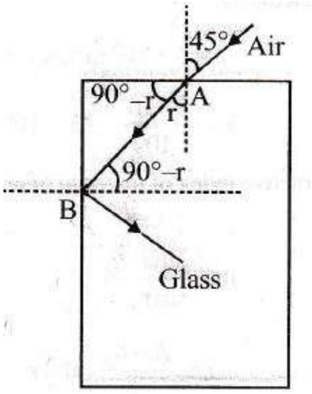
205. A monochromatic beam of light passes from a denser medium into a rarer medium. As a result
a) Its velocity increases b) Its velocity decreases c) Its frequency decreases
d) Its wavelength decreases

206. The Brewsters angle i_b for an interface should be_____
a) $i_b = 90^\circ$ b) $0^o < i_b < 30^o$ c) $30^o < t_b < 45^o$ d) $45^o < t_b < 90^o$

207. Two towers on the top of two hills are 40 km apart. The line joining them passes 50 m above a hill halfway between the towers. The longest wavelength of radio waves which can be sent between the two towers without appreciable diffraction effects is
a) 1.25 m b) 0.125 m c) 2.50 m d) 0.250 m

208. In Young's double slit experiment, one of the slits is wider than the other, so that the amplitude of the light from one slit is double that from the other slit. If I_m be the maximum intensity, the resultant intensity when they interfere at phase difference ϕ is given by:
a) $\frac{I_m}{3}\left(1+2\cos^2\frac{\phi}{2}\right)$ b) $\frac{I_m}{5}\left(1+4\cos^2\frac{\phi}{2}\right)$ c) $\frac{I_m}{9}\left(1+8\cos^2\frac{\phi}{2}\right)$ d) $\frac{I_m}{9}\left(8+\cos^2\frac{\phi}{2}\right)$

209. A light ray falls on a rectangular glass slab as shown. The index of refraction of the glass, if total intemal reflection is to occur at the vertical face, is__



a) $\sqrt{3/2}$ b) $\frac{(\sqrt{3}+1)}{2}$ c) $\frac{(\sqrt{2}+1)}{2}$ d) $\sqrt{5}/2$

210. In Young's double slit experiment the distance d between the slits S_1 and S_2 is 1mm. What should the width of each slit be so as to obtain 10^{th} maxima of the double slit pattern within the central maximum of the single slit pattern?
a) 0.9mm b) 0.8mm c) 0.2mm d) 0.6mm

211. A plano convex lens fits exactly into a plano concave lenai Their plane ourfueeo are parallel to eaeh other: If lenses are made of different materials of refractive indices μ_1 and μ_2 and R is the radulus of curvature of the curved surface of the lenses, then the focal length of the combination is______
a) $\frac{R}{2(\mu_1-\mu_2)}$ b) $\frac{R}{(\mu_1-\mu_2)}$ c) $\frac{2R}{(\mu_2\mu_1)}$ d) $\frac{R}{2(\mu_2{'}\mu_1)}$

212. A lens is placed between a source of light and a wall. It forms images of area A_1 and A_2 on the wall, for its two different positions, the area of the source of light is_____
a) $\sqrt{A_1A_2}$ b) $\frac{A_1+A_2}{2}$ c) $\frac{A_1-A_2}{2}$ d) $\frac{1}{A_1}+\frac{1}{A_2}$

213. The velocity of light in air is 3 x 10^8 m s^{-1} and that in water is 2.2 x 10^8 m S^{-1}. The polarising angle of incidence is :
a) 45° b) 50° c) 53.74° d) 63°

214. In a Young's double slit experiment an electron beam is used to obtain interference pattern. If the speed of electron decreases then
a) distance between two consecutive fringes remains the same
b) distance between two consecutive fringes decreases
c) distance between two consecutive fringes increases d) none of these

215. A converging beam of rays is incident on a diverging lens. Having passed through the lens the rays intersect at a point 15 cm from the lens on the opposite side. If the lens is removed the point where the rays meet will move 5 cm closer to the lens. The focal length of the lens is ____________ .

a) -10 cm b) 20 cm c) -30 cm d) 5 cm

216. A point source of light is placed 4m below the surface of water of refractive index 5/3. The minimum diameter of a disc, which should be placed over the source, on the surface of water to cut off all light coming out of water is_____

a) infinite b) 6 m c) 4 m d) 3 m

217. A convex lens and a concave lens, each having same focal length of 25 cm, are put in contact to form a combination of lenses. The power in diopters of the combination is_____

a) infinite b) 0 c) 25 d) 50

218. Speed of light is maximum in

a) Water b) Air c) Glass d) Diamond

219. By Huygen's wave theory of light, we cannot explain the phenomenon of

a) Interference b) Diffraction c) Photoelectric effec d) Polarisatio

220. A thin prism of angle 15° made of glass of refractive index μ_1 = 1.5 is combined with another prism of glass of refractive index IL2 = 1.75. the combination of the prism produces dispersion without deviation. The angle of the second prism should be:

a) 7° b) 10° c) 12° d) 5°

221. Two slits are separated by a distance of 0.5 mm and illuminated with light of I.=6000A. If the screen is placed 2.5 m from the slits. The distance of the third bright image from the centre will be :

a) 1.5 mm b) 3 mm c) 6 mm d) 9 mm

 RAVI MATHS TUITION CENTER

Ravi Maths Tuition Centre

Time : 1 Mins | **DUAL NATURE OF MATTER AND REACTION 1** | **Marks : 723**

1. When the photons of energy hυ fall on a photosensitive metallic surface of work function huo, electrons are emitted from the surface. The most energetic electron coming out of the surface have kinetic energy equal to
   a) hυ b) hυ_0 c) hυ+hυ_0 d) hυ-hυ_0
2. The photoelectric work function for a metal surface is 4.125 eV. The cut-off wavelength for this surface is ____________
   a) 4125 b) 3000 c) 6000 d) 2062
3. A light of wavelength 600 nm is incident on a metal surface. When light of wavelength 400 nm is incident, the maximum kinetic energy of the emitted photoelectrons is doubled. The work function of the metal is :
   a) 1.03 eV b) 2.11 eV c) 4.14 eV d) 2.43 eV
4. The photoelectric cut off voltage in a certain experiment is l.5 V. The maximum kinetic energy of photoelectrons emitted is
   a) 2.4 eV b) 1.5 eV c) 3.1 eV d) 4.5 eV
5. In photoelectric effect, the photoelectric current is independent of
   a) intensity of incident light b) potential difference applied between the two electrodes
   c) the nature of emitter material d) frequency of incident light
6. work function of cesium is 2.14 eV. The threshold frequency of caesium is :
   a) 5.16 x 10^{19} Hz b) 5.16 x 10^{16} Hz c) 5.16 x 10^{18} Hz d) 5.16 x 10^{14} Hz
7. Assertion: Aphotocell is a technological application of the photoelectric effect.
   Reason : Photocell is a device whose electric properties are affected by electricity.
   a)
   If both assertion and reason are true and reason is the correct explanation of assertion
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion.
   c) If assertion is true but reason is false. d) If both assertion and reason are false.
8. An electron of mass m when accelerated through a potential difference V has de-Broglie wavelength λ The de Broglie wavelength associated with a proton of mass M accelerated through the same potential difference will be :
   a) λm/M b) $\lambda\sqrt{m/M}$ c) λM/m d) $\lambda\sqrt{M/m}$

9. The photoelectric threshold wavelength for potassium (work function being 2 eV) is :
   a) 310 nm b) 620 nm c) 1200 nm d) 2100 nm
10. For photoelectric emission from certain metal the cutoff frequency is v. If radiation of frequency 2v impinges on the metal plate, the maximum possible velocity of the emitted electron will be (m is electron mass) :
   a) $\sqrt{hv/(2m)}$ b) $\sqrt{hv/(m)}$ c) $\sqrt{2hv/(m)}$ d) $2\sqrt{hv/(m)}$
11. The momentum of the photon of wavelength 5000 will be :
   a) 1.3×10^{-27}kg-m/sec b) 1.3×10^{-28}kg-m/sec c) 4×10^{29}kg-m/sec
   d) 4×10^{-18}kg-m/sec
12. In photoelectric effect, the work function of a metal is 3. 5 eV. The emitted electrons can be stopped by applying a potential of -7.2V. Then, _________
   a) the energy of the incident photons is 4.7 eV
   b) the energy of the incident photons is 2.3 eV
   c) if higher frequency photons be used, the photoelechic current will rise
   d) when the energy of photons is 3 .5 eV, the photoelectric current will be maximum
13. In Davisson and Germer experiment, the tungsten filament is coated with
   a) aluminium oxide b) barium chloride c) titanium oxide d) barium oxide
14. When the energy of the incident radiation is increased by 20% the kinetic energy of the photoelectrons emitted from a metal surface increased from 0.5 eV to 0.8 eV. The work function of the metal is :
   a) 1.3 eV b) 1.5 eV c) 0.65 eV d) 1.0 eV

15. Assertion: Though light of a single frequency (monochromatic) is incident on a metal, the energies of emitted photoelectrons are different.
   Reason : The energy of electrons emitted from inside the metal surface is lost in collision with the other atoms in the metal
   a)
   If both assertion and reason are true and reason is the correct explanation of assertion
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion.
   c) If assertion is true but reason is false. d) If both assertion and reason are false.
16. The de Broglie wavelength of an electron with kinetic energy 120 eV is (Given h = 6.63 x 10^{-31} J s, me = 9 x 10^{-31} kg, 1 eV = I.6 x 10^{-19} J)
   a) 2.13$\mathring{A}$ b) 1.13$\mathring{A}$ c) 4.15$\mathring{A}$ d) 3.14$\mathring{A}$
17. Ihe de Broglie wavelength associated with a ball of mass 150 g travelling at 30 m s^{-1} is :
   a) 1.47×10^{-34}m b) 1.47×10^{-16}m c) 1.47×10^{-19}m d) 1.47×10^{-31}m
18. Which of the following devices is sometimes called an electric eye?
   a) LED b) Photocell c) Integrated chip (IC) d) Solar cell

19. Electrons with de Broglie wavelength λ fall on the target in an X ray tube. The cut off wavelength (λ_O) of the emitted X rays is

a) $\lambda_O = \frac{2mc\lambda^2}{h}$ b) $\lambda_O = \frac{2h}{mc}$ c) $\lambda_O = \frac{2m^2c^2\lambda^2}{h}$ d) $\lambda_O = \lambda$

20. Which one among the following shows particle nature of light?

a) Photoelectric effect b) Interference c) Refraction d) Polarization

21. Which phenomenon best supports the theory that matter has a wave nature?

a) Electron momentum b) Electron diffraction c) Photon momentum

d) Photon diffraction

22. The work function of a metal is 4.2 eV, its threshold wavelength will be :

a) 4000 Å b) 3500 Å c) 2955 Å d) 2500 Å

23. The number of photoelectrons emitted for light of a frequency v (higher than the threshold frequency v_0) is proportional to :

a) Frequency of light (v) b) $v-v_0$ c) Threshold frequency (v_0) d) Intensity of light

24. A certain metallic surface is illuminated with monochromatic light of wavelength, λ. The stopping potential for photoelectric current for this light is $3V_0$. If the same surface is illuminated with light of wavelength 2λ, the stopping potential is V_0. The threshold wavelength for this surface for photoelectric effect is :

a) λ/4 b) λ/6 c) 6λ d) 4λ

25. Consider figure. Suppose the voltage applied to A is increased. The diffracted beam will have the maximum at a value of θ that

a) will be larger than the earlier value b) will be the same as the earlier value

c) will be less than the earlier value d) will depend on the target

26. A photon of energy E ejects a photoelectron from a metal surface whose work function is Φ_0. If this electron enters into a uniform magnetic field B in a direction perpendicular to the field and describes a circular path of radius r, then the radius r is (in the usual notation)

a) $\sqrt{\frac{2m(E-\phi_0)}{eB}}$ b) $\sqrt{2m(E-\phi_0)eB}$ c) $\sqrt{\frac{2m(E-\phi_0)}{mB}}$ d) $\sqrt{\frac{2m(E-\phi_0)}{eB}}$

27. An X-ray tube produces a continuous spectrum of radiation with its short wavelength end at 0.45 Å. The maximum energy of a photon in the radiation is :

a) 30.4 keV b) 27.6 keV c) 15.2 keV d) 12.8 keV

28. Who established that electric charge is quantised?

a) J,J.Thomson b) William Crookes c) R.A Millikan d) Wilhelm Rontgen

29. The momentum of a photon of energy 1 MeV in kg m/s, will be ______________ .

a) 7×10^{-24} b) 10^{-22} c) 5×10^{-22} d) 0.33×10^{6}

30. Gases begin to conduct electricity at low pressure, because ____________ .

a) at low pressure gases turn to plasma

b)

colliding electrons can acquire higher kinetic energy due to increased mean free path leading to ionisation of atoms

c) atoms break up into electrons and protons

d) the electrons in atoms can move freely at low pressures

31. Three bodies, a ring, a solid cylinder and a solid sphere roll down the same inclined plane without slipping. They start from rest. The radii of the bodies are identical. Which of the bodies reaches the ground with maximum velocity?

a) Ring b) Solid cylinder c) Solid sphere d) All reach the ground with same velocity

32. Which of the following is true?

a) The stopping potential increases with increasing intensity of incident light

b) The photocurrent increases with increasing intensity of light

c) The current in photocell increases with increasing frequency of light

d) The photocurrent is proportional to applied voltage

33. The potential energy of particle of mass m varies as

$$U(x) = \begin{cases} E_0 & for \quad \le x \le 1 \\ 0 & for \quad x > 1 \end{cases}$$

The de Broglie wavelength of the particle in the range $0 \le x \le 1$ is λ_1 and that in the range x > 1 is λ_2 , If the total energy of the particle is $2E_0$, find λ_1 / λ_2

a) $\sqrt{2}$ b) $\sqrt{3}$ c) $\sqrt{\frac{1}{2}}$ d) $\sqrt{\frac{2}{3}}$

34. A particle A with a mass m_A is moving with a velocity v and hits a particle B of mass m_B at rest. If motion is one dimensional and take the collision is elastic, then the change in the de Broglie wavelength of the particle A is

a) $\frac{h}{2m_A v}\left[\frac{(m_A+m_B)}{(m_A-m_B)}-1\right]$ b) $\frac{h}{m_A v}\left[\frac{(m_A-m_B)}{(m_A+m_B)}-1\right]$

c) $\frac{h}{m_A v}\left[\frac{(m_A+m_B)}{(m_A-m_B)}-1\right]$ d) $\frac{2h}{m_A v}\left[\frac{(m_A+m_B)}{(m_A-m_B)}+1\right]$

35. The minimum energy required for the electron emission from the metal surface can be supplied to the free electrons by which of the following physical processes?

a) Thermionic emission b) Field emission c) Photoelectric emission d) All of these

36. The specific charge of a proton is 9.6×10^7 C kg^{-1}. The specific charge of an alpha particle will be

a) 9.6×10^7 C kg^{-1} b) 19.2×10^7 C kg^{-1} c) 4.8×10^7 C kg^{-1} d) 2.4×10^7 C kg^{-1}

37. Two particles A_l and A_2 of masses m_l, m_2 ($m_1 > m_2$) have the same de Broglie wavelength. Then

a) their momenta are the same b) their energies are the same

c) momentum of A_l is less than the momentumof A_2.

d) energy of A_l is more than the energy of A_2.

38. An ionization chamber with parallel conducting plates as anode and cathode has 5×10^7 electrons and the same number of single charge positive ions per cm^3. The electrons are moving towards the anode with velocity 0.4 m/s. The current density from anode to cathode is 4 mA/ m^2. The velocity of positive ions moving towards cathode is

____

a) 0.4m/s b) 1.6m/s c) 0 d) 0.1m/s

39. A silver sphere of radius 1 cm and work function 4.7 eV is suspended from an insulating thread in free-space. It is under continuous illumination of 200 nm wavelength light. As photoelectrons are emitted, the sphere gets charged and acquires a potential. The maximum number of photoelectrons emitted from the sphere is A x 10^z (where 1 < A < 10). The value of Z is

a) 6 b) 7 c) 8 d) 9

40. Assertion: The wave nature of electrons was first experimentally verified by Davisson and Germer Experiment.

Reason: From the electron diffraction measurements, the wavelength of matter waves was found to be 0.165 nm

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

41. Two identical photocathodes receive light of frequencies υ_1 and υ_2. If the velocities of the photoelectrons (of mass m) coming out are respectively v_1 and v_2 then

a) $v_1^2 - v_2^2 = \frac{2h}{m}(\upsilon_1 - \upsilon_2)$ b) $\nu_1 + \nu_2 = \left[\frac{2h}{m}(\upsilon_1 + \upsilon_2)\right]^{1/2}$ c) $v_1^2 + v_2^2 = \frac{2h}{m}(\upsilon_1 + \upsilon_2)$

d) $\nu_1 - \nu_2 = \left[\frac{2h}{m}(\upsilon_1 - \upsilon_2)\right]^{1/2}$

42. Assertion: Photocell is also called electric eye.

Reason: Photocell can see the things placed in front of it.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

43. In the question number 33, find the wavelength of the incident light if the stopping potential is 0.6 V

a) 326 nm b) 454 nm c) 524 nm d) 232 nm

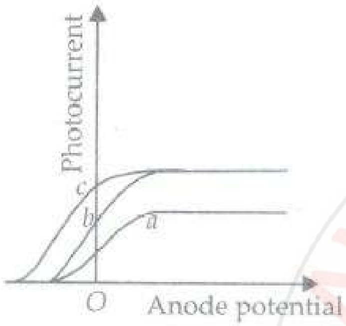
44. Light of frequency 7.21 x 10^{14} Hz is incident on a metal surface. Electrons with a maximum speed of 6 x 10^5 m s^{-1} are ejected from the surface. The threshold frequency for photoemission of electrons is (Given h = 6.63 x 10^{-34}) Js, me = 9.1 x 10-^{31} kg)

a) 2.32×10^{14} Hz b) 2.32×10^{12} Hz c) 4.74×10^{14} Hz d) 4.74×10^{12} Hz

45. Assuming an electron is confined to a 1 nm wide region. Find the uncertainty in momentum using Heisenberg uncertainty principle.
(Take $h = 6.63 \times 10^{-34}$ J s)
a) 1.05×10^{-25} kg m s^{-1} b) 2.03×10^{-31} kg m s^{-1} c) 3.05×10^{-34} kg m s^{-1}
d) 2.49×10^{-32} kg m s^{-1}

46. When ultraviolet radiation is incident on a surface, no photoelectrons are emitted. If a second beam causes photoelectrons to be ejected, it may consists of ___________
a) infra-red waves b) X-rays c) visible light rays d) radio waves

47. The figure shows the variation of photo current with anode potential for a photo-sensitive surface for threedifferent radiations. Let I_a, I_b and I_c be the intensities and υ_a , υ_b and υ_c be the frequencies for the curves a, band e respectively. Then



a) $\upsilon_a = \upsilon_b$ and $I_a \neq I_b$ b) $\upsilon_a = \upsilon_c$ and $I_a = I_c$ c) $\upsilon_a = \upsilon_b$ and $I_a = I_b$
d) $\upsilon_b = \upsilon_c$ and $I_b = I_c$

48. If m is the mass of an electron and c is the speed of light, the ratio of the wavelength of a photon of energy E to that of the electron of the same energy is
a) $c\sqrt{\frac{2m}{E}}$ b) $\sqrt{\frac{2m}{E}}$ c) $\sqrt{\frac{2m}{cE}}$ d) $\sqrt{\frac{m}{E}}$

49. If K_1 and K_2 are maximum kinetic energies of photoelectrons emitted when lights of wavelength λ_1 and λ_2 respectively incident on a metallic surface if λ_1 and $3\lambda_2$, then
a) $K_1>(K_2/3)$ b) $K_1<(K_2/3)$ c) $K_1=3K_2$ d) $K_2=3K_1$

50. The phenomenon of photoelectric emission was discovered in 1887 by
a) Wilhelm Hallwachs b) Philipp Lenard c) Albert Einstein d) Heinrich Hertz

51. Who won the Nobel prize in physics in the year 1929 for the discovery of the wave nature of electrons?
a) Erwin Schrodinger b) R.A Millikan c) Louis Victor de Broglie d) Albert Einstein

52. The threshold frequency of a certain metal is 3.3×10^{14} Hz. If light offrequency 8.2×10^{24} Hz is incident on the metal, then the cut off voltage for photoelectric emission is (Given $h = 6.63 \times 10^{-34}$ J s)
a) 2 V b) 4 V c) 6 V d) 8 V

53. The maximum frequency and minimum wavelength of X-rays produced by 30 kV electrons respectively is :

a) 7.24×10^{18} Hz, 0.041 nm b) 3.21×10^{18} Hz, 0.211 nm
c) 5.32×10^{18} Hz, 0.001 nm d) 2.13×10^{18} Hz, 0.011 nm

54. Number of ejected photoelectron increases with increase ___________
a) in intensity of light b) in wavelength of light c) in frequency of light d) Never

55. Two particles A and B of de Broglie wavelengths λ_A and λ_B combine to form a particle C. The process conserves momentum. Find the de Broglie wavelength of the particle C. (The motion is one dimensional).
a) λ_A b) $\lambda_A \lambda_B /(\lambda_A + \lambda_B)$ c) $\lambda_A \lambda_B /|\lambda_A - \lambda_B|$ d) both (b) and (c)

56. Relativistic corrections become necessary when the expression for the kinetic energy $\frac{1}{2}$ mv^2, becomes comparable with mc^2, where m is the mass of the particle. At what de Broglie wavelength will relativistic correction' become important for an electron?
a) λ =1nm b) λ =10nm c) λ =10^{-1}nm d) λ =10^{-4}nm

57. A particle is moving three times as fast as an electron. The ratio of the de Broglie wavelength of the particle to that of the electron is 1.813×10^{-4}. The mass of the particle is ($m_e = 9.1 \times 10^{-31}$ kg)
a) 1.67×10^{-14} kg b) 1.67×10^{-27} kg c) 1.67×10^{-31} kg d) 1.67×10^{-19} kg

58. When the velocity of an electron increases, its de Broglie wavelength
a) increases b) decreases c) remains same d) may increase or decrease

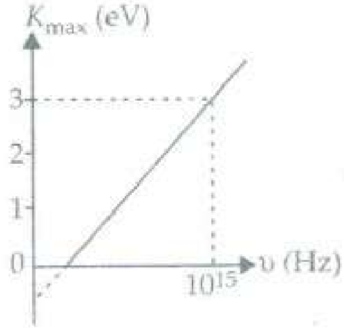
59. The time taken by a photoelectron to come out after the photon strikes is approximately
a) 10^{-1}s b) 10^{-4}s c) 10^{-10}s d) 10^{-16}s

60. Assertion: Photosensitivity of a metal is high if its work function is small.
Reason : Work function = $h\upsilon_0$ where υ_0 is the threshold frequency
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

61. Doubly ionised helium atoms and hydrogen ions are accelerated from rest through the same potential drop. The ratio of the final velocities of the helium and the hydrogen ion is ___________
a) $\frac{1}{2}$ b) 2 c) $\frac{1}{\sqrt{2}}$ d) $\sqrt{2}$

62. When the light of frequency $2v_0$ (where v_0 is threshold frequency), is incident on a metal plate, the maximum velocity of electrons emitted is v_1. When the frequency of the incident radiation is increased to $5v_0$, the maximum velocity of electrons emitted from the same plate is v_2. The ratio of v_1 to v_2 is :
a) 1 : 2 b) 1 : 4 c) 4 : 1 d) 2 : 1

63. Figure represents a graph of kinetic energy of most energetic photoelectrons K_{max} (in eV) and frequency υ for a metal used as cathode in photoelectric experiment.The threshold frequency of light for the photoelectric emission from the metal is



a) 1×10^{14} Hz b) 1.5×10^{14} Hz c) 2×10^{14} Hz d) 2.7×10^{14} Hz

64. Light of wavelength 0.6 mm from a sodium lamp falls on a photocell and causes the emission of photoelectrons for which the stopping potential is 0.5 V With light of wavelength 0.4 mm from a sodium lamp, the stopping potential is l.5 V With this data, the value of h /e is
a) 4×10^{-59} V s b) 0.25×10^{15} V s c) $4 X 10^{-15}$ V s d) 4×10^{-8} V s

65. When a beam of 10.6 eV photons of intensity 2.0 W/m^2 falls on a platinum surface of area 1.0×10^{-4} m^2 and work function 5.6 eV, 0.53% of the incident photons eject photoelectrons. Find the number of photoelectrons emitted per second :
a) 6.25×10^{8} b) 1.25×10^{9} c) 1.25×10^{6} d) 6.25×10^{11}

66. Assertion: The threshold frequency of photoelectric effect supports the particle nature of light.
Reason : If frequency of incident light is less than the threshold frequency, electrons are not emitted from metal surface.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

67. In a photon-particle collision (such as photonelectron collision), which of the following may not be conserved?
a) Total energy b) Number of photons c) Total momentum d) Both (a) and (b)

68. The wavelength associated with an electron, accelerated through a potential difference of 100V is ofthe order of __________ .
a) 1000 b) 100 c) 10.5 d) 1.2

69. Consider a beam of electrons (each electron with energy E_0) incident on a metal surface kept in an evacuated chamber. Then
a) no electrons will be emitted as only photons can emit electrons.
b) electrons can be emitted but all with an energy E_0

c)
electrons can be emitted with any energy, with a maximum of $E_0 - \phi$ (ϕ is the work function).
d) electrons can be emitted with any energy, with a maximum of E_0

70. If the de Broglie wavelengths for a proton and for a α particle are equal, then the ratio of their velocities will be :
a) 4 : 1 b) 2 : 1 c) 1 : 2 d) 1 : 4

71. If alpha particle, proton and electron move with the same momentum, then their respective de Broglie wavelengths λ_α , λ_p , λ_e are related as
a) $\lambda_\alpha = \lambda_p = \lambda_e$ b) $\lambda_\alpha < \lambda_p < \lambda_e$ c) $\lambda_\alpha > \lambda_p > \lambda_e$ d) $\lambda_p > \lambda_e > \lambda_\alpha$

72. A source S_1 is producing 10^{15} photons per second of wavelength 5000 Å. Another source S_2 is producing 1.02×10^{15} photons per second of wavelength 5100 Å. Then, (power of S_2)1 (power of S_1) is equal to :
a) 1.00 b) 1.02 c) 1.04 d) 0.98

73. The de Broglie wavelength of an electron in a metal at 27°e is
(Given $m_e = 9.1 \times 10^{-31}$ kg, $k_B = 1.38 \times 10^{-23}$ J K^{-1})
a) 6.2×10^{-9} m b) 6.2×10^{-10} m c) 6.2×10^{-8} m d) 6.2×10^{-7} m

74. A photo-cell ernploys photoelectric effect to convert ____________
a) change in the intensity of illumination into in photoelectric current
b)
change in the intensity of illumination into a change in the work function of the photocathode
c) change in the frequency oflight into a change in the electric current
d) change in the frequency of light into a change in electric voltage

75. Light of two different frequencies whose photons have energies 1 eV and 2.5 eV respectively illuminate a metallic surface whose work function is 0.5 eV successively. Ratio of maximum speeds emitted electrons will be :
a) 1 : 4 b) 1 : 2 c) 1 : 1 d) 1 : 5

76. When light of wavelength 300 nm (nanometer) falls on a photoelectric emitter, photoelectrons are liberated. For another emitter, however, light of 600 nm wavelength is sufficient for creating photoemission, what is the ratio of the work functions of the two emitters?
a) 1:2 b) 2:1 c) 1:4 d) 4:1

77. If a proton and an electron have the same de Broglie wavelength, then
a) kinetic energy of electron < kinetic energy of proton
b) kinetic energy of electron = kinetic energy of proton
c) momentum of electron = momentum of proton
d) momentum of electron < momentum of proton

78. Consider the four gases hydrogen, oxygen, nitrogen and helium at the same temperature. Arrange them in the increasing order of the de Broglie wavelengths of their molecules.

a) Hydrogen, helium, nitrogen, oxygen b) Oxygen, nitrogen, hydrogen, helium
c) Oxygen, nitrogen, helium, hydrogen d) Nitrogen, oxygen, helium, hydrogen

79. The maximum value of photoelectric current is called
a) base current b) saturation current c) collector current d) emitter current

80. A monochromatic light of frequency 3×10^{14}Hz is produced by a LASER, emits the power of 3×10^{-3}W Find how many number of photons are emitted per second.
a) 1.5×10^{16} b) 2.5×10^{16} c) 4.5×10^{16} d) 8.5×10^{16}

81. The wavelength of light in the visible region is about 390 nm for violet colour and about 760 nm for red colour. The energy of photon in eV at violet end is
a) 2.32 b) 3.19 c) 1.42 d) 4.13

82. In an electron gun the control grid is given a negative potential relative to cathode in order to
a) Decelerate electrons
b) Repel electrons and thus to control the number of electrons passing through it
c) To select electrons of same velocity and to converge them along the axis
d) To decrease the kinetic energy of electrons

83. In the phenomenon of electric discharge through gases at low pressure, the coloured glow in the tube appears as a result of ___________ .
a) excitation of electrons in the atoms b) collision between the atoms of the gas
c) collisions between the charged particles emitted from the cathode and the atoms of the gas.
d) collision between different electrons of the atoms of the gas.

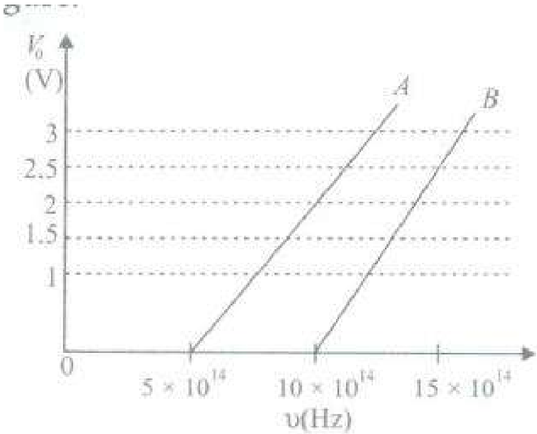
84. Which of the following statements is correct regarding the photoelectric experiment?
a) The photo current increases with intensity of light
b) Stopping potential increases with increase in intensity of incident light.
c) The photocurrent increases with increase in frequency. d) All of the these

85. The 21 cm radiowave emitted by hydrogen in interstelar space is due to the interaction called the hyperfine interaction in atomic hydrogen. The energy of the emitted wave is nearly _________
a) 10^{-17} J b) 1J c) 7×10^{-6} J d) 10^{-24} J

86. The energy flux of sunlight reaching the surface of the earth is 1.388×10^{3}W m^{2}. The photons in the sunlight have an average wavelength of 550 nm. How many photons per square metre are incident on the earth per second?
a) 4×10^{21} b) 4×10^{34} c) 4×10^{31} d) 4×10^{28}

87. Cathode rays were discovered by
a) Maxwell Clerk James b) Heinrich Hertz c) William Crookes d) J.Thomson

88. A student performs an experiment on photoelectric effect using two materials A and B. A plot of stopping potential (V_0) vs frequency (D) is as shown in the figure.



The value of h obtained from the experiment for both A and B respectively is (Given electric charge of an electron = 1.6×10^{-19} C)

a) 3.2×10^{-34} J s, 4×10^{-34} J s b) 6.4×10^{-34} J s, 8×10^{-34} J s

c) 1.2×10^{-34} J s, 3.2×10^{-34} J s d) 4.2×10^{-34} J s, 5×10^{-34} J s

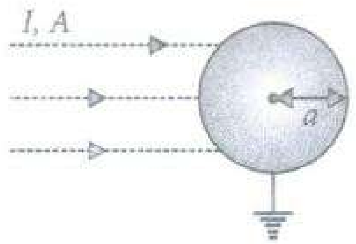
89. The de Broglie wavelength λ of an electron accelerated through a potential V in volts is

a) $\dfrac{1.227}{\sqrt{V}}$ nm b) $\dfrac{0.1227}{\sqrt{V}}$ nm c) $\dfrac{0.01227}{\sqrt{V}}$ nm d) $\dfrac{12.27}{\sqrt{V}}$ nm

90. A proton is fired from very far away towards a nucleus with charge Q = 120e, where e is the electronic charge. It makes a closest approach of 10 fm to the nucleus. The de Broglie wavelength (in units of fm) of the proton at its start is (Take the proton mass, m_p = $\left(\frac{5}{3}\right) \times 10^{-27}$ kg,

a) 7 b) 9 c) 11 d) 13

91. A parallel beam of monochromatic radiation of cross-section area A($<\pi$ a2), intensity I and frequency v is incident on a solid conducting sphere of work function ϕ_0 $(h\upsilon > \phi_0)$ and radius a.The sphere is grounded by a conducting wire. Assume that for each incident photon, one photoelectron is ejected. Just after this radiation is incident on initially unchanged sphere the current through the conducting wire is



a) $\dfrac{IAe}{h\upsilon}$ b) $\dfrac{IA}{2h\upsilon}$ c) $\dfrac{2IA}{h\upsilon}$ d) $\dfrac{2IA}{3h\upsilon}$

92. The momentum of a photon is 3.3×10^{-29} kg-m/sec. Its frequency will be :

a) 3×10^{3}Hz b) 6×10^{3}Hz c) 7.5×10^{12}Hz d) 1.5×10^{13}Hz

93. Monochromatic light of frequency 6.0×10^{14} Hz is produced by a traser. The power emitted is 2×10^{14} w. The number of photons emitted, on the average by the sources per second is ____________.

a) 5×10^{16} b) 5×10^{17} c) 5×10^{14} d) 5×10^{15}

94. The photoelectric threshold wavelength for silver is λ_0. The energy of the electron ejected from the surface of silver by an incident wavelength $\lambda(\lambda<\lambda_0)$ will be

a) $hc(\lambda_0-\lambda)$ b) $\frac{hc}{\lambda_0-\lambda}$ c) $\frac{h}{c}\left(\frac{\lambda_0-\lambda}{\lambda\lambda_0}\right)$ d) $hc\left(\frac{\lambda_0-\lambda}{\lambda\lambda_0}\right)$

95. For a certain metal, incident frequency υ is five times of threshold frequency υ_0 and the maximum velocity of coming out photoelectrons is 8×10^6 m s^{-1} If $\upsilon = 2\upsilon_0$, the maximum velocity of photoelectrons will be:

a) 4×10^6 m s^{-1} b) 6×10^6 m s^{-1} c) 8×10^6 m s^{-1} d) 1×10^6 m s^{-1}

96. The photoelectric threshold frequency of a metal is υ. When light of frequency 4υ is incident on the metal, the maximum kinetic energy of the emitted photoelectron is

a) $4h\upsilon$ b) $3h\upsilon$ c) $5h\upsilon$ d) $\frac{5h\upsilon}{2}$

97. Kinetic energy of an electron which is accelerated in a potential difference of 100 V is ____________

a) 1.6×10^{-17} J b) 1.6×10^{-19} J c) 1.6×10^{-21} J d) 1.6×10^{-25} J

98. A photoelectric cell is illuminated by a point source of light 1m away. When the source is shifted to 2 m then

a) each emitted electron carries one quarter of the initial energy

b) number of electrons emitted is half the initial number

c) each emitted electron carries half the initial energy

d) number of electrons emitted is a quarter of the initial number

99. Two radiations of photons energies 1 eV and 2.5 eV, successively illuminate a photosensitive metallic surface of work function 0.5 eV. The ratio of the maximum speeds of the emitted electrons is :

a) 1 : 2 b) 1 : 1 c) 1 : 5 d) 1 : 4

100. Assertion: If the frequency of the incident light on a metal surface is doubled, the kinetic energy of emitted electrons is more than doubled.

Reason : The metal will provide additional energy to the emitted photoelectron for light of higher frequency than that for lower frequency.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

101. Photons with energy 5 eV are incident on a cathode C in a photoelectric cell. The maximum energy of emitted photoelectrons is 2 eV. When photons of energy 6 eV are incident on C, no photoelectrons will reach the anode A, if the stopping potential of A relative to C is :

a) + 3 V   b) + 4 V   c) - 1 V   d) - 3 V

102. A piece of iron is heated in a flame. It first becomes dull red then becomes reddish yellow and finally turns to white hot. The correct explanation for the above observation is possible by using :

a) Stefan's law   b) Wien's displacement law   c) Kirchhoff's law

d) Newton's law of cooling

103. In a discharge tube ionization of enclosed gas is produced due to collisions between ___________

a) negative electrons and neutral atoms/molecules

b) photons and neutral atorns /molecules   c) neutral gas atoms/molecules

d) positive ions and neutral atoms/molecules

104. An electron of mass m and charge e is acclerated from rest through a potential difference of V volt in vacuum. Its final speed will be ___________

a) $\frac{eV}{2m}$ b) $\frac{eV}{m}$ c) $\sqrt{\frac{2eV}{m}}$ d) $\sqrt{\frac{eV}{2m}}$

105. A photosensitive metallic surtace has work function, hv_0. If photons of energy 2 hv_0 fall on this surface, the electrons come out with a maximum velocity of 4 $\times$ 106 ms. When the photon energy is increased to 5 hv_0, then maximum velocity of photoelectrons will be ___________

a) 2×10^7 m/s   b) 2×10^6 m/s   c) 8×10^6 m/s   d) 8×10^5 m/s

106. Assume that a molecule is moving with the root mean square speed at temperature 300 K. The de Broglie wavelength of nitrogen molecule is (Atomic mass of nitrogen = 14.0076 u, h = 6.63 X 10^{-34} J s, k_B = 1.38 X 10^{-23} J K^{-1}, 1 u = 1.66 X 10^{-27} kg)

a) 2.75 x 10^{-11} m   b) 2.75 x 10^{-12} m   c) 3.24 x 10^{-11} m   d) 3.24 x 10^{-12} m

107. The wavelength of matter wave is independent of

a) mass   b) velocity   c) momentum   d) charge

108. A and B are two metals with threshold frequencies 1.8 x 10^{14} Hz and 2.2 x 10^{14} Hz. Two identical photons of energy 0.825 eV each are incident on them. Then photoelectrons are emitted in (Take h = 6.6 X 10^{-34} J s)

a) B alone   b) A alone   c) neither A nor B   d) both A and B

109. The de Broglie wavelength of a particle of kinetic energy K is λ. What will be the wavelength of the particle, if its kinetic energy is $\frac{K}{4}$?

a) λ b) 2λ c) $\frac{\lambda}{2}$ d) 4λ

110. Assertion: In photon-particle collision the total energy and total momentum are conserved.

Reason : The number of photons are conserved in a collision

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

111. There are two sources of light, each emitting with a power of 100 W One emits X-rays of wavelength 1 nm and the other visible light of 500 nm. The ratio of number of photons of X-rays to the photons of visible light of the given wavelength is

a) 1: 500 b) 1: 400 c) 1: 300 d) 1: 200

112. Frequency of photon having energy 66 eV is :

a) 8 x 10^{-15} Hz b) 12 x $I0^{-15}$ Hz c) 16 x 10^{15} Hz d) None of these

113. A proton, a neutron, an electron and an α -particle have same energy. Then their de Broglie wavelengths compare as

a) $\lambda_p = \lambda_n > \lambda_e > \lambda_\alpha$ b) $\lambda_\alpha < \lambda_p = \lambda_n < \lambda_e$

c) $\lambda_e < \lambda_p = \lambda_n > \lambda_\alpha$ d) $\lambda_e = \lambda_p = \lambda_n = \lambda_\alpha$

114. In photoelectric effect, stopping potential depends on:

a) frequency of incident light b) nature of the emitter material

c) intensity of incident light d) both (a) and (b)

115. If h is Planck's constant, the momentum of a photon of wavelength 0.01 $\mathring{A}$ is

a) 10^{-2}h b) h c) 10^2h d) 10^{12}h

116. Assertion : Photoelectric effect supports the quantum nature of light.

Reason: Photoelectric emission is instantaneous.

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

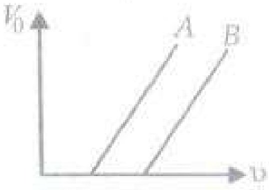
c) If assertion is true but reason is false. d) If both assertion and reason are false.

117. Photons absorbed in matter are converted to heat. A source emitting n photons per second of frequency Uis used to convert 1 kg of ice at 0°C to water at O°c. Then, the time T taken for the conversion

a) decreases with increasing n, with υ fixed. b) decreases with n fixed, υ increasing

c) remains constant with nand υ changing such that -nυ = constant d) All of these

118. The figure shows stopping potential V_0 and frequency υ for two different metallic surfaces A and B. The work function of A, as compared to that of B is



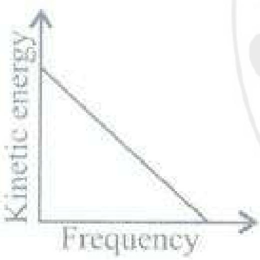
a) less b) more c) equal d) nothing can be said

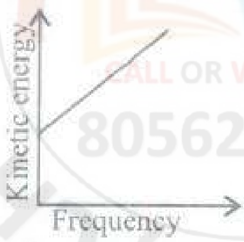
119. If the momentum of an electron is changed by p, then the de Broglie wavelength associated with it changes by 0.5%.The initial momentum of electron will be:
a) 400 P b) p/200 c) 100 P d) 200 P

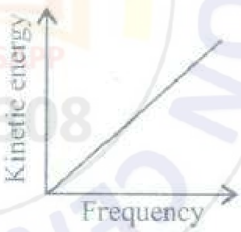
120. When photons of energy hv fallon an aluminium plate (of work function E_o), photoelectrons of maximum kinetic energy K are ejected. If the frequency of the radiation is doubled, the maximurn kinetic energy of the ejected photoelectrons will be ___________
a) 2K b) K c) K+hv d) K+E_o

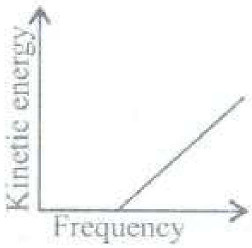
121. Monochromatic light of wavelength 667 nm is produced by a helium neon laser. The power emitted is 9 mW. The number of photons arriving per second on the average at a target irradiated by this beam is :
a) 3×10^{19} b) 9×10^{17} c) 3×10^{16} d) 9×10^{15}

122. According to Einstein's photoelectric equation, the graph between the kinetic energy of photoelectrons ejected and the frequency of incident radiation is

a) 

b) 

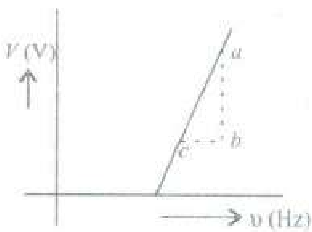
c) 

d) 

123. The potential difference that must be applied to stop the fastest photo electrons emitted by a nickel surface, having work function 5.01eV, when ultraviolet light of 200 nm falls on it, must be :
a) 2.4 V b) -1.2 V c) -2.4 V d) 1.2 V

124. In a photoelectric experiment, if both the intensity and frequency of the incident light are doubled, then the saturation photoelectric current
a) remains constant b) is halved c) is doubled d) becomes four times

125. In a photoelectric experiment, the graph of frequency υ of incident light (in Hz) and stopping potential V (in V) is as shown in the figure. From figure, the value of the Planck's constant is (e is the elementary charge)



a) $e\frac{ab}{bc}$ b) $e\frac{cb}{ab}$ c) $e\frac{ac}{bc}$ d) $e\frac{ac}{ab}$

126. Assertion: The stopping potential depends on the frequency of incident light.
Reason : The stopping potential is related to maximum kinetic energy by e $V_0 = K_{max.}$
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

127. Light of wavelength 5000 falls on a sensitive plate with photoelectric work function of 1.9 eV. The kinetic energy of the photoelectron emitred will be ___________
a) 0.58 eV b) 2.48 eV c) 1 .24 eV d) 1.16 eV

128. In a photoemissive cell, with exciting wavelength 1, the fastest electron has speed v. If the exciting wavelength is changed to 31/4, the speed of the fastest emitted electron will be ___________
a) $v\left(\frac{3}{4}\right)^{1/2}$ b) $v\left(\frac{4}{3}\right)^{1/2}$ c) $less\ than\ v\left(\frac{4}{3}\right)^{1/2}$ d) $greater\ than\ v\left(\frac{4}{3}\right)^{1/2}$

129. The work functions for metals A, B and C are respectively 1.92 eV, 2.0 eV and 5 eV. According to Einstein's equation, the metals which will emit photoelectrons for a radiation of wavelength 4100 is/are ___________
a) none b) A only c) A and B only d) all three metals

130. Light of wavelengths λ falls on a metal having work function Photoelectric effect will take place only
a) $\lambda \geq \lambda_0$ b) $\lambda \leq \lambda_0$ c) $\lambda \geq 2\lambda_0$ d) $\lambda = 4\lambda_0$

131. When intensity of incident light increases ____________
a) photocurrent increases b) photocurrent decreases
c) kinetic energy of emitted photoelectrons increases
d) kinetic energy of emitted photoelectrons decreases

132. Assertion: Free electrons inside a metal are free to move out of the metal.
Reason : Free electrons inside conductor do not need additional energy to get out of the metal.
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

133. A particle of mass 4 m at rest decays into two particles of masses m and 3m having non-zero velocities. The ratio of the de Broglie wavelengths of the particles 1 and 2 is :

a) $\frac{1}{2}$ b) $\frac{1}{4}$ c) 2 d) 1

134. Assertion: Photoelectric effect is the phenomenon of emission of photon by metal when illuminated by light of suitable frequency.
Reason: An electron beam carries sufficient energy to release photons from the metal
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

135. An electron is moving with an initial velocity $\vec{v} = v_0 \hat{i}$ (v_0 > 0) and is in a magnetic field $\vec{B} = B_0 \hat{j}$. Then it's de Broglie wavelength :
a) remains constant b) increases with time c) decreases with time
d) increases and decreases periodically

136. In photoelectric effect, the photo current
a) depends both on intensity and frequency of the incident light
b)
does not depend on the frequency of incident light but depends on the intensity of the incident light.
c) decreases with increase in frequency of incident light.
d) decreases with increase in frequency of incident light.

137. Momentum of a photon of wavelength λ is :
a) h/λ b) Zero c) $h\lambda/c^2$ d) hλ/c

138. A 200W sodium street lamp emits yellow light of wavelength 0.6 μ m. assuming it to be 25% efficient in converting electrical energy to light, the number of photons of yellow light it emits per second is :
a) 1.5×10^{20} b) 6×10^{18} c) 62×10^{20} d) 3×10^{19}

139. A particle is dropped from a height H. The de Broglie wavelength of the particle as a function of height is proportional to
a) H b) $H^{1/2}$ c) H^0 d) $H^{-1/2}$

140. In question number 5, find the kinetic energy of the most energetic photoelectron emitted at t = 10 s when it reaches plate B.
(Neglect the time taken by the photoelectron to reach plate B)
a) 23 eV b) 30 eV c) 15 eV d) 20 eV

141. An α -particle moves in a circular path of radius 0.83 cm in the presence of a magnetic field of 0.25 Wb m^{-2}. The de Broglie wavelength associated With the particle will be
a) 1$\mathring{A}$ b) 0.1$\mathring{A}$ c) 10$\mathring{A}$ d) 0.01$\mathring{A}$

142. The de-Broglie wavelength λ associated with an electron having, kinetic energy E is given by the expression:

a) $h/\sqrt{2mE}$ b) 2h/mE c) $\sqrt{2mhE}$ d) $2\sqrt{2mE}$

143. According to Einstein's photoelectric equation, the graph of kinetic energy of the photoelectron emitted from the metal versus the frequency of the incident radiation gives a straight line graph, whose slope:

a) depends on the intensity of the incident radiation.

b) depends on the nature of the metal and also on the intensity of incident radiation.

c) is same for all metals and independent of the intensity of the incident radiation.

d) depends on the nature of the metal

144. In the Davisson and Germer experiment, the velocity of electrons emitted from the electron gun can be increased by :

a) increasing the potential difference between the anode and filament

b) increasing the filament current c) decreasing the filament current

d) decreasing the potential difference between the anode and filament

145. In photoelectric emission process from a metal of work function 1.8 eV, the kinetic energy of most energetic electrons is 0.5 eV. The corresponding stopping potential is:

a) 1.8 V b) 1.2 V c) 0.5 V d) 2.3 V

146. A 5 watt source emits monochromatic light of wavelength 5000 A. When placed 0.5 m away, it liberates photoelectrons from a photosensitive metallic surface. When the source is moved to a distance of 1.0 m, the number of photoelectrons liberated will be reduced by a factor of ___________

a) 4 b) 16 c) 2 d) 14

147. Assertion: Photoelectric current depends on the intensity of incident light.

Reason : Number of photoelectrons emitted per second is directly proportional to the intensity of incident radiation

a)

If both assertion and reason are true and reason is the correct explanation of assertion

b)

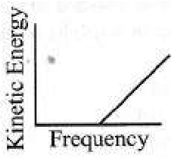
If both assertion and reason are true but reason is not the correct explanation of assertion.

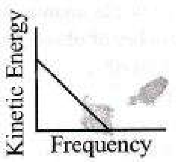
c) If assertion is true but reason is false. d) If both assertion and reason are false.

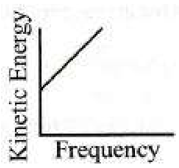
148. A metallic surface is irradiated by a monochromatic light of frequency υ_1 and stopping potential is found to be v_1 If the light of frequency υ_2 irradiates the surface, the stopping potential will be

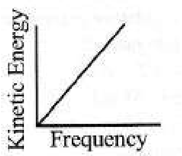
a) $V_1+\frac{h}{e}(\upsilon_1+\upsilon_2)$ b) $V_1+\frac{h}{e}(\upsilon_2-\upsilon_1)$ c) $V_1+\frac{e}{h}(\upsilon_2+\upsilon_1)$ d) $V_1-\frac{h}{e}(\upsilon_1+\upsilon_2)$

149. According to Einstein's photoelectric equation, the graph between the kinetic energy of photoelectrons ejected and the frequency of incident radiation is _____________

a) 

b) 

c) 

d) 

150. The linear momentum of a 3 MeV photon is
a) 0.01 eV s m^{-1} b) 0.02 eV s rn^{-1} c) 0.03 eV s m^{-1} d) 0.04 eV s m^{-1}

151. The nature of ions knocked out from hot surface is _________
a) protons b) electrons c) neutrons d) nuclei

152. The work function for Al, K and Pt is 4.28 eV, 2.30 eV and 5.65 eV respectively. Their respective threshold frequencies would be
a) pt >Al >K b) Al >Pt >K c) K > Al> Pt d) Al> K> Pt

153. Monochromatic radiation emitted when electron of hydrogen atom jumps from first excited state to the ground state potential is measured to be 3.5 V. The threshold frequency of the material is :
a) 4 x 10^{15} Hz b) 5 x 10^{15} Hz c) 1.6 x 10^{15} Hz d) 2.5 x 10^{15} Hz

154. The work function of a surface of a photosensitive material is 6.2 eV. The wavelength of incident radiation for which the stopping potential is 5 V lies inthe _____________
a) Ultravioletregion b) Visible region c) Infra-red region d) X-ray region

155. G.P. Thomson experimentally confirmed the existence of matter waves by the phenomena
a) diffraction b) refraction c) polarization d) scattering

156. Wavelength of a 1 keV photon is 1.24 x 10^{-9} m. What is the frequency of 1 MeV photon?
a) 1.24 x 10^{15} Hz b) 2.4 x 10^{20} Hz c) 1.24 x 10^{18} Hz d) 2.4 x 10^{23} Hz

157. An electromagnetic wave of wavelength λ is incident on a photosensitive surface of negligible work function. If the photoelectrons emitted from this surface have the de Broglie wavelength λ ', then
a) $\lambda = \frac{mc}{h}\lambda'^2$ b) $\lambda = \frac{3mc}{2h}\lambda'^2$ c) $\lambda = \frac{2mc}{h}\lambda'^2$ d) $\lambda = \frac{5mc}{h}\lambda'^2$

158. In which of the following photocell is not used?
a) Burglar alarm b) Television camera c) Automatic street lights d) Vacuum cleaner

159. The de Broglie wavelength is given by
a) $p = \frac{2\pi h}{\lambda}$ b) $p = \frac{h}{2\lambda}$ c) $p = \frac{2\pi}{h\lambda}$ d) $p = \frac{2\pi}{\lambda}$

160. Which of the following statements about photon is incorrect?
a) Photons exert no pressure b) Momentum of photon is $\frac{h\upsilon}{c}$
c) Rest mass of photon is zero. d) Energy of photon is hυ

161. A 100 W sodium lamp radiates energy uniformly in all directions. The lamp is located at the centre of a large sphere that absorbs all the sodium light which is incident on it. The wavelength of the sodium light is 589 nm. The number of photons delivered per second to

the sphere is :

a) 3×10^{15} b) 3×10^{10} c) 3×10^{20} d) 3×10^{19}

162. Photoelectric emission occurs only when the incident light has more than a certain minimum :

a) power b) wavelength c) intensity d) frequency

163. Two metallic plates A and B, each of area 5×10^{-4} m^2, are placed parallel to each other at a separation of 1 cm. Plate B carries a positive charge of 33.7×10^{-12} C. A monochromatic beam of light, with photons of energy 5 eV each, starts falling on plate A at t = 0 so that 10^{16} photons fall on it per square metre per second. Assume that one photoelectron is emitted for every 10^6 incident photons. Also assume that all the emitted photoelectrons are collected by plate Band the work function of plate A remains constant at the value 2 eV. Determine the number of photoelectrons emitted upto t = 10 s.

a) 5×10^6 b) 7×10^7 c) 5×10^7 d) 9×10^6

164. The de Broglie wavelength of a photon is twice the de Broglie wavelength of an electron. The speed of the electron is $v_e = \frac{c}{100}$. Then

a) $\frac{E_e}{E_p} = 10^{-4}$ b) $\frac{E_e}{E_p} = 10^{-2}$ c) $\frac{P_e}{m_e c} = 10^{-2}$ d) $\frac{P_e}{m_e c} = 10^{-4}$

165. A metal surface ejects electrons when hit by green light but none when hit by yellow light. The electrons will be ejected when the surface is hit by

a) blue light b) heat rays c) infrared light d) red light

166. In the question number 48, the energy of photon in eV at the red end of the visible spectrum is

a) 6.63 b) 3.62 c) 7.61 d) 1.64

167. Assertion: All the photoelectrons emitted from the metal do not have the same energy.
Reason : The maximum kinetic energy of photoelectrons depends on the light source and the emitter plate material

a)
If both assertion and reason are true and reason is the correct explanation of assertion

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

168. The rest mass of photon is

a) $\frac{hv}{c}$ b) $\frac{hv}{c^2}$ c) $\frac{hv}{\lambda}$ d) zero

169. The energy of a photon of wavelength λ is given by :

a) hλ b) chλ c) λ/hc d) hc/λ

170. 'n' photons of wavelength '入' are absorbed by a black body of mass 'm'. The momentum gained by the body is :

a) $\frac{h}{m\lambda}$ b) $\frac{mnh}{\lambda}$ c) $\frac{nh}{m\lambda}$ d) $\frac{nh}{\lambda}$

171. The cathode of a photoelectric cell is changed such that the work function changes from W_1 to W_2(W2> W_1). If the current before and after changes are I_1 and I_2, all other conditions remaining unchanged, then (assuming h_n > w_r)
a) $I_1 = l_2$ b) $I_1 < I_2$ c) $I_1 > I_2$ d) $I_1 < I_2 < 2I_1$

172. The matter-wave picture of electromagnetic wave radiation elegantly incorporated the
a) Heinsenbergs uncertainty principle b) correspondence principle c) cosmic theory
d) Hertz's observations

173. An electron (mass m) with an initial velocity $\vec{v} = v_0 \hat{i}$ (v_0 > 0) is in an electric field $\vec{E} = -E_0 \hat{i}$ (E_0 = constant> 0). It's de Broglie wavelength at time t is given by :
a) $\frac{\lambda_0}{\left(1 + \frac{eE_0t}{mv_0}\right)}$ b) $\lambda_0 \left(1 + \frac{eE_0t}{mv_0}\right)$ c) λ_0 d) λ_0 t

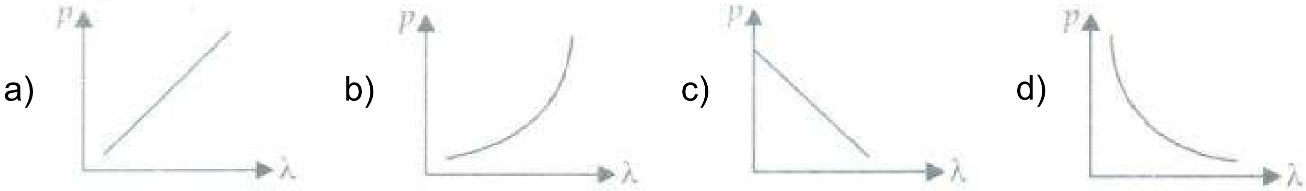
174. Einstein work on the photoelectric effect provided support for the equation ____________
a) E= hv b) E = mc^2 c) $E = -\frac{Rhc}{n^2}$ d) $K.E. = \frac{1}{2}mv^2$

175. A proton and an a-particle are accelerated through the same potential difference. The ratio of de Broglie wavelength λ_P to that of $\lambda\alpha$
a) $\sqrt{2}$: 1 b) $\sqrt{4}$: 1 c) $\sqrt{6}$: 1 d) $\sqrt{8}$: 1

176. Assertion: Millikan's experiment established that electric charge is quantised.
Reason: From this experiment mass of the electron could not be determined
a)
If both assertion and reason are true and reason is the correct explanation of assertion
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

177. The de Broglie wavelength of a neutron in thermal equilibrium with heavy water at a temperature T (Kelvin) and mass m, is :
a) $h/\sqrt{3mkT}$ b) $2h/\sqrt{3mkT}$ c) $2h/\sqrt{mkT}$ d) $h/\sqrt{mkT}$

178. Which of the following figure represents the variation of particle momentum (P) and associated de Broglie wavelength (λ)?



179. A blue lamp mainly emits light of wavelength 4500 Å. The lamp is rated at 150 Wand 8% of the energy is emitted as visible light. The number of photons emitted by the lamp per second is :
a) 3×10^{19} b) 3×10^{24} c) 3×10^{20} d) 3×10^{18}
180. Thermionic emissions are related to:
a) conduction b) convection c) radiation d) none of these
181. Wave theory cannot explain the phenomena of
A. Polarization
B. Diffraction
C. Compton effect
D. Photoelectric effect
Which of the following is correct?
a) A and B b) B and D c) C and D d) D and A
182. The energy that should be added to an electron to reduce its de Broglie wavelength from one nm to 0.5 nm is
a) four times the initial energy b) equal to the initial energy c) twice the initial energy d) thrice the initial energy
183. The energy of a photon is E = hv and the momentum of photon p = h/λ., then the velocity of photon will be :
a) E/p b) Ep c) $(Ep)^2$ d) 3×10^8 m/s
184. The wavelength of a photon needed to remove a proton from a nucleus which is bound to the nucleus with 1 MeV energy is nearly
a) 1.2 nm b) 1.2×10^{-3} nm c) 1.2×10^{-6} nm d) 1.2×10^{1} nm
185. An electron of mass m with an initial velocity $v = v_0 i (v_0 > 0)$ enters in electric field $E = - E_0 \hat{i}$ (E0 = constant > 0). If λ_0 is its de-Broglie wavelength initially, then its de Broglie wavelength at time t is :
a) $\lambda_0 /[1 + (eE_0/mv_0) \times t]$ b) $\lambda_0[1 + (eE_0/mv_0) \times t]$ c) $\lambda_0 t$ d) λ_0
186. Which of the following moving particles (moving with same velocity) has largest wavelength of matter waves?
a) Electron b) a-particle c) Proton d) Neutron
187. Which one of the following statements is not true for cathode rays?
a) Cathode rays produce heat when incident on metals
b) Cathode rays travel in a straight line c) Cathode rays do not deflect in electric field
d) Cathode rays produce fluorescence when they fall on certain meterials
188. Which of these particles having the same kinetic energy has the largest de Broglie wavelength?
a) Electron b) Alpha particle c) Proton d) Neutron
189. If the kinetic energy of the particle is increased to 16 times its previous value, the percentage change in the de Broglie wavelength of the particle is :
a) 60 b) 50 c) 25 d) 75

190. Estimate the speed with which electrons emitted from a heated cathode of an evacuated tube impinge on the anode maintained at a potential difference of 500 V with respect to the cathode. Ignore the small initial speeds of the electrons. The specific charge of the electron i.e., its elm is given to be $1.76 \times 10^{11} C\ kg^{-1}$.

a) $1.33 \times 10^{6}\ ms^{-1}$ b) $2.66 \times 10^{7}\ ms^{-1}$ c) $1.33 \times 10^{7}\ ms^{-1}$ d) $2.66 \times 10^{6}\ ms^{-1}$

191. A particle moves in a closed orbit around the origin, due to a force which is directed towards the origin. The de Broglie wavelength of the particle varies cyclically between two values λ_1 and λ_2 with $\lambda_1 > \lambda_2$

Which of the following statements is true?

a) The particle could be moving in a circular orbit with origin as centre.

b) The particle could be moving in an elliptical orbit with origin as its focus

c)

When thede Broglie wavelength is λ_1 the particle is nearer the origin than when its value is λ_2

d) Both (a) and (c)

192. Monochromatic light of frequency 6×10^{14} Hz is produced by a laser. The power emitted is 2×10^{-3}W. The number of photons emitted per second is (Given $h = 6.63 \times 10^{-34}$Js).

a) 2×10^{15} b) 3×10^{15} c) 4×10^{15} d) 5×10^{15}

Ravi Maths Tuition Centre

Time : 1 Mins **ATOMS AND NUCLAI 1** **Marks : 1379**

1. A set of atoms in an excited state decays:
   a) in general to any of the states with lower energy
   b) into a lower state only when excited by an external electric field
   c) all together simultaneously into a lower state d) to emit photons only when they collide
2. A radio isotope X with a half life 1.4 x 10^9 years decays to Y which is stable. A sample of the rock from a cave was found to contain X and Y in the ratio 1:7. The age of the rock is::
   a) 4.20 x 10^9 years b) 8.40 x 10^9 years c) 1.96 x 10^9 years d) 3.92 x 10^9 years
3. The ratio of the speed of the electron in the ground state of hydrogen atom to the speed of light in vacuum is
   a) $\frac{1}{2}$ b) $\frac{2}{237}$ c) $\frac{1}{137}$ d) $\frac{1}{237}$
4. A nucleus represented by the symbol ${}_Z^AX$ has ____________ .
   a) A protons and (Z-A) neutrons b) Z neutrons and (A-Z) protons
   c) Z protons and (A-Z) neutrons d) Z protons and A neutrons
5. A freshly prepared radioactive source of half-life 2 h emits radiation of intensity which is 64 times the permissible safe level. The minimum time after which it would be possible to work safely with this source is
   a) 128 h b) 24 h c) 6 h d) 12 h
6. The radius of a spherical nucleus as measured by electron scattering is 3.6 fm. What is the mass number of the nucleus most likely to be?
   a) 27 b) 40 c) 56 d) 120
7. **Assertion:** The trajectory traced by an incident particle depends on the impact parameter of collision.
   Reason: The impact parameter is the perpendicular distance of the initial velocity vector of the incident particle from the centre of the target nucleus.
   a) If both assertion and reason are true and reason is the correct explanation of assertion.
   b) If both assertionand reason are true but reason is not the correct explanationof assertion.
   c) If assertion is true but reason is false. d) If both assertion and reason are false.
8. Assertion: Binding energy per nucleon is nearly constant for element in the range A = 30 to A = 170.
   Reason: The nuclear force between two nucleons falls rapidly to zero as their distance is more than a few femtometres.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

9. The ionization energy of L^{++} is equal to
a) 9 hcR b) 6 hcR c) 2 hcR d) hcR
10. The count rate of a Geiger Muller counter for the radiation of a radioactive material of half life 30 min decreases to $5s^{-1}$ after 2h, The initial count rate was ____________ .
a) 10 s^{-1} b) 25 s^{-1} c) 80 s^{-1} d) 625 s^{-1}
11. The ratio of wavelengths of the last line of Balmer series and the last line of Lyman series is:
a) 1 b) 4 c) 0.5 d) 2
12. Mass numbers of the elements A, B, C and D are 30, 60, 90, and 120 respectively. The specific binding energy of them are 5 MeV, 8.5 MeV, 8 MeV and 7 MeV respectively. Then, in which of the following reaction/s energy is released?
(1) $D \rightarrow 2B$
(2) $C \rightarrow B + A$
(3) $B \rightarrow 2A$
a) only in (1) b) in (2), (3) c) in (1), (3) d) in (1), (2) and (3)
13. At a given instant, there are 25% undecayed radioactive nuclei in a sample. After 10 seconds the number of undecayed nuclei reduces to 12.5%, the mean life of the nuclei is
a) 10.21 s b) 14.43 s c) 5.31 s d) 7.43 s
14. In a nuclear reactor, moderators slow down the neutrons which come out in a fission process. The moderator used have light nuclei. Heavy nuclei will not serve the purpose because
a) they will break up.

b) elastic collision of neutrons with heavy nuclei will not slow them down.

c) the net weight of the reactor would be unbearably high.

d) substances with heavy nuclei do not occur in liquid or gaseous state at room temperature.

15. Rutherford's experiment on scattering of particles showed for the first time that the atom has:
a) Electrons b) Protons c) Nucleus d) Neutrons
16. The binding energy per nucleon is maximum in case of ______________ .
a) ${}_2\mathrm{He}^4$ b) ${}_{26}\mathrm{Fe}^{56}$ c) ${}_{56}\mathrm{Ba}^{141}$ d) ${}_{92}\mathrm{U}^{235}$
17. If in a nuclear fusion reaction, mass defect is 0.3%, then energy released in fusion of 1 kg mass
a) 27 x 10^{10}J b) 27 x 10^{11}J c) 27 x 10^{12}J d) 27 x 10^{13}J
18. The half life of polonium is 140 days. In what time will 15 g of polonium be disintegrated out of its initial mass of 16 g?
a) 230 days b) 560 days c) 730 days d) 160 days
19. From quantisation of angular momentum, one gets for hydrogen atom, the radius of the nth orbit as

$$r_n = \left(\frac{n^2}{m_e}\right)\left(\frac{h}{2\pi}\right)^2\left(\frac{4\pi^2\varepsilon_0}{e^2}\right)$$

For a hydrogen like atom of atomic number Z,
a) the radius of the first orbit will be the same b) r_n will be greater for larger Z values
c) r_n will be smaller for larger Z values d) none of these

20. In question number 7, for Z = 79 if initial energy is 10 MeV the impact parameter (in fm) of which the scattering angle is 90° is
a) 22 b) 44 c) 11 d) zero

21. In the Bohr model of the hydrogen atom, the lowest orbit corresponds to
a) infinite energy b) maximum energy c) minimum energy d) zero energy

22. Fusion reaction takes place at high temperature because:
a) Nuclei break up at high temperature b) Atoms gets ionised at high temperature
c) Kinetic energy is high enough to overcome the coulomb repulsion between nuclei
d) Molecules break up at high temperature

23. In the nucleus of $_{11}\mathrm{Na}^{23}$, the number of protons, neutrons and electrons are:
a) 11,12,0 b) 23,12,11 c) 12,11,0 d) 23,11,12

24. If muonic hydrogen atom is an atom in which a negatively charged muon (μ) of mass about 207 m_e revolves around a proton, then first Bohr radius of this atom is (r_e = 0.53 $\times$ 10^{-10} m)
a) 2.56 $\times$ 10^{-10} m b) 2.56 $\times$ 10^{-11} m c) 2.56 $\times$ 10^{-12} m d) 2.56 $\times$ 10^{-13} m

25. If there are N atoms in a source of Laser light and each atom is emitting light with intensity I, then the total intensity produced by it is
a) NI b) N^2I c) N^3I d) N^4I

26. A nucleus $_nX^m$ emits one a and two b-particles. The resulting nucleus is:
a) $_nX^{m-4}$ b) $_{n-2}X^{m-4}$ c) $_{n-4}Z^{m-4}$ d) None of these

27. Hydrogen atom in ground state is excited by a monochromatic radiation of $1 = 975\ \mathring{A}$. Numbér of spectral lines in the resulting spectrum emitted will be _____________ .
a) 3 b) 2 c) 6 d) 10

28. The mass number of iron nucleus is 56, the nuclear density is
a) 2.29 x 10^{16}kg m^{-3} b) 2.29 x 10^{17}kg m^{-3} c) 2.29 x 10^{18}kg m^{-3} d) 2.29 x 10^{15}kg m^{-3}

29. The total energy of an electron in the first excited state of hydrogen atom is about -3.4 eV. Its kinetic energy in this state is ______________ .
a) 3.4 eV b) 6.8 eV c) -3.4 eV d) -6.8 eV

30. The valence electron in alkali metal is a ____________ .
a) f-electron b) p-electron c) s-electron d) d-electron

31. A fission reaction is given by $^{236}_{92}U \rightarrow ^{140}_{54}Xe + ^{94}_{38}Sr + x + y$, where x and y are two particles. Considering $^{236}_{92}U$ to be at rest, the kinetic energies of the products are denoted by K_{xe},K_{sr}, K_x (2 MeV) and K_y (2 MeV), respectively. Let the binding energies per nucleon of $^{236}_{92}U,^{140}_{54}Xe\ are\ ^{94}_{38}Sr$ be 7.5 MeV, 8.5 MeV and 8.5 MeV, respectively. Considering different conservation laws, the correct option(s) is(are)
a) x = n, y = n, K_{sr} = 129 MeV, K_{Xe}= 86 MeV b) x = p,y =$\bar{e}$, K_{sr} = 129 MeV, K_{Xe} = 86 MeV
c) x = p, y = n, K_{Sr} = 129 MeV, K_{Xe} = 86 MeV d) x = n, y = n, K_{Sr} = 86 MeV, K_{Xe}= 129 MeV

32. For which one of the following, Bohr model in not valid?

a) Singly ionised helium atom $\left(\mathrm{He}^{+}\right)$ b) Deuteron atom
c) Singly ionised neon atom $\left(\mathrm{Ne}^{+}\right)$ d) Hydrogen atom

33. The excitation energy of Lyman last line is
a) the same as ionisation energy b) the same as the last absorption line in Lyman series
c) both (a) and (b) d) different from (a) and (b)

34. The number of beta particles emitted by a radioactive substance is twice the number of alpha particles emitted by it. The resulting daughter is an:
a) Isotope of parent b) Isobar of parent c) Isomer of parent d) Isotone of parent

35. For a nuclear fusion process, the suitable nuclei are:
a) any nuclei b) heavy nuclei c) light nuclei
d) nuclei lying in the middle of the periodic table

36. Which of the following statements is true for nuclear forces?
a) They obey the inverse square law of distance
b) They obey the inverse third power law of distance c) They are short range forces
d) They are equal in strength to electromagnetic forces

37. The ratio of kinetic energy to the total energy of an electron in a Bohr orbit of the hydrogen atom, is ______________ .
a) 2:-1 b) 1:-1 c) 1: 1 d) 1:-2

38. According to second postulate of Bohr model, the angular momentum (L_n) of n^{th} possible orbit of hydrogen atom is given by
a) $\frac{h}{2\pi n}$ b) $\frac{nh}{2\pi}$ c) $\frac{2\pi n}{h}$ d) $\frac{2\pi}{nh}$

39. If an electron in a hydrogen atom jumps from the 3rd orbit to the 2nd orbit, it emits a photon of wavelength λ. When it jumps from the 4th orbit to the 3rd orbit, the corresponding wavelength of the photon will be :
a) $(16/25)\lambda$ b) $(9/16)\lambda$ c) $(20/7)\lambda$ d) $(20/13)\lambda$

40. In the Bohr's model of a hydrogen atom, the centripetal force is furnished by the Coulomb attraction between the proton and the electron. If a_0 is the radius of the ground state orbit, m is the mass and e is the charge on the electron, e_0 is the vacuum permittivity, the speed of the electron is ______________ .
a) zero b) $\frac{e}{\sqrt{\varepsilon_0 a_0 m}}$ c) $\frac{e}{\sqrt{4\pi\varepsilon_0 a_0 m}}$ d) $\frac{\sqrt{4\pi\varepsilon_0 a_0 m}}{e}$

41. The decay constant of a radioactive isotope is λ . If A_1 and A_2 are its activities at times t_1 and t_2 respectively, then the number of nuclei which have decayed during the time (t_1 - t_2)
a) $A_1t_1 - A_2t_2$ b) $A_1 - A_2$ c) $(A_1 - A_2)/\lambda$ d) $\lambda(A_1-A_2)$

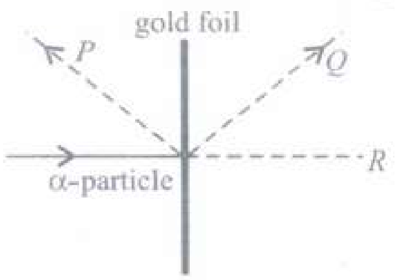
42. The mass defect for the nucleus of helium is 0.0303 a.m.u. What is the binding energy per nucleon for helium in MeV:
a) 28 b) 7 c) 4 d) 1

43. A radioactive decay can form an isotope of the original nucleus with the emission of particles
a) one α and four β b) one α and two β c) one α and one β d) four α and one β

44. In the Bohr model of the hydrogen atom, let R, V and E represent the radius of the orbit, speed of the electron and the total energy of the electron respectively. Which of the following quantities are proportional to the quantum number n?

a) VR b) RE c) R/E d) none of these

45. In an experiment on a-particle scattering, a-particles are directed towards a gold foil and detectors are placed in position P,Q and R. What is the distribution of a-particles as recorded at P, Q



and R?

a)

P	Q	R
all	none	none

b)

P	Q	R
none	none	all

c)

P	Q	R
a few	some	most

d)

P	Q	R
most	some	a few

46. Carbon dating is best suited for determining the age of fossils, if their age in years is of the order of
a) 10^3 b) 10^4 c) 10^5 d) 10^6

47. If the nuclear force between two protons, two neutrons and between proton and neutron is denoted by F_{pp}, F_{nn} and F_{pn} respectively, then ______________ .
a) $F_{pp}^{pn} \approx F_{nn} \gg F_{pn}$ b) $F_{pp}{}^{1}F_{nn} and F_{pp} = F_{nn}$ c) $F_{pp}^{pp} = F_{nn} = F_{pn}^{pn}$
d) $F_{pp}{}^{1}F_{nn}{}^{1}F_{pn}$

48. The total energy of electron in the ground state of hydrogen atom is -13.6 eV. The kinetic energy of an electron in the first excited state is ______________ .
a) 6.8 eV b) 13.6 eV c) 1.7 eV d) 3.4 eV

49. Suppose an electron is attracted towards the origin by a force klr, where k is a constant and r is the distance of the electron from the origin. By applying Bohr model to this system, the radius of nth orbit of the electron is found to be rn and the kinetic energy of the electron is found to be Tn. Then which of the following is true?
a) $T_n \propto \frac{1}{n^2}$ b) T_n is independent of n; $r_n \propto n$ c) $T_n \propto \frac{1}{n} and\ r_n$
d) $T_n \propto \frac{1}{n} and\ r_n \propto n^2$

50. Which of the following statements is true for hydrogen atom?
a) Angular moment $\propto \frac{1}{n}$ b) Linear moment $\propto \frac{1}{n}$ c) Radius $\propto \frac{1}{n}$ d) Energy $\propto \frac{1}{n}$

51. The ratio of the nuclear radii of the gold isotope $^{197}_{79}Au$ and silver isotope $^{197}_{47}Au$ is:
a) 1.23 b) 0.216 c) 2.13 d) 3.46

52. A núcleus $^{A}_{Z}X$ has mass represented by $M(A,Z)$. If M_p and M_n denote the mass of proton and neutron respectively and B.E. the, binding energy in MeV, then ______________ .
a) $B.E. = [ZM_p + (A-Z)M_n - M(A,Z)]\,c^2$
b) $B.E. = [ZM_p + ZM_n - M(A,Z)]\,c^2$
c) $B.E. = M(A,Z) - ZM_p - (A-Z)M_n$
d) $B.E. = [M(A,Z) - ZM_p - (A-Z)M_n]\,c^2$

53. The moment of momentum for an electron in second orbit of hydrogen atom as per Bohr's model is

a) $\frac{h}{\pi}$ b) $2\pi h$ c) $\frac{2h}{\pi}$ d) $\frac{\pi}{h}$

54. Two radioactive substances A and B have decay constants 5λ and λ respectively. At t = 0, they have the same number of nuclei. The ratio of number of nuclei of A to those of B will be $(1/e)^2$ after a time interval

a) 4λ b) 2λ c) $1/2\lambda$ d) $1/4\lambda$

55. The set which represents the isotope, isobar and isotone respectively is:

a) $({}_1^2H, {}_1^3H), ({}_{79}^{197}Au, {}_{80}^{198}Hg)$ and $({}_2^3He, {}_1^2H)$ b) $({}_2^3He, {}_1^1H), ({}_{79}^{197}Au, {}_{80}^{198}Hg)$ and $({}_1^1He, {}_1^3H)$
c) $({}_2^3He, {}_1^3H), ({}_1^2H, {}_1^3H)and({}_{79}^{197}Au, {}_{80}^{198}Hg)$ d) $({}_1^2H, {}_1^3H), ({}_2^3He, {}_1^3H)and({}_{79}^{197}Au, {}_{80}^{198}Hg)$

56. Radioactive ${}_{27}^{60}Co$ is transformed into stable ${}_{28}^{60}Ni$ by emitting two λ-rays of energies:

a) 1.33 MeV and 1.17 MeV in succession b) 1.17 MeV and 1.33 MeV in succession
c) 1.37 MeV and 1.13 MeV in succession d) 1.13 MeV and 1.37 MeV in succession

57. The count rate of a radioactive sample falls from 4.0 x 10^6 s^{-1} to 1.0 X 10^6 s^{-1} in 20 hours. What will be the count rate after 100 hours from begining?

a) 3.91 x 10^3 s^{-1} b) 3.91 x $10^2 s^{-1}$ c) 3.91 X 10^4 s^{-1} d) 3.91 x 10^6 s^{-1}

58. Consider 3^{rd} orbit of He^+ $(Helium)$, using non-relativistic approach, the speed of electron in this orbit will be [given $K = 9 \times 10^9$ constant, Z=2 and h (Plank's Constant) $= 6.6 \times 10^{-34}\ \mathrm{J\ s^{-1}}$]

a) $1.46 \times 10^6\ \mathrm{m/s}$ b) $0.73 \times 10^6\ \mathrm{m/s}$ c) $3.0 \times 10^8\ \mathrm{m/s}$ d) $2.92 \times 10^6\ \mathrm{m/s}$

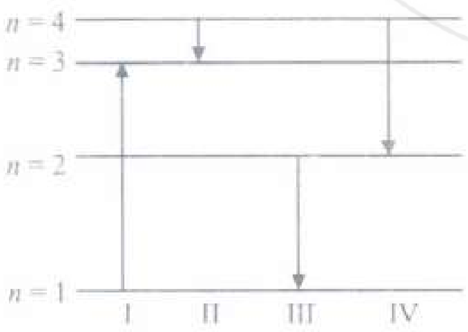
59. The radius of hydrogen atom in its ground state is 5.3 x 10^{-11} m. After collision with an electron it is found to have a radius of 21.2 x 10^{-11} m. What is the principal quantum number n of the final state of the atom?

a) n = 4 b) n = 2 c) n = 16 d) n = 3

60. In terms of Bohr radius a_0, the radius of the second Bohr orbit of a hydrogen atom is given by:

a) $4a_0$ b) $8a_0$ c) $\sqrt{2}a_0$ d) $2a_0$

61. The diagram shows the energy levels for an electron in a certain atom. Which transition shown represents the emission of a photon with the most energy?



a) I b) II c) III d) IV

62. The half life of radioactive radon is 3.8 days. The time at the end of which (1/20) th of the radon sample will remain undecayed (Given $\log_{10}e$ = 0.4343) is

a) 3.8 days b) 16.5 days c) 33 days d) 76 days

63. An electron in the ground state of hydrogen atom is revolving in anticlockwise direction in circular orbit of radius R. The orbital magnetic dipole moment of the electron will be

a) $\frac{eh}{4\pi m}$ b) $\frac{eh}{2\pi m}$ c) $\frac{eh^2}{4\pi m}$ d) $\frac{e^2h}{4\pi m}$

64. A radioisotope 'X with a halflife 1.4 x 10^9 years decays to 'Y' which is stable. A sample of the rock from a cave was found to contain 'X and 'Y' in the ratio 1: 7. The age of the rock is:
a) 1.96 x 10^9 years b) 3.92 x 10^9 years c) 4.20 x 10^9 years d) 8.40 x 10^9 years

65. The binding energy of an electron in the ground state of He is equal to 24.6 eV. The energy required to remove both the electrons is
a) 49.2 eV b) 54.4 eV c) 79 eV d) 108.8 eV

66. When a uranium isotop $^{235}_{92}\mathrm{U}$ is bombareded with a neutron, it generates $^{89}_{36}\mathrm{Kr}$, three neutrons and:
a) $^{103}_{36}\mathrm{Kr}$ b) $^{144}_{56}\mathrm{Ba}$ c) $^{91}_{40}\mathrm{Zr}$ d) $^{101}_{36}\mathrm{Kr}$

67. The Bohr model of atoms
a) assumes that the angular momentum of electrons is quantized.
b) uses Einstein's photoelectric equation.
c) predicts continuous emission spectra for atoms.
d) predicts the same emission spectra for all types of atoms.

68. The wavelength of spectral line in the Lyman series of a H -atom is 1028$\mathring{A}$. If instead of hydrogen, we consider deuterium then shift in the wavelength of this line will be (m_p = 1860 m_e)
a) 1027.7 $\mathring{A}$ b) 1036 $\mathring{A}$ c) 1028 $\mathring{A}$ d) 1021 $\mathring{A}$

69. The energy of ground electronic state of hydrogen atom is -136 eV. The energy of the first excited state will be:
a) -54.4 eV b) -27.2 eV c) -6.8 eV d) -3.4 eV

70. The mass density of a nucleus varies with mass number A as:
a) A^2 b) A c) constant d) $\frac{1}{A}$

71. In a hydrogen atom the total energy of electron is
a) $\frac{e^2}{4\pi\varepsilon_0 r}$ b) $\frac{-e^2}{4\pi\varepsilon_0 r}$ c) $\frac{-e^2}{8\pi\varepsilon_0 r}$ d) $\frac{e^2}{8\pi\varepsilon_0 r}$

72. Assertion: An α-particle is emitted when uranium 238 decays into thorium.
Reason: The decay of uranium 238 to thorium is represented by
$^{238}_{92}U \rightarrow ^{234}_{90}Th + ^{4}_{2}He$ .The helium nuclei is called an alpha particle.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

73. The de-Broglie wavelength of an electron in the first Bohr orbit is
a) equal to one-fourth the circumference of the first orbit
b) equal to half the circumference of first orbit
c) equal to twice the circumference of first orbit
d) equal to the circumference of the first orbit.

74. In a Geiger-Marsden experiment. Find the distance of closest approach to the nucleus of a 7.7 MeV a-particle before it comes momentarily to rest and reverses its direction. (Z for gold nucleus = 79)

a) 10 fm b) 20 fm c) 30 fm d) 40 fm

75. Radioactive material 'N has decay constant '8λ' and material 'B' has decay constant 'λ'. Initially they have same number of nuclei. After what time, the ratio of number of nuclei of material 'B' to that 'N will be 1/e?

a) $1/7\lambda$ b) $1/8\lambda$ c) $1/9\lambda$ d) $1/\lambda$

76. An alpha nucleus of energy $1/2mv^2$ bombards a heavy nuclear target of charge Ze. Then the distance of closest approach for the alpha nucleus will be proportional to :

a) 1/Ze b) ν^2 c) 1/m d) $1/\nu^2$

77. Who modified Bohr's theory by introducing elliptical orbits for electron path :

a) Hund b) Thomson c) Rutherford d) Sommerfield

78. **Assertion:** In the experiment of alpha particle scattering, extremely thin gold foils are preferred over other metals.

Reason: Gold is a ductile material.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertionand reason are true but reason is not the correct explanationof assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

79. The radius of n^{th} orbit r_n in terms of Bohr radius (a_0) for a hydrogen atom is given by the relation

a) na_0 b) $\sqrt{n}a_0$ c) $n^2 a_0$ d) n^3a_0

80. In any fission process, the ratio

$\frac{\text{mass of fission products}}{\text{mass of parent nucleus}}$ is :

a) equal to 1 b) greater than 1 c) less than 1

d) depends on the mass of the parent nucleus

81. In an atom the ratio of radius of orbit of electron to the radius of nucleus is

a) 10^3 b) 10^4 c) 10^5 d) 10^6

82. If radius of the $^{27}_{12}\mathrm{AL}$ nucleus is taken to be RA1, then the radius of $^{125}_{53}\mathrm{Te}$ nucleus is nearly:

a) $\frac{5}{3}R_{A1}$ b) $\frac{3}{5}R_{A1}$ c) $\left(\frac{13}{53}\right)^{1/3}R_{A1}$ d) $\left(\frac{53}{13}\right)^{1/3}R_{A1}$

83. The element Curium $^{248}_{96}Cm$ has a mean life of 10^{13} second. Its primary decay modes are spontaneous fission and α-decay, the former with a probability of 8% and the latter with a probability of 92%. Each fission releases 200 MeV of energy. The masses involved in α-decay are as follow $^{248}_{96}Cm$ = 248.072220 u, $^{244}_{94}Pu$ = 244.064100 u and $^{4}_{2}He$ = 4.002603 u. Calculate the power output from a sample of 10^{20} Cm atoms. (1 u = 931 MeV/c^2).

a) 4.42×10^{-3} W b) 3.32×10^{-5} W c) 4.42×10^{-5} W d) 3.32×10^{-3} W

84. Energy levels A, B, C of a certain atom correspond to increasing values of energy ie., $E_A < E_B < E_C$. If l_1, l_2, l_3 are the wavelengths of radiation corresponding to the transitions C to B, B to A and C to A respectively, which of the following relation is correct?

a) $l_3 = 1_1 + l_2$ b) $l_3 = \frac{\lambda_1\lambda_2}{\lambda_1+\lambda_2}$ c) $1_1 + 1_2 + 1_3 = 0$ d) $\lambda_3^2 = \lambda_1^2 + \lambda_2^2$

85. Two radioactive materials X_1 and X_2 have decay constants 51 and 1 respectively. If initially they have the same number of nuclei, then the ratio of the number of nuclei of X_1 to that of X_2 will be $\frac{1}{e}$ after a time:
a) 1 b) $\frac{1}{2}\lambda$ c) $\frac{1}{4\lambda}$ d) $\frac{e}{\lambda}$

86. An electron is in an excited state in a hydrogen like atom. It has a total energy of -3.4 eV. The kinetic energy of the electron is E and its de Broglie wavelength is λ. Then
a) E = 6.8 eV, λ = 6.6 $\times$ 10^{-10} m b) E = 3.4 eV, λ = 6.6 $\times$ 10^{-10} m
c) E = 3.4 eV, λ = 6.6 $\times$ 10^{-11} m d) E = 6.8 eV, λ = 6.6 $\times$ 10^{-11} m

87. In a sample of radioactive material, what fraction of the initial number of active nuclei will remain undisintegrated after half of the half life of the sample?
a) $\frac{1}{4}$ b) $\frac{1}{2\sqrt{2}}$ c) $\frac{1}{\sqrt{2}}$ d) $\sqrt{2}-1$

88. In nuclear reactors, the control rods are made of
a) cadmium b) graphite c) krypton d) plutonium

89. How does the binding energy per nucleon vary with the increase in the number of nucleons?
a) Increases continuously with mass number b) Decreases continuously with mass number
c) First decreases and then increases with increase in mass number
d) First increases and then decreases with increase in mass number

90. In nuclear reaction, there is conservation of
a) mass only b) energy only c) momentum only d) mass, energy and momentum

91. Hydrogen atoms are excited from ground state of the principal quantum number 4. Then, the number of spectral lines observed will be:
a) 3 b) 6 c) 5 d) 2

92. What is the ratio of the shortest wavelength of the Balmer series to the shortest wavelength of the Lyman series?
a) 4 : 1 b) 4 : 3 c) 4 : 9 d) 5 : 9

93. An element A decays into an element C by a two step process A$\rightarrow$ B+$_2He^4$ and B$\rightarrow$ C+$2e^-$ .Then,
a) A and C are isotopes b) A and C are isobars c) B and C are isotopes
d) A and B are isobars

94. M_n and M**p**, represent mass of neutron and proton respectively. If an element having atomic mass M has N neutron and Z-proton, then the correct relation will be ________________ .
a) $M < [NM_n + ZM_p]$ b) $M > [NM_n + ZM_p]$ c) $M = [NM_n + ZM_p]$
d) $M = N[M_n + M_p]$

95. Two stable isotopes ^6_3Li and ^7_3Li have respective abundances of 7.5% and 92.5%. These isotopes have masses 6.01512 u and 7.01600 u respectively. The atomic weight of lithium is
a) 6.941 u b) 3.321 u c) 2.561 u d) 0.621 u

96. When a nucleus in an atom undergoes a radioactive decay, the electronic energy levels of the atom
a) do not change for any type of radioactivity
b) change for α and β radioactivity but not for γ-radioactivity.

c) change for α-radioactivity but not for others

d) change for β-radioactivity but not for others.

97. A hydrogen atom and a Li^{++} ion are both in the second excited state. If l_H and l_{Li} are their respective electronic angular momenta and E_H and E_{Li} their respective energies, then

a) $l_H > l_{Li}$ and $|E_H| > |E_{Li}|$ b) $l_H = l_{Li}$ and $|E_H| > |E_{Li}|$ c) $l_H = l_{Li}$ and $|E_H| < |E_{Li}|$

d) $l_H < l_{Li}$ and $|E_H| < |E_{Li}|$

98. Which of the following is used as a moderator in nuclear reactors?

a) Plutonium b) Cadmium c) Heavy water d) Uranium

99. The half life of a radioactive isotope 'X' is 50 years. It decay to another element 'Y' which is stable. The two elements 'X' and 'Y' were found to be in the ratio of 1:15 in a sample of a given rock. The age of the rock was estimated to be :

a) 150 years b) 200 years c) 250 years d) 100 years

100. In the question number 5, if α = $2N_o\lambda$, calculate the number of nuclei of A after one half-life of A, and also the limiting value of N as

a) $2N_o, \frac{5}{2}N_o$ b) $3N_o, 2N_o$ c) $4N_o, 2N_o$ d) $\frac{3}{2}N_o, 2N_o$

101. In a given reaction,

$Z^{X^{A}3/4\to}{}_{Z+1}Y^{A}3/4 \to {}_{Z-1}K^{A} \quad 43/4 \to_{Z-1} K^{A-4}$

Radioactive radiations are emitted in the sequence of:

a) a, b, g b) g, a, b c) b, a, g d) g, b, a

102. A hydrogen atom initially in the ground level absorbs a photon and is excited to n = 4 level then the wavelength of photon is

a) 790 $\mathring{A}$ b) 870 $\mathring{A}$ c) 970 $\mathring{A}$ d) 1070 $\mathring{A}$

103. If n is the orbit number of the electron in a hydrogen atom, the correct statement among the following is

a) electron energy increases as n increases.

b) hydrogen emits infrared rays for the electron transition from n = ∞ to n = 1.

c) electron energy is zero for n = 1. d) electron energy varies as n^2.

104. The equation $4{}_1^1H^+ \to {}_2^4He^{2+}$ +$2e^-$ + 26 MeV represents

a) β- decay b) $\gamma-$decay c) fusion d) fission

105. The ionisation energy of hydrogen atom is 13.6 eV. Following Bohr's theory the energy corresponding to a transition between 3rd and 4th orbit is ______________ .

a) 3.40 eV b) 1.51 eV c) 0.85 eV d) 0.66 eV

106. The energy of hydrogen atom in nth orbit is E_n, then the energy in nth orbit of single ionised helium atom will be _____________ .

a) $4E_n$ b) $E_n/4$ c) $2E_n$ d) $E_n/2$

107. The binding energy per nucleon of deuterium and helium nuclei are 1.1 MeV and 7.0 MeV respectively. When two deuterium nuclei fuse to form a helium nucleus the energy released in the fusion is

a) 23.6 MeV b) 2.2 MeV c) 28.0 MeV d) 30.2 MeV

108. The spectrum obtained from a sodium vapour lamp is an example of ____________ .

a) Band spectrum b) Continous spectrum c) Emission spectrum

d) Absorption spectrum

109. Fission of nuclei is possible because the binding energy per nucleon in them
a) increases with mass number at low mass numbers.
b) decreases with mass number at low mass numbers.
c) increases with mass number at high mass numbers.
d) decreases with mass number at high mass numbers.

110. The energy equivalent of 0.5 g of a substance is:
a) 0.5×10^{13} J b) 4.5×10^{16} J c) 4.5×10^{13} J d) 1.5×10^{13} J

111. If the nuclear radius of ^{27}A1 is 3.6 Fermi, the approximate nuclear radius of ^{64}Cu in Ferm is:
a) 2.4 b) 1.2 c) 4.8 d) 3.6

112. The inverse square law in electrostatics is $\left|\vec{F}\right| = \frac{e^2}{(4\pi\varepsilon_0).r^2}$ for the force between an electron and a proton. The $\left(\frac{1}{r}\right)$ dependence of $\left|\vec{F}\right|$ can be understood in quantum theory as being due to the fact that the 'particle' of light (photon) is massless. If photons had a mass m_p, force would be modified to $\left|\vec{F}\right| = \frac{e^2}{(4\pi\varepsilon_0)r^2}\left[\frac{1}{r^2} + \frac{\lambda}{r}\right].exp(-\lambda r)$ where $\lambda = m_p c/h$ and $h = \frac{h}{2\pi}$. The change ion the ground state energy (eV) of a H-atom if m_p were 10^{-6} times the mass of an electron. (r_B = Bohr's radius)
a) 18.6 λ r_B b) -27.2 c) 27.2 λ r_B d) $-\lambda r_B$

113. The ratio of the radii of the nuclei $_{13}Al^{27}$ and $_{52}\mathrm{Te}^{125}$ is approximately:
a) 6: 10 b) 13: 52 c) 40: 177 d) 14: 73

114. The half life of $^{238}_{92}U$ undergoing α-decay is 4.5×10^9 years. The activity of 1 g sample of $^{238}_{92}U$ is
a) 1.23×10^4 Bq b) 1.23×10^5 Bq c) 1.23×10^3 Bq d) 1.23×10^6 Bq

115. It is possible to understand nuclear fission on the basis of the :
a) liquid drop model of the nucleus b) meson theory of the nuclear forces
c) proton-proton cycle d) independent particle model of the nucleus

116. According to Bohr's theory, the wave number of last line of Balmer series is (R = 1.1×10^7 m^{-1})
a) 5.5×10^5 m^{-1} b) 4.4×10^7 m^{-1} c) 2.75×10^6 m^{-1} d) 2.75×10^8 m^{-1}

117. The energy of second Bohr orbit of the hydrogen atom is - 328 kJ mol^{-1}, hence the energy of fourth Bohr orbit would be :
a) - 41 kJ/mol b) -1312 kJ/mol c) - 164kJ/mol d) - 82 kJ/mol

118. Assertion: Fusion of hydrogen nuclei into helium nuclei is the source of energy of all stars.
Reason: In fusion heavier nuclei split to form lighter nuclei.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

119. An electron in a hydrogen atom makes a transition from n = n_1 to n = n_2. The time period of the electron in the initial state is eight times that in the final state. The possible values of n_1 and n_2 are

a) $n_1 = 4, n_2 = 2$ b) $n_1 = 8, n_2 = 2$ c) $n_1 = 8, n_2 = 1$ d) $n_1 = 6, n_2 = 2$

120. The total energy (E_n) of the electron in the stationary states in the n_{th} orbit of the hydrogen atom is

a) $\frac{-13.6}{n}eV$ b) $\frac{-13.6}{n^2}eV$ c) $\frac{-136}{n}eV$ d) $\frac{-136}{n^2}eV$

121. M_p denotes the mass of a proton and M_n that of a neutron. A given nucleus, of binding energy B, contains Z protons and N neutrons. The mass M(N, Z) of the nucleus is given by (c is the velocity of light) :

a) $M(N, Z) = NM_n + ZM_p + B/c^2$ b) $M(N, Z) = NM_n + ZMp - Bc^2$
c) $M(N, Z) = NM_n + ZMp + Bc^2$ d) $M(N, Z) = NM_n + ZM_p - B/c^2$

122. The fission properties of ${}^{239}_{94}Pu$ are very similar to those of ${}^{235}_{92}U$. The average energy released per fission is 180 MeV If all the atoms in 1 kg of pure ${}^{239}_{94}Pu$ undergo fission, then the total energy released in MeV is

a) 4.53×10^{26}MeV b) 2.21×10^{14}MeV c) 1×10^{13}MeV d) 6.33×10^{24}MeV

123. Two samples X and Y contain equal amount of radioactive substances. If $\frac{1}{16}^{th}$ of the sample X and $\frac{1}{256}^{th}$ of the sample Y, remain after 8 hours, then the ratio of half life periods of X and Y is:

a) 2: 1 b) 1: 2 c) 1: 4 d) 4: 1

124. Two H atoms in the ground state collide inelastically. The maximum amount by which their combined kinetic energy is reduced is

a) 10.2 eV b) 20.4 eV c) 13.6 eV d) 27.2 eV

125. What is the radius of iodine atom? (atomic no. 53 , mass no. 126)

a) 2.5×10^{-11} m b) 2.5×10^{-9} m c) 7×10^{-9} m d) 7×10^{-6} m

126. The Rydberg formula, for the spectrum of the hydrogen atom where all terms have their usual meaning is

a) $h\upsilon_{if} = \frac{me^4}{8\varepsilon_0^2 h^2}\left(\frac{1}{n_f} - \frac{1}{n_i}\right)$ b) $h\upsilon_{if} = \frac{me^4}{8\varepsilon_0^2 h^2}\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$

c) $h\upsilon_{if} = \frac{8\varepsilon_0^2 h^2}{me^4}\left(\frac{1}{n_f} - \frac{1}{n_i}\right)$ d) $h\upsilon_{if} = \frac{8\varepsilon_0^2 h^2}{me^4}\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$

127. Light energy emitted by star is due to

a) breaking of nuclei b) joining of nuclei c) burning of nuclei d) reflection of solar light

128. Hydrogen atom from excited state comes to the ground state by emitting a photon of wavelength λ. If R is the Rydberg constant, then the principal quantum number n of the excited state is

a) $\sqrt{\frac{\lambda R}{\lambda R-1}}$ b) $\sqrt{\frac{\lambda}{\lambda R-1}}$ c) $\sqrt{\frac{\lambda R^2}{\lambda R-1}}$ d) $\sqrt{\frac{\lambda R}{\lambda-1}}$

129. If $M(A;Z)$, M_p and M_n denote the masses of the nucleus ${}^{A}_{Z}X$, proton and neutron respectively in units of u(1 u = 931.5 MeV / C^2) and BE represents its bonding energy in MeV, then ____________ .

a) $M(A,Z) = ZM_p + (A-Z)M_n - BE/c^2$
b) $M(A,Z) = ZM_p + (A-Z)M_n + BE$
c) $M(A,Z) = ZM_p + (A-Z)M_n - BE$
d) $M(A,Z) = ZM_p + (A-Z)M_n + BE/c^2$

130. If speed of electron in ground state energy level is 2.2×10^6 m s^{-1}, then its speed in fourth excited state will be
a) 6.8×10^6 m s^{-1} b) 8.8×10^5 m s^{-1} c) 5.5×10^5 m s^{-1} d) 5.5×10^6m s^{-1}

131. The half life of a radioactive substance is 30 days. What is the time taken to disintegrate to 3/4th of its original mass?
a) 30 days b) 15 days c) 60 days d) 90 days

132. Plutonium decays with half life of 24000 years. If plutonium is stored for 72000 years, the fraction of it that remains is
a) 1/8 b) 1/3 c) 1/4 d) 1/2

133. Heavy water is used as a moderator in a nuclear reactor. The function of the moderator is :
a) to control energy released in the reactor b) to absorb neutrons and stop chain reaction
c) to cool the reactor d) to slow down the neutrons to thermal energies.

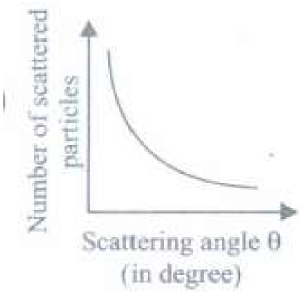
134. **Assertion:** Bohr's postulate states that the electrons in stationary orbits around the nucleus do not radiate.
Reason: According to classical physics, all moving electrons radiate.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanationof assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

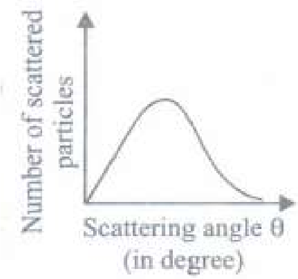
135. If the binding energy per nucleon of deuterium is 1.115 MeV, its mass defect in atomic mass unit is
a) 0.0048 b) 0.0024 c) 0.0012 d) 0.0006

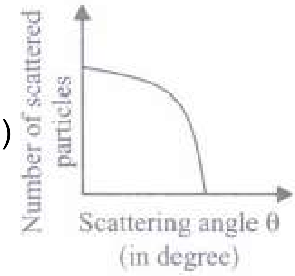
136. Assertion: The whole mass of the atom is concentrated in the nucleus.
Reason: The mass of a nucleus can be either less than or more than the sum of the masses of nucleons present in it.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

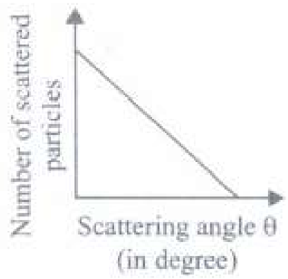
137. The simple Bohr model cannot be directly applied to calculate the energy levels of an atom with many electrons. This is because
a) of the electrons not being subject to a central force
b) of the electrons colliding with each other c) of screening effects
d) the force between the nucleus and an electron will no longer be given by Coulomb's law.

138. The graph of the total number of a-particles scattered at different angles in a given interval of time for a-particle scattering in the Geiger-Marsden experiment is given by

a) 

b) 

c) 

d) 

139. A radioactive nucleus of mass M emits a photon of frequency v and the nucleus recoils. The recoil energy will be :
a) Mc^2-hv b) $h^2v^2/2Mc^2$ c) zero d) hv

140. Alpha-particles are:
a) protons b) positron c) neutrally charged d) ionized helium atoms

141. **Assertion:** Atoms of each element are stable and emit characteristic spectrum.
Reason: The spectrum provides useful information about the atomic structure.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanationof assertion
c) If assertion is true but reason is false d) If both assertion and reason are false.

142. Samples of two radioactive nuclides A and B are taken. λ_A and λ_B are the disintegration constants of A and B respectively. In which of the following cases, the two samples can simultaneously have the same decay rate at any time? Initial rate of decay of A is twice the initial rate of decay of Band AA = AB.
a) Initial rate of decay of A is twice the initial rate of decay of B and $\lambda_A = \lambda_B$
b) Initial rate of decay of A is twice the initial rate of decay of B and $\lambda_A > \lambda_B$
c) Initial rate of decay of B is twice the initial rate of decay of A and $\lambda_A > \lambda_B$
d) Initial rate of decay of B is twice the initial rate of decay of A at t = 2h and $\lambda_B = \lambda_A$

143. A sample has 4×10^{16} radioactive nuclei of half life 10 days. The number of atoms decaying in 30 days is:
a) 3.9×10^{16} b) 5×10^{15} c) 10^{16} d) 3.5×10^{16}

144. The half life of a radioactive substance is 20 s, the time taken for the sample to decay by $7/8^{th}$ of its initial value is
a) 20s b) 40s c) 60s d) 80s

145. The half life period of a radioactive element X is same as the mean life time of another radioactive element Y. Initially, they have the same number of atoms. Then
a) X and Y decay at same rate always b) X will decay faster than Y
c) Y will decay faster than X d) X and Y have same decay rate initially

146. A source S_1 is producing, 10^{15} photons per second of wavelength 5000 $\mathring{A}$. Another source 52 is producing 1.02 x 10^{15} photons per second of wavelength 5100$\mathring{A}$. Then, (power of S_2)/(power of S_1) is equal to :

a) 1.00 b) 1.02 c) 1.04 d) 0.98

147. One requires energy E_n to remove a nucleon from a nucleus and an energy 'E_e' to remove an electron from the orbit of an atom. Then:

a) $E_n = E_e$ b) $E_n < E_e$ c) $E_n > E_e$ d) $E_n \geq E_e$

148. The frequency of radiation emitted when the electron falls from n = 4 to n = 1 in a hydrogen atom will be (Given ionization energy of H = 2.18 X 10^{-18} J/atom and h = 6.625 X 10^{-34} Js) :

a) 3.08×10^{15}/s b) 2.00×10^{15}/s c) 1.54×10^{15}/s d) 1.03×10^{15}/s

149. The halflife of a radioactive nucleus is 50 days. The time interval (t_2-t_1) between the time t_2 when $\frac{2}{3}$ of it has decayed and the time t_1 when $\frac{1}{3}$ of it had decayed is:

a) 30 days b) 50 days c) 60 days d) 15 days

150. The count rate from 100 cm^3 of a radioactive liquid is c. Some of this liquid is now discarded. The count rate of the remaining liquid is found to be c/10 after three half-lives. The volume of the remaining liquid, in cm^3, is

a) 20 b) 40 c) 60 d) 80

151. Which source is associated with a line emission spectrum?

a) Electric fire b) Neon street sign c) Red traffic light d) Sun

152. The ground state energy of H-atom is 13.6 eV. The energy needed to ionise H-atom from its second excited state:

a) 1.51 eV b) 3.4 eV c) 13.6 eV d) 12.1 eV

153. Suppose we consider a large number of containers each contaming initially 10000 atoms of a radioactive material with a half life of 1 year. After 1 year,

a) all the containers will have 5000 atoms of the material.

b)

all the containers will contain the same number of atoms of the material but that number will only be approximately 5000.

c)

the containers will in general have different number of the atoms of the material but their average will be close to 5000.

d) none of containers can have more than 5000 atoms.

154. When a hydrogen atom is raised from the ground state to an excited state:

a) PE decreases and KE increases b) PE increases and KE decreases

c) Both KE and PE decrease d) Absorption spectrum

155. The energy required to break one bond in DNA is 10^{-20} J. This value in eV is nearly:

a) 0.006 b) 6 c) 0.6 d) 0.06

156. When an electron falls from a higher energy to a lower energy level the difference in the energies appears in the form of

a) electromagnetic radiation only b) thermal radiation only

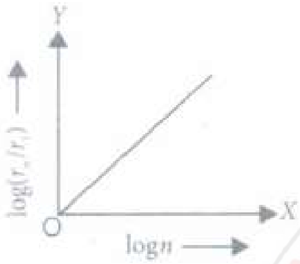
c) both electromagnetic and thermal radiations d) none of these

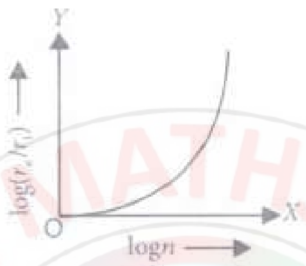
157. In the Geiger-Marsden scattering experiment the number of scattered particles detected are maximum and minimum at the scattering angles respectively at
a) 0° and 180°   b) 180° and 0°   c) 90° and 180°   d) 45° and 90°

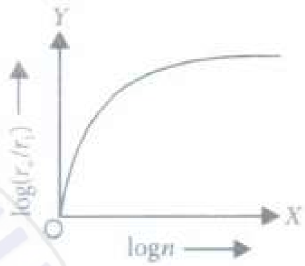
158. A 10 kg satellite circles earth once every 2 h in an orbit having a radius of 8000 km. Assuming that Bohr's angular momentum postulate applies to a satellite just as it does to an electron in the hydrogen atom, then the quantum number of the orbit of satellite is
a) 5.3×10^{40} b) 5.3×10^{45} c) 7.8×10^{48} d) 7.8×10^{50}

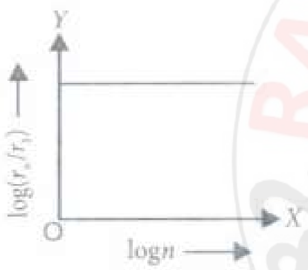
159. Consider 3rd orbit of He^+ (Helium) using nonrelativistic approach, the speed of electron in this orbit will be :
a) 0.73×10^6 m/s   b) 3.0×10^8 m/s   c) 2.92×10^6 m/s   d) 1.46×10^6 m/s

160. In a hydrogen atom, the radius of nth Bohr orbit is r_n, The graph between log(rn/rl) and logn will be

a) 

b) 

c) 

d) 

161. Assertion: The mass of β-particles when they are emitted is higher than the mass of electrons obtained by other means.
Reason: β-particle and electron, both are similar particles.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false.   d) If both assertion and reason are false.

162. If an electron is revolving in its Bohr orbit having Bohr radius of 0.529 $\mathring{A}$, then the radius of third orbit is
a) 4234 nm   b) 4496 $\mathring{A}$ c) 4.761 $\mathring{A}$ d) 5125 nm

163. If separation of two energy levels in an atom is 2.3 eV, then the frequency of radiation emitted when the atom transits from the upper level to the lower level is
a) 2.6×10^{13} Hz   b) 5.6×10^{14} Hz   c) 5.6×10^{18} Hz   d) 2.6×10^{18} Hz

164. Experimental evidence for the existence of the atomic nucleus comes from:
a) Millikan's oil drop experiment   b) Atomic emission spectroscopy
c) The magnetic bending of cathode rays   d) Alpha scattering by a thin metal foil

165. The shortest wavelength in the Balmer series is ($R = 1.097 \times 10^7$ m^{-1})
a) 200 nm   b) 256.8 nm   c) 300 nm   d) 364.6 nm

166. Assertion: A free neutron is unstable.

Reason: Free neutron disintegrates into proton, electron and an anti neutrino i.e.

$n \rightarrow p + \overline{e} + \overline{v}$

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

167. A nucleus with mass number 220 initially at rest emits an α particle. If the Q value of the reaction is 5.5 MeV, the kinetic energy of the α particle is

a) 4.4 MeV b) 5.4 MeV c) 5.6 MeV d) 6.5 MeV

168. The ground state energy of hydrogen atom is -13.6eV. The kinetic energy of the electron in this state is

a) 2.18 x 10^{-14}J b) 2.18 x 10^{-16}J c) 2.18 x 10^{-18}J d) 2.18 x 10^{-19}J

169. Atomic hydrogen has life period of :

a) one minute b) one day c) a fraction of a second d) one hour

170. The relation between the orbit radius and the electron velocity for a dynamically stable orbit in a hydrogen atom is (where, all notations have their usual meanings)

a) $v = \sqrt{\frac{4\pi\varepsilon_0}{me^2r}}$ b) $r = \sqrt{\frac{e^2}{4\pi\varepsilon_0 v}}$ c) $v = \sqrt{\frac{e^2}{4\pi\varepsilon_0 mr}}$ d) $r = \sqrt{\frac{ve^2}{4\pi\varepsilon_0 m}}$

171. Fast neutrons can easily be slowed down by

a) the use of lead shielding b) passing them through water

c) elastic collisions with heavy nuclei d) applying a strong electric field.

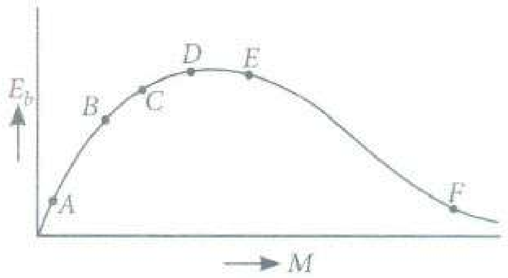
172. The nucleus ${}_6C^{12}$ absorbs an energetic neutron and emits a beta particle (b). The resulting nucleus is ______________ .

a) ${}_7\mathrm{N}^{14}$ b) ${}_7\mathrm{N}^{13}$ c) ${}_5\mathrm{B}^{13}$ d) ${}_6\mathrm{C}^{13}$

173. The number of de Broglie wavelengths contained in the second Bohr orbit of Hydrogen atom is

a) 1 b) 2 c) 3 d) 4

174. Given figure shows a plot of binding energy per nucleon e,against the nuclear mass M. A, B, C, D, E, F correspond to different nuclei. Consider four reactions



(i) A + B $\longrightarrow$ C + ε (ii) C $\longrightarrow$ A + B + ε

(iii) D + E $\longrightarrow$ F + ε (iv) F $\longrightarrow$ D + E + ε

Where E is the energy released. In which reactions is ε positive?

a) (i) and (iii) b) (ii) and (iv) c) (ii) and (iii) d) (i) and (iv)

175. Existence of positively charged nucleus was established by :

a) Positive ray analysis b) a-ray scattering experiments c) X-ray analysis
d) Discharge tube experiments

176. Half-lives of two radioactive substances A and B are respectively 20 minutes and 40 minutes. Initially, the samples of A and B have equal number of nuclei. After 80 minutes the ratio of remaining 'numbers of A and B nuclei is :
a) 1: 16 b) 4: 1 c) 1: 4 d) 1: 1

177. In the nuclear decay given below:
$^{A}_{Z}X \rightarrow {}^{A}_{Z-1}Y \rightarrow {}^{A-4}_{Z-1}B^{*} \rightarrow {}^{A-4}_{Z-1}B$
the particles emitted in the sequence are:
a) g, b, a b) b, g, a c) a, b, g d) b, a, g

178. In the question number 63, the frequency of emitted photon due to the given transition is (h = 6.64×10^{-34} J s, 1 eV = 1.6×10^{-19} J)
a) 2.46×10^{10} Hz b) 2.46×10^{12} Hz c) 2.46×10^{15} Hz d) 2.46×10^{18} Hz

179. Two radioactive nuclei A and B are taken with their disintegration constant λ_A and λ_B and initially N_A and N_B number of nuclei are taken then the time after which their un disintegrated nuclei are same is
a) $\frac{\lambda_A\lambda_B}{(\lambda_A-\lambda_B)}In(\frac{N_B}{N_B})$ b) $\frac{1}{(\lambda_A+\lambda_B)}In(\frac{N_B}{N_A})$ c) $\frac{1}{(\lambda_B-\lambda_A)}In(\frac{N_B}{N_A})$ d) $\frac{1}{(\lambda_A-\lambda_B)}In(\frac{N_B}{N_A})$

180. The mass of proton is 1.0073 u and that of neutron is 1.0087 u (u = atomic mass unit). The binding energy of $_2He^4$ is :
a) 0.061 u b) 0.0305 J c) 0.0305 erg d) 28.4 MeV

181. Ionization potential of hydrogen atom is 13.6 eV. Hydrogen atoms in the ground state are excited by monochromatic radiation of photon energy 12.1 eV. According to Bohr's theory, the spectral lines emitted by hydrogen will be ____________.
a) Three b) Four c) One d) Two

182. The half life of $^{90}_{38}Sr$ is 28 years. The disintegration rate of 15 mg of this isotope is of the order of:
a) 10^{11} Bq b) 10^{10} Bq c) 10^{7} Bq d) 10^{9} Bq

183. Energy is absorbed in the hydrogen atom giving absorption spectra when transition takes place from
a) n = 1 → n' where n' > 1 b) n = 2 → 1 c) n' → n d) n → n' = ∞

184. The Binding energy per nucleon of $^{7}_{3}Li$ and $^{4}_{2}He$ nuclei are 5.60 MeV and 7.06 MeV, respectively. In the nuclear reaction $_3Li^7 + {}_1H^1 \rightarrow {}_2He^4 + {}_3He^4 + Q$ the value of energy Q released is :
a) 8.4 MeV b) 17.3 MeV c) 19.6 MeV d) - 2.4 MeV

185. Assertion: The detection of neutrinos is extremely difficult.
Reason: Neutrinos interact only very weakly with matter.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

186. Energy E of a hydrogen atom with principal quantum number n is given by E = $-13.6/n^2$ eV. The energy of photon ejected when the electron jumps from n = 3 state to n = 2 state of hydrogen is approximately;
a) 1.9 eV b) 1.5 eV c) 0.85 eV d) 3.4 eV

187. The volume occupied by an atom is greater than the volume of the nucleus by a factor of about:
a) 10^{15} b) 10^1 c) 10^5 d) 10^{10}

188. The half-life of a radioactive isotope 'X' is 20 years. It decays to another element 'Y' which is stable. The two elements 'X' and 'Y' were found to be in the ratio 1:7 in a sample of a given rock. The age of the rock is estimated to be :
a) 40 years b) 60 years c) 80 years d) 100 years

189. An ionised H-molecule consists of an electron and two protons. The protons are separated by a small distance of the order of angstrom. In the ground state,
a) the electron would not move in circular orbits
b) the energy would be $(2)^4$ times that of a H-atom
c) the molecule will soon decay in to a proton and a H-atom d) none of these

190. In question number 70, what is the frequency of photon?
a) 3.1×10^{15}Hz b) 3.1×10^{18}Hz c) 9.1×10^{15}Hz d) 9.1×10^{18}Hz

191. The first spectral series was discovered by
a) Balmer b) Lyman c) Paschen d) Pfund

192. An electron is accelerated from rest through a potential difference of V volt. If the de-Broglie wavelength of the electrons is 1.227×10^{-2} nm, the potential difference is:
a) 10^4 V b) 10 V c) 10^2 V d) 10^3 V

193. In the Geiger-Marsden scattering experiment, in case of head-on collision the impact parameter should be
a) maximum b) minimum c) infinite d) zero

194. The energy of a hydrogen atom in the ground state is - 13.6 eV. The energy of He^+ ion in the first excited state will be :
a) -13.6 eV b) - 27.2 eV c) - 54.4 eV d) - 6.8 eV

195. A radioactive element has half-life period 800 yr. After 6400 yr, what amount will remain?
a) $\frac{1}{2}$ b) $\frac{1}{16}$ c) $\frac{1}{8}$ d) $\frac{1}{256}$

196. If υ_1 is the frequency of the series limit of Lyman series, υ_2 is the frequency of the first line of Lyman series and υ_3 is the frequency of the series limit of the Balmer series, then
a) $\upsilon_1 - \upsilon_2 = \upsilon_3$ b) $\upsilon_1 = \upsilon_2 - \upsilon_3$ c) $\frac{1}{\upsilon_2} = \frac{1}{\upsilon_1} + \frac{1}{\upsilon_3}$ d) $\frac{1}{\upsilon_1} = \frac{1}{\upsilon_2} + \frac{1}{\upsilon_3}$

197. If the wavelength of the first line of the Balmer series of hydrogen is 6561 $\overset{o}{A}$, the wavelength of the second line of the series should be
a) l3122$\overset{o}{A}$ b) 3280 $\overset{o}{A}$ c) 4860 $\overset{o}{A}$ d) 2187 $\overset{o}{A}$

198. The equivalent energy of 1 g of substance is:
a) 9×10^{13}J b) 6×10^{12}J c) 3×10^{13}J d) 6×10^{13}J

199. Tritium is an isotope of hydrogen whose nucleus triton contains 2 neutrons and 1 proton. Free neutrons decay into p $+\bar{e}+\bar{v}$. If one of the neutrons in triton decays, it would transform into He^3 nucleus. This does not happen. This is because

a) Triton energy is less than that of a He^3nucleus.

b) the electron created in the beta decay process cannot remain in the nucleus.

c)
both the neutrons in triton have a decay simultaneously resulting in a nucleus with 3 protons, which is not a He^3 nucleus.

d)
because free neutrons decay due to external perturbations which is absent in a triton nucleus.

200. In a radioactive material the activity at time t_1 is R_1 and at a later time t_2, it is R_2. If the decay constant of the material is 1, then

a) $R_1 = R_2 e^{\lambda(t_1-t_2)}$ b) $R_1 = R_2 e^{t_1/t_2}$ c) $R_1 = R_2$ d) $R_1 = R_2 e^{-\lambda(t_1-t_2)}$

201. The Bohr model for the H-atom relies on the Coulomb's law of electrostatics. Coulomb's law has not directly been verified for very short distances of the order of angstroms. Supposing Coulomb's law between two opposite charge + q_1 , - q_2 is modified to

$= \frac{q_1 q_2}{4\pi\varepsilon_0}\frac{1}{R_0^2}\left(\frac{R_0}{r}\right)^{\varepsilon}, r \le R_0$ Calculate in such a case, the ground state energy (in eV) of a H-atom, if ε = 0.1, R_0 = 1 $\mathring{A}$.

a) -11.4 b) -17.3 c) 5.9 d) -23.2

202. When atoms are bombarded with alpha particles, only a few in million suffer deflection, others pass out undeflected. This is because:

a) The force of repulsion on the moving alpha particle is small

b)
The force of attraction on the alpha particle to the oppositely charged electrons is very small

c) There is only one nucleus and large number of electrons

d) The nucleus occupies much smaller volume compared to the volume of the atom

203. Let $E_n = \frac{-me^4}{8\varepsilon_0^2 n^2 h^2}$ be the energy of the n^{th} level of H-atom. If all the H -atoms are in the ground state and radiation of frequency $(E_2 - E_1)/h$ falls on it, then

a) it will not be absorbed at all b) some of atoms will move to the first excited state

c) all atoms will be excited to the n = 2 state

d) all atoms will make a transition to the n = 3 state

204. The activity of a radioactive sample is measured as 9750 counts per minute at t = 0 and as 975 counts per minute at t = 5 minutes. The decay constant is approximately:

a) 0.922 per minute b) 0.691 per minute c) 0.461 per minute d) 0.230 per minute

205. **Assertion:** Atom as a whole is electrically neutral.

Reason : Atom contains equal amount of positive and negative charges.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertionand reason are true but reason is not the correct explanationof assertion

c) If assertion is true but reason is false d) If both assertion and reason are false.

206. The half life of a radioactive nucleus is 50 days. The time interval (t_2 - t_1) between the time t_2 when 2/3 of it has decayed and the time t_1 when 1/3 of it had decayed is :
a) 50 days b) 60 days c) 15 days d) 30 days

207. The ratio of longest wavelengths corresponding to Lyman and Balmer series in hydrogen spectrum is ____________ .
a) $\frac{3}{23}$ b) $\frac{7}{29}$ c) $\frac{9}{31}$ d) $\frac{5}{27}$

208. How much mass has to be converted into energy to produce electric power of 500 MW for one hour?
a) 2×10^{-5}kg b) 1×10^{-5}kg c) 3×10^{-5}kg d) 4×10^{-5}kg

209. A radioactive element x with half life 2 h decays giving a stable element Y. After a time t, ratio of X and Y atoms is 1: 16. Time t is
a) 6h b) 4h c) 8h d) 16h

210. An electron emitted in beta radiation originates from:
a) inner orbits of atom b) free electrons existing in the nuclei
c) decay of a neutron in a nuclei d) photon escaping from the nucleus

211. A nucleus ruptures into two nuclear parts, which have their velocity ratio equal to 2: 1 What will be the ratio of their nuclear size (nuclear radius)?
a) $2^{1/3}$: 1 b) 1: $2^{1/3}$ c) $3^{1/2}$: 1 d) 1: $3^{1/2}$

212. Consider aiming abeam offree electrons towards free protons. When they scatter, an electron and a proton cannot combine to produce a H-atom, because of
a) energy conservation b) simultaneously releasing energy in the from of radiation
c) momentum conservation d) angular momentum conservation

213. The activity of a radioactive sample is measured as N_0 counts per minute at t = 0 and N_0/e counts per minute at t = 5 minutes. The time (in minutes) at which the activity reduces to half its value is :
a) $\log_e 2/5$ b) $5/1og_e 2$ c) $51og_{10}2$ d) $5\log_e 2$

214. Assertion: Neutrons penetrate matter more readily as compared to protons.
Reason: A neutron has no charge.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

215. Pick out the incorrect statement from the following.
a) β^- from the nucleus is always accompanied with a neutrino.
b) The energy of the α-particle emitted from a given nucleus is always constant.
c) γ-ray emission makes the nucleus more stable d) Nuclear force is charge-independent.

216. The mass of ${}_3^7Li$ is 0.042 amu less than the sum of masses of its constituents. The binding energy per nucleon is
a) 2.433 MeV b) 3.739 MeV c) 5.586 MeV d) 10.522 MeV

217. The nuclei $\underset{6}{C^{13}}$ and ${}_7N^{14}$ can be described as:
a) isotones b) isobars c) isotopes of carbon d) isotopes of nitrogen

218. When hydrogen atom is in its first excited level, its radius is ___________ .
a) Four times, its ground state radius b) Twice, its ground state radius
c) Same as its ground state radius d) Half of its ground state radius

219. Out of the following which one is not a possible energy for a photon to be emitted by hydrogen atom according to Bohr's atomic model?
a) 0.65 eV b) 1.9 eV c) 11.1 eV d) 13.6 eV

220. If the nucleus of ${}_{13}AI^{27}$ has a nuclear radius of about 3.6fm, then ${}_{52}Te^{125}$ would have its radius approximately as
a) 9.6 fm b) 12 fm c) 4.8 fm d) 6 fm

221. The ionisation energy of hydrogen atom is 13.6 eV the ionisation energy of helium atom would be:
a) 13.6 eV b) 27.2 eV c) 6.8 eV d) 54.4 eV

222. The electric current I created by the electron in the ground state of H atom using Bohr model in terms of Bohr radius (a_0) and velocity of electron in first orbit v_0 is
a) $\frac{ev_0}{2\pi a_0}$ b) $\frac{2\pi a}{ev_0}$ c) $\frac{2\pi a}{v_0}$ d) $\frac{v_0}{2\pi a}$

223. Assertion: Naturally, thermonuclear fusion reaction is not possible on earth.
Reason: For thermonuclear fusion to take place, extreme condition of temperature and pressure are required.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

224. Assertion: The radius of a nucleus determined by electron scattering is found to be slightly different from that determined by alpha particle scattering.
Reason: Electron scattering senses the charge distribution of the nucleus whereas alpha and similar particles sense the nuclear matter.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

225. The deuteron is bound by nuclear forces just as H -atom is made up of p and e bound by electrostatic forces. If we consider the force between neutron and proton in deuteron as given in the form of a Coulomb potential but with an effective charge e' $F = \frac{1}{4\pi\varepsilon_o}\frac{e'^2}{r}$ Estimate the value of (e'/e) given that the binding energy of a deuteron is 2.2 MeV.
a) 1.89 b) 9.24 c) 3.64 d) 7.62

226. When an electron jumps from L to K shell :
a) Energy is absorbed b) Energy is released
c) Energy is sometimes absorbed and sometimes released
d) Energy is neither absorbed nor released

227. Assertion: There occurs a chain reaction when uranium is bombarded with slow neutrons.
Reason: When uranium is bombarded with slow neutrons more neutrons are produced.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

228. The binding energy of a H-atom, considering an electron moving around a fixed nuclei (proton), is

B=$\frac{me^4}{8n^2\varepsilon_0^2h^2}$ (m = electron mass). If one decides to work in a frame of reference where the electron is at rest, the proton would be moving around it. By similar arguments, the binding energy would be

B=$\frac{me^4}{8n^2\varepsilon_0^2h^2}$ (M = proton mass)

This last expression is not correct because

a) n would not be integral b) Bohr-quantisation applies only to electron

c) the frame in which the electron is at rest is not inertial

d) the motion of the proton would not be in circular orbits, even approximately

229. The mass of alpha-particle is :

a) less than the sum of masses of two protons and two neutrons

b) equal to mass of four protons c) equal to mass of four neutrons

d) equal to sum of masses of two protons and two neutron

230. What is the respective number of α and β-particles emitted in the following radiactive decay

$^{200}X_{90}{}^{3/4} \rightarrow 168Y_{80}$?

a) 6 and 8 b) 6 and 6 c) 8 and 8 d) 8 and 6

231. A 280 day old radioactive substance shows an activity of 6000 dps, 140 days later its activity becomes 3000 dps. What was its initial activity?

a) 20000 dps b) 24000 dps c) 12000 dps d) 6000 dps

232. In the given reactions, which of the following nuclear fusion reaction is not possible?

a) $^{13}_{6}C +^{1}_{1} H \rightarrow^{14}_{6} C + 4.3MeV$ b) $^{12}_{6}C +^{1}_{1} H \rightarrow^{13}_{7} C + 2MeV$

c) $^{14}_{7}N +^{1}_{1} H \rightarrow^{15}_{8} O + 7.3MeV$ d) $^{235}_{92}C +^{1}_{0} n \rightarrow^{140}_{54} Xe +^{94}_{38} Sr +^{1}_{0} n +^{1}_{0} n + 200MeV$

233. In which of the following Bohr's orbit (n) a hydrogen atom emits the photons of lowest frequency?

a) n = 2 to n = 1 b) n = 4 to n = 2 c) n = 4 to n = 1 d) n = 4 to n = 3

234. The angular speed of the electron in the n^{th} orbit of Bohr's hydrogen atom is

a) directly proportional to n b) inversely proportional to $\sqrt{n}$ c) inversely proportional to n^2

d) inversely proportional to n^3

235. The gravitational force between a H -atom and another particle of mass m will be given by

Newton's law: F =$G\frac{M.m}{r^2}$where ris in km and

a) M is not related to the mass of the hydrogen atom.

b)

M = m_{proton} + $m_{electron}$ $-\frac{|V|}{C^2}$ ($|V|$ =magnitude of the potential energy of electron in the H-atom).

c) M= m_{proton} + $m_{electron}$ d) M = m_{proton} + $m_{electron}$ $-\frac{B}{C^2}$ (B=13.6eV)

236. In a nuclear fusion reaction, two nuclei, A & B, fuse to produce a nucleus C, releasing an amount of energy $\triangle$E in the process. If the mass defects of the three nuclei are $\triangle M_A$, $\triangle M_B$ & $\triangle M_C$ respectively, then which of the following relations holds? Here, c is the speed of light.

a) $\triangle M_A + \triangle M_B = \triangle M_C - \triangle E/C^2$ b) $\triangle M_A + \triangle M_B = \triangle M_C + \triangle E/C^2$

c) $\triangle M_A - \triangle M_B = \triangle M_C - \triangle E/C^2$ d) $\triangle M_A - \triangle M_B = \triangle M_C + \triangle E/C^2$

237. How long can an electric lamp of 100 W be kept glowing by fusion of 2.0 kg of deuterium? Take the fusion reaction as ${}_1^2H +{}_1^2 H \rightarrow{}_2^3 He + n + 3.27$MeV

a) 2.4 x 10^6 years b) 7.4 x 10^4 years c) 1.6 x 10^6 years d) 4.9 x 10^4 years

238. The power obtained in a reactor using U^{235} disintegration is 1000 kW, The mass decay of U^{235} per hour is:

a) 10 microgram b) 20 microgram c) 40 microgram d) 1 microgram

239. The first line of the Lyman series in a hydrogen spectrum has a wavelength of 1210 $\mathring{A}$. The corresponding line of a hydrogen- like atom of Z = 11 is equal to

a) 4000 $\mathring{A}$ b) 100 $\mathring{A}$ c) 40 $\mathring{A}$ d) 10 $\mathring{A}$

240. Let m_p be the mass of a proton, m_n the mass of a neutron, M_1 the mass of a ${}_{10}^{20}Ne$ nucleus and M_2 the mass of a ${}_{20}^{40}Ca$ nucleus. Then

a) $M_2 = M_1$ b) $M_2 > 2M_1$ c) $M_2 < 2M_1$ d) $M_1 < 10 (m_n + m_p)$

241. The most penetrating radiation of the following is:

a) gamma-rays b) alpha particles c) beta-rays d) X-rays

242. Deuterium was discovered in 1932 by Harold Urey by measuring the small change in wavelength for a particular transition in ^{1}H and ^{2}H. This is because, the wavelength of transition depend to a certain extent on the nuclear mass. If nuclear motion is taken into account then the electrons and nucleus revolve around their common centre of mass. Such a system is equivalent to a single particle with a reduced mass μ, revolving around the nucleus at a distance equal to the electron-nucleus separation. Here μ = $m_eM/(m_e + M)$ where M is the nuclear mass and m_e is the electronic mass. Estimate the percentage difference in wavelength for the 1st line of the Lyman series in ^{1}H and ^{2}H. (Mass of ^{1}H nucleus is 1.6725 $\times$ 10^{-27} kg, Mass of ^{2}H nucleus is 3.3374 $\times$ 10^{-27} kg, Mass of electron = 9.10^9 $\times$ 10^{-31} kg.)

a) 2.7 $\times$ 10^{-1} % b) 2.7 $\times$ 10^{-2}% c) 3.5 $\times$ 10^{-2}% d) 3.5 $\times$ 10^{-1}%

243. When beryllium is bombarded with a-particles, extremely penetrating radiations which cannot be deflected by electrical or magnetic field are given out. These are:

a) A beam of protons b) a-rays c) A beam of neutrons d) X-rays

244. Order of magnitude of density of uranium nucleus is:

a) 10^{20} kg m^{-3} b) 10^{17} kgm^{-3} c) 10^{14} kg m^{-3} d) 10^{11} kgm^{-3}

245. **Assertion:** Most of the mass of the atom is concentrated in its nucleus.
Reason: All alpha particles striking a gold sheet are scattered in different directions.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanationof assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

246. In the question number 79, what would be the angular momentum of H_γ photon if the angular momentum of the system is conserved
a) h b) 2 h c) 3 h d) 4 h

247. Thermal neutrons are those which
a) Are at very high temperature b) Move with high velocities
c) Have kinetic energies similar to those of surrounding molecules d) Are at rest

248. The average binding energy of a nucleon inside an atomic nucleus is about ____________ .
a) 8 MeV b) 8 eV c) 8 J d) 8 erg

249. **Assertion:** Hydrogen atom consists of only one electron but its emission spectrum has many lines.
Reason : Only Lyman series is found in the absorption spectrum of hydrogen atom whereas in the emission spectrum, all the series are found.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanationof assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

250. M_x and M_y denote the atomic masses of the parent and the daughter atom respectively in a radioactive decay. The Q-value for a β^-decay is Q_1 and that for a β^+decay is Q_2. If m_e denotes the mass of an electron, then which of the following statements is correct?
a) $Q_1 = (M_x - M_y)c^2$ and $Q_2 = (M_x - M_y - 2m_e)c^2$ b) $Q_1 = (M_x - M_y)c^2$ and $Q_2 = (M_x - M_y)c^2$
c) $Q_1 = (M_x - M_y - 2m_e)\ C^2$ and $Q_2 = (M_x - M_y + 2me)C^2$
d) $Q1 = (M_x - M_y + 2m_e)c^2$ and $Q2 = (Mx - M_y + 2m_e)c^2$

251. A sample of radioactive material has mass m, decay constant λ, molecular weight M and Avogadro constant N_A. The initial activity of the sample is
a) λm b) $\frac{\lambda m}{M}$ c) $\frac{\lambda m N_A}{M}$ d) $m N_A \lambda$

252. **Assertion:** Bohr model can not be extended to two or more electron atoms.
Reason : Each electron in the atom interacts not only with the positively charged nucleus but also with all other electrons.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanationof assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

253. When an electron jumps from the fourth orbit to the second orbit, one gets the
a) second line of Paschen series b) second line of Balmer series
c) first line of Pfund series d) second line of Lyman series

254. In which of the following systems will the radius of the first orbit (n =1) be minimum?

a) Hydrogen atom b) Doubly ionized lithium c) Singly ionized helium d) Deuterium atom

255. If a proton had a radius R and the charge was uniformly distributed, the ground state energy (in eV) of a H-atom for R = 0.1 $\mathring{A}$ is

a) -13.6 b) -27.2 c) -3.4 d) -30.8

256. The constituents of atomic nuclei are believed to be:

a) neutrons and protons b) protons only c) electrons and protons

d) electrons, protons and neutrons

257. α-particles, β-particles and γ-rays are all having same energy. Their penetrating power in a given medium in increasing order will be _______________ .

a) b, g, a b) g, a, b c) a, b, g d) b, a, g

258. The mass of a $^{7}_{3}\mathrm{Li}$ nucleus is 0.042 u less than the sum of the masses of all its nucleons. The binding energy per nucleon of $^{7}_{3}\mathrm{Li}$ nucleus is nearly:

a) 46 MeV b) 5.6 MeV c) 3.9 MeV d) 23 MeV

259. **Assertion:** According to electromagnetic theory an accelerated particle continuously emits radiation.

Reason: According to classical theory, the proposed path of an electron in Rutherford atom model will be parabolic.

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertionand reason are true but reason is not the correct explanationof assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

260. A deuteron strikes $_{8}O^{16}$ nucleus with subsequent emission of an alpha particle. Identify the nucleus so produced:

a) $_{3}Li^{7}$ b) $_{5}B^{10}$ c) $_{7}N^{13}$ d) $_{7}N^{14}$

261. A certain mass of Hydrogen is changed to Helium by the process of fusion. The mass defect in fusion reaction is 0.02866 a.m.u. The energy liberated per a.m.u. is:

(Given: 1a.m.u = 931 MeV)

a) 26.7 MeV b) 6.675 MeV c) 13.35 MeV d) 2.67 MeV

262. If in nuclear fusion process the masses of the fusing nuclei be m_1 and m_2 and the mass of the resultant nucleus be m_3 then:

a) $m_3 > (m_1 + m_2)$ b) $m_3 = m_1 + m_2$ c) $m_3 = | m_1 - m_2 |$ d) $m_3 < (m_1 + m_2)$

263. An electron in the hydrogen atom jumps from excited state n to the ground state. The wavelength so emitted illuminates a photosensitive material having work function 2.15 eV. If the stopping potential of the photoelectron is 10 V, the value of n is _____________ .

a) 3 b) 4 c) 5 d) 2

264. If 200 MeV energy is released in the fission of a single nucleus of $^{235}_{92}U$,the fissions which are required to produce a power of 1 kW is

a) 3.125×10^{13} b) 1.52×10^{6} c) 3.125×10^{12} d) 3.125×10^{14}

265. The nucleus $_{48}Cd^{115}$, after two successive β-decay will give _______________ .

a) $_{46}\mathrm{Pa}^{115}$ b) $_{49}In^{114}$ c) $_{50}Sn^{113}$ d) $_{50}Sn^{115}$

266. Assertion: Nuclear sources will give a million times larger energy than conventional sources.

Reason: Nuclear energy sources are massive than conventional energy sources

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false.

267. Nuclei of a radioactive element A are being produced at a constant rate α. The element has a decay constant λ. At time t = 0, there are N_o. nuclei of the element. The number N of nuclei of A at time t is :

a) $\frac{1}{\lambda}[\alpha+(\alpha-N_o\lambda)e^{-\lambda t}]$ b) $\frac{1}{\lambda}[\alpha-(\alpha-N_o\lambda)e^{-\lambda t}]$ c) $[\alpha-(\alpha-N_o\lambda)e^{-\lambda t}]$

d) $[\alpha-(N_o\lambda-\alpha)e^{-\lambda t}]$

268. The ground state energy of hydrogen atom is 13.6 eV. When its electron is in the first excited state, its excitation energy is _______________ .

a) 3.4 eV b) 6.8 eV c) 10.2 eV d) 0

269. Two nuclei have their mass numbers in the ratio of 1:3. The ratio of their nuclear densities would be:

a) 1:3 b) 3:1 c) $(3)^{1/3}$:1 d) 1:1

270. In the question number 59, the value of velocity of the revolving electron is:

a) 1.2×10^6 ms^{-1} b) 2.2×10^6 ms^{-1} c) 3.2×10^6 ms^{-1} d) 4.2×10^6 ms^{-1}

271. If 13.6 eV energy is required to separate a hydrogen atom into a proton and an electron, then the orbital radius of electron in a hydrogen atom is

a) 5.3×10^{-11} m b) 4.3×10^{-11} m c) 6.3×10^{-11} m d) 7.3×10^{-11} m

272. A proton carrying 1 MeV kinetic energy is moving in a circular path of radius R in uniform magnetic field. What should be the energy of an a-particle to describe a circle of same radius in the same field?

a) 1 MeV b) 0.5 MeV c) 4 MeV d) 2 MeV

273. In one a and 2β-emissions:

a) Mass number reduces by 2 b) Mass number reduces by 6

c) Atomic number reduces by 2 d) Atomic number remains unchanged

274. The nuclei of which one of the following pairs of nuclei are isotones?

a) $34Se^{74}, {}_{31}Ga^{71}$ b) ${}_{38}Sr^{84}, {}_{38}Sr^{86}$ c) ${}_{42}Mo^{92}, {}_{40}Zr^{92}$ d) ${}_{20}Ca^{40}, {}_{16}S^{32}$

275. Solar energy is mainly caused due to :

a) gravitational contraction b) burning of hydrogen in the oxygen

c) fission of uranium present in the Sun

d) fusion of protons during synthesis of heavier elements

276. Heavy stable nuclei have more neutrons than protons. This is because of the fact that

a) neutrons are heavier than protons. b) electrostatic force between protons are repulsive.

c) neutrons decay into protons through beta decay.

d) nuclear forces between neutrons are weaker than that between protons.

277. The natural boron of atomic weight 10.81 is found to have two isotopes ^{10}B and ^{11}B. The ratio of abundance of isotopes of natural boron should be

a) 11:10 b) 81:19 c) 10:11 d) 19:81

278. When an atomic gas or vapour is excited at low pressure, bypassing an electric current through it then
a) emission spectrum is observed b) absorption spectrum is observed
c) band spectrum is observed d) both (b) and (c)

279. The value of ionisation energy of the hydrogen atom is
a) 3.4 eV b) 10.4 eV c) 12.09 eV d) 13.6 eV

280. **Assertion:** In alpha particle scattering number of alpha particle undergoing head on collision is small.
Reason : Small fraction of the number of incident particles rebound back.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanationof assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

281. Tritium with a half-life of 12.5 years undergoing beta decay. What fraction of a sample of pure tritium will remain undecayed after 25 years.
a) one half b) one fourth c) one third d) can't say

282. During negative β-decay, an antineutrino is also emitted along with the emitted electron. Then,
a) only linear momentum will be conserved
b) total linear momentum and total angular momentum but not total energy will be conserved
c) total linear momentum and total energy but not total angular momentum will be conserved
d) total linear momentum, total angular momentum and total energy will be conserved

283. Atomic power station at Tarapore has a generating capacity of 200 MW. The energy generated in a day by this station is :
a) 200 MW b) 200 J c) 4800 x 10^6 J d) 1728 x 10^{10}J

284. In Balmer series of emission spectrum of hydrogen, first four lines with different wavelength H $_\alpha$'Hβ,H $_\gamma$ and H$_8$ are obtained. Which line has maximum frequency out of these?
a) H_α b) H_β c) H_γ d) H_8

285. **Assertion :** Bohr's third postulate states that the stationary orbits are those for which the angular momentum is some integral multiple of h2πh2π.
Reason : Linear momentum of the electron in the atom is quantised.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanationof assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

286. Assertion: When a nucleus is in an excited state, it can make a transition to a lower energy state by the emission of gamma rays.
Reason: There are energy levels for a nucleus just like there are energy levels in atoms.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

287. Which of the following postulates of the Bohr model led to the quantization of energy of the hydrogen atom?
a) The electron goes around the nucleus in circular orbits.
b) The angular momentum of the electron can only be an integral multiple of $h/2\pi$.
c) The magnitude of the linear momentum of the electron is quantized
d) Quantization of energy is itself a postulate of the Bohr model.

288. Solar energy is due to :
a) fusion reaction b) fission reaction c) combustion reaction d) chemical reaction

289. Radon has 3.8 days as its half-life. How much radon will be left out of 15 mg mass after 38 days?
a) 1.05 mg b) 0.015 mg c) 0.231 mg d) 0.50 mg

290. The binding energy of deuteron is 2.2 MeV and that of ${}_{2}^{4}\mathrm{He}$ is 28 MeV. If two deuterons are fused to form one ${}_{2}^{4}\mathrm{He}$, then the energy released is ______________ .
a) $23.6\mathrm{MeV}$ b) $19.2\mathrm{MeV}$ c) $30.2\mathrm{MeV}$ d) $25.8\mathrm{MeV}$

291. Electron occupies the available orbital singly before pairing in anyone orbital occurs, it is :
a) Pauli's exclusion principle b) Hund's Rule c) Heisenberg's principle
d) Prout's hypothesis

292. A triply ionized beryllium (Be^{3+}) has the same orbital radius as the ground state of hydrogen. Then the quantum state n of Be^{3+} is
a) n = 1 b) n = 2 c) n = 3 d) n = 4

293. A sample of a radioactive element has a mass of 10 g at an instant t = 0. The approximate mass of this element in the sample left after two mean lives is
a) 1.35 g b) 2.50 g c) 3.70 g d) 6.30 g

294. The ionization energy of the electron in the hydrogen atom in its ground state is 13.6 eV. The atoms are excited to higher energy levels to emit radiations of 6 wavelengths. Maximum wavelength of emitted radiation corresponds to the transition between ______________ .
a) n=3 to n=1 states b) n=2 to n=1 states c) n=4 to n=3 states d) n=3 to n=2 states

295. The wavelength limit present in the Pfund series is ($R = 1.097 \times 10^{7}\ m^{-1}$)
a) 1572 nm b) 1898 nm c) 2278 nm d) 2535 nm

296. An electron changes its position from orbit n = 2 to the orbit n = 4 of an atom. The wavelength of the emitted radiations is (R = Rydbery's constant)
a) $\frac{16}{R}$ b) $\frac{16}{3R}$ c) $\frac{16}{5R}$ d) $\frac{16}{7R}$

297. The relationship between kinetic energy (K) and potential energy (U) of electron moving in a orbit around the nucleus is
a) U = -K b) U = -2K c) U = -3K d) $U = -\frac{1}{2}K$

298. Two radioactive nuclei P and Q, in a given sample decay into a stable nucleolus R. At time t = 0, number of P species are $4N_0$ and that of Q are N_0. Half-life of P (for conversion to R) is 1 minute where as that of Q is 2 minutes. Initially there are no nuclei of R present in the sample. When number of nuclei of P and Q are equal, the number of nuclei of R present in the sample would be:
a) $3\ N_0$ b) $\frac{9N_0}{2}$ c) $\frac{5N_0}{2}$ d) $2\ N_0$

299. If E is the energy of n^{th} orbit of hydrogen atom the energy of n^{th} orbit of He atom will be

a) E b) 2E c) 3E d) 4E

300. Ratio of longest wave lengths corresponding to Lyman and Balmer series in hydrogen spectrum is:

a) 5/27 b) 3/23 c) 7/29 d) 9/3

301. The ground state energy of an atom is -13.6 eV. The photon emitted during the transition of electron from n = 3 to n = 1 state, is incident on a photosensitive material of unknown work function. The photoelectrons are emitted from the materials with a maximum kinetic energy of 9 eV. The threshold wavelength of the material used is

a) 0.9×10^{-7} m b) 4×10^{-7} m c) 0.47×10^{-7} m d) 9×10^{-7} m

302. In a Rutherford scattering experiment when a projectile of charge Z_1 and mass M_1 approaches a target nucleus of charge Z_2 and mass M_2, the distance of closest approach is r_0. The energy of the projectile is

a) Directly proportional to $Z_1 Z_2$ b) Inversely proportional to Z_1

c) Directly proportional to mass M_1 d) Directly proportional to $M_1 \times M_2$

303. The shortest wavelength present in the Paschen series of spectral lines is

a) 720 nm b) 790 nm c) 800 nm d) 820 nm

304. The wavelength of the first line of Lyman series for hydrogen atom is equal to that of the second line of Balmer series for hydrogen like ion. The atomic number Z of hydrogen like ion is :

a) 3 b) 4 c) 1 d) 2

305. The half-life of a radioactive substance is 30 minutes. The time (in minutes) taken between 40% decay and 85% decay of the same radioactive substance is :

a) 15 b) 30 c) 45 d) 60

306. Hydrogen atom emits light when it changes from n = 5 energy level to n = 2 energy level. Which colour oflight would the atom emit?

a) red b) yellow c) green d) violet

307. Wavelength of spectral line emitted is inversely proportional to :

a) Radius b) Energy c) Velocity d) Quantum number

308. Which of the following is not correct about Bohr model of the hydrogen atom?

a)
An electron in an atom could revolve in certain stable orbits without the emission of radiant energy.

b)
Electron revolves around the nucleus only in those orbits for which angular momentum $L_n = \frac{nh}{2\pi}$.

c)
When electron make a transition from one ofits stable orbit to lower orbit then a photon emitted with energy $hv = E_f - E_i$

d) Bohr model is applicable to all atoms.

309. The stable nucleus that has a radius half that of Fe^{56} is:

a) Li^7 b) Na^{21} c) S^{16} d) Ca^{40}

310. In Geiger-Marsden scattering experiment, the trajectory traced by an α-particle depends on
a) number of collision b) number of scattered α- particles c) impact parameter
d) none of these

311. Complete the equation for the following fission process.
$_{92}\mathrm{U}^{235} + _0n^1 3/4 \rightarrow _{38}\mathrm{Sr}^{90} + \ldots\ldots$
a) $_{54}\mathrm{Xe}^{143} + 3_0n^1$ b) $_{54}\mathrm{Xe}^{145}$ c) $_{57}\mathrm{Xe}^{142}$ d) $_{54}\mathrm{Xe}^{142} + _0n^1$

312. To explain his theory Bohr used;
a) Conservation of linear momentum b) Conservation of angular momentum
c) Conservation of quantum frequency d) Conservation of energy

313. In the question number 67, find the potential energy of electron (in Joule) in the given state.
a) -4.36 × 10-14 J b) -4.36 × 10^{-16} J c) -4.36 × 10^{-17} J d) -4.36 × 10^{-18} J

314. A nuclear reaction is given by
$_zX^A \rightarrow _{z+1}Y^A + _{-1}e^0 + \bar{v}$, represents :
a) fission b) β-decay c) g-decay d) fusion

315. O_2 molecule consists of two oxygen atoms. In the molecule, nuclear force between the nuclei of the two atoms:
a) is not important because nuclear forces are short-ranged
b) is as important as electrostatic force for binding the two atoms
c) cancels the repulsive electrostatic force between the nuclei
d) is not important because oxygen nucleus has equal number of neutrons and protons

316. Atomic weight of boron is 10.81 and it has two isotopes $^{10}_{9}B$ and $^{11}_{5}B$. Then, the ratio of atoms of $^{10}_{5}B$ and $^{11}_{5}B$ in nature would be:
a) 19: 81 b) 10: 11 c) 15: 16 d) 81: 19

317. J.J. Thomson's cathode-ray tube experiment demonstrated that.
a)
The e/m ratio of the cathode-ray particles changes when a different gas is placed in the discharge tube
b) Cathode rays are streams of negatively charged ions
c) All the mass of an atom is essentially in the nucleus.
d) The e/m of electrons is much greater than the e/m of protons

318. In accordance with the Bohr's model, the quantum number that characterises the earth's revolution around the sun in an orbit of radius 1.5 × 10^{11} m with orbital speed 3 × 10^4 m s^{-1} is (Mass of earth = 6 × 10^{24}kg)
a) 5.98 × 10^{86} b) 2.57 × 10^{38} c) 8.57 × 10^{64} d) 2.57 × 10^{74}

319. In the Auger process an atom makes a transition to a lower state without emitting a photon. The excess energy is transferred to an outer electron which may be ejected by the atom. (This is called an Auger electron). Assuming the nucleus to be massive, the kinetic energy (in keV) of an n = 4 Auger electron emitted by Chromium by absorbing the energy from a n = 2 to n = 1 transition is
a) 4.6 b) 7.5 c) 5.38 d) 3.36

320. Which of the following statements does not form part of Bohr's model of the hydrogen atom:

a) Energy of the electrons in the orbit is quantized
b) The electron in the orbit nearest the nucleus has the lowest energy
c) Electrons revolve in different orbits around the nucleus
d)
The position and velocity of the electrons in the orbit cannot be determined simultaneously

321. Which of the following cannot be emitted by radioactive substances during their decay?
a) Neutrinos b) Protons c) Electrons d) Helium nuclei

322. The energy required to excite an electron in hydrogen atom to its first excited state is
a) 8.5 eV b) 10.2 eV c) 12.7 eV d) 13.6 eV

323. The total energy of an electron in an atom in an orbit is 3.4 eV. Its kinetic and potential energies are, respectively:
a) $-3.4\mathrm{eV}, -6.8\mathrm{eV}$ b) $3.4\mathrm{eV}, -6.8\mathrm{eV}$ c) $3.4\mathrm{eV}, 3.4\mathrm{eV}$ d) $-3.4\mathrm{eV}, -3.4\mathrm{eV}$

324. Which of the following spectral series falls within the visible range of electromagnetic radiation?
a) Lyman series b) Balmer series c) Paschen series d) Pfund series

325. The wavelength of radiation emitted is λ_0 when an electron jumps from the third to second orbit of hydrogen atom. For the electron jumping from the fourth to the second orbit of the hydrogen atom, the wavelength of radiation emitted will be
a) (16/25)λ_0 b) (20/27)λ_0 c) (27/20)λ_0 d) (25/16)λ_0

326. The decay constant, for a given radioactive sample, is 0.3465 day^{-1}. What percentage of this sample will get decayed in a period of 4 days?
a) 100% b) 50% c) 75% d) 10%

327. **Assertion :** For the scattering of α-particles at large angles, only the nucleus of the atom is responsible.
Reason : Nucleus is very heavy in comparison to electrons.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanationof assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

328. A radioactive sample with a half-life of 1 month has the label: Activity =2 microcurie on 1-8-1991. What would be its activity two months earlier?
a) 1.0 microcurie b) 0.5 microcurie c) 4 microcurie d) 8 microcurie

329. A free neutron decays into a proton, an electron and:
a) a beta particle b) an alpha particle c) an anti-neutrino d) a neutrino

330. The minimum energy that must be given to a H atom in ground state so that it can emit an H_γ line in Balmer series is
a) 12.4 eV b) 10.2 eV c) 13.06 eV d) 13.6 eV

331. For a radioactive material, half-life is 10 minutes. If initially there are 600 number of nuclei, the time taken (in minutes) for the disintegration of 450 nuclei is:
a) 30 b) 10 c) 20 d) 15

332. Two particles of masses m_1, m_2 move with initial velocities u_1 and u_2. On collision, one of the particles get excited to higher level, after absorbing energy e. If final velocities of particles be v_1 and v_2 then we must have ______________ .
a) $\frac{1}{2}m_1u_1^2 + \frac{1}{2}m_2u_2^2 = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2 - \varepsilon$
b) $\frac{1}{2}m_1u_1^2 + \frac{1}{2}m_2u_2^2 - \varepsilon = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2$
c) $\frac{1}{2}m_1^2u_1^2 + \frac{1}{2}m_2^2u_2^2 + \varepsilon = \frac{1}{2}m_1^2v_1^2 + m_2^2v_2^2$
d) $m_1^2u_1 + m_2^2u_2 - \varepsilon = m_1^2v_1 + m_2^2v_2$

333. A mixture consists of two radioactive materials A_1 and A_2 with half lives of 20 s and 10 s respectively. Initially the mixture has 40 g of A_1 and 160 g of A_2. The amount of the two in the mixture will become equal after:
a) 60s b) 80s c) 20s d) 40s

334. Taking the Bohr radius as ao = 53 pm, the radius of Li^{++} ion in its ground state, on the basis of Bohr's model, will be about:
a) 53 pm b) 27 pm c) 18 pm d) 13 pm

335. Electron in hydrogen atom first jumps from third excited state to second excited state and then from second excited to the first excited state. The ratio of the wavelength $1_1 : 1_2$ emitted in the two cases is ______________ .
a) 7/5 b) 27/20 c) 27/5 d) 20/7

336. **Assertion:** The total energy of an electron revolving in any stationary orbit is negative.
Reason: Energy can have positive or negative values.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanationof assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

337. Rutherford's experiments suggested that the size of the nucleus is about
a) 10^{-14} m to 10^{-12} m b) 10^{-15} m to 10^{-13} m c) 10^{-15} m to 10^{-14} m d) 10^{-15} m to 10^{-12} m

338. Assertion: Nuclear force between neutron-neutron, proton-neutron and proton-proton is approximately the same.
Reason: The nuclear force does not depend on the electric charge.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

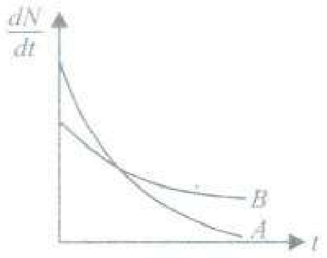
339. Assertion: Isotopes of an element can be separated by using a mass spectrometer.
Reason: Separation of isotopes is possible because of difference in electron number of isotopes.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

340. The mass number of a nucleus is :

a) sometimes less than and sometimes more than its atomic number
b) always less than its atomic number c) always more than its atomic number
d) sometimes equal to its atomic number

341. **Assertion:** Large angle of scattering of alpha particles led to the discovery of atomic nucleus.
Reason : Entire positive charge of atom is concentrated in the central core.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanationof assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

342. The variation of decay rate of two radioactive samples A and B with time is shown in figure.



Which of the following statements is/are true?
a) Decay constant of A is greater than that of B, hence A always decays faster than B.
b) Decay constant of A is greater than that of B, but it does not always decays faster than B.
c)
Decay constant of B is smaller than that of A but still its decay rate becomes equal to that of A at a later instant.
d) Both (b) and (c).

343. The transition from the state n=3 to n=1 in a hydrogen like atom results in ultraviolet radiation. Infrared radiation will be obtained in the transition from:
a) $2 \to 1$ b) $3 \to 2$ c) $4 \to 2$ d) $5 \to 4$

344. An electron of a stationary hydrogen atom passes from the fifth energy level to the ground level. The velocity that the atom acquired as a result of photon emission will be:
(m is the mass of the electron, R, Rydberg constant and h Planck's constant)
a) $\frac{24hR}{25m}$ b) $\frac{25hR}{24m}$ c) $\frac{25m}{24hR}$ d) $\frac{24m}{25hR}$

345. A nucleus $_nX^m$ emits one α-particle and two β particles. The resulting nucleus is :
a) $_{n-4}Z^{m-6}$ b) $_nZ^{m-6}$ c) $_nX^{m-4}$ d) $_{n-2}Y^{m-4}$

346. Bohr's basic idea of discrete energy levels in atoms and the process of emission of photons from the higher levels to lower levels was experimentally confirmed by experiments performed by
a) Michelson-Morley b) Millikan c) Joule d) Franck and Hertz

347. In Rutherford scattering experiment, what will be the correct angle for a-scattering for an impact parameter, b = 0?
a) 90^o b) 270^o c) 0^o d) 180^o

348. Match the correct pairs.

	Emission series		Make transitions from higher levels to following levels
A	Lyman series	P	n=l
B	Paschen series	Q	n=2

C	Balmer series	R	n=3
D	Brackett series	S	n=4
		T	n=5

a) A-P; B-R; C-Q; D-S b) A-P; B-Q; C-R; D-T c) A-Q; B-R; C-S; D- T
d) A- T; B-S; C-R; D-Q

349. The Balmer series for the H -atom can be observed
a)
if we measure the frequencies of light emitted when an excited atom falls to the ground state
b)
if we measure the frequencies of light emitted due to transitions between excited states and the first excited state
c) in any transition in a H-atom d) none of these

350. A fraction f_1 of a radioactive sample decays in one mean life, and a fraction f_2 decays in one half life. Then
a) $f_1 > f_2$ b) $f_1 2$ c) $f_1 = f_2$
d) either of (a), (b) or (c) depending on the values of the mean life and half life.

351. The nature of ions knocked out from hot surfaces is:
a) protons b) electrons c) neutrons d) nuclei

352. The half life of radium is about 1600 years. Of 100 g of radium existing now, 25 g will remain unchanged after ______________ .
a) 3200 years b) 4800 years c) 6400 years d) 2400 years

353. For scattering by an inverse-square field (such as that produced by a charged nucleus in Rutherford's model) the relation between impact parameter b and the scattering angle θ is given by, b = $(Ze^2 \cot(\theta/2))/(2\pi\varepsilon_0 m v^2)$ The scattering angle for b = 0 is
a) 180° b) 90° c) 45° d) 120°

354. The wavelength of the first line of Lyman series is 1215 $\mathring{A}$, the wavelength of first line of Balmer series will be
a) 4545 $\mathring{A}$ b) 5295 $\mathring{A}$ c) 6561 $\mathring{A}$ d) 6750 $\mathring{A}$

355. An electron in hydrogen atom makes a transition $n_1 \rightarrow n_2$ where n_1 and n_2 are principal quantum numbers of the two states. Assuming Bohr's model to be valid the time period of the electron in the initial state is eight times that in the final state. The possible values of n_1 and n_2 are:
a) n_1 = 4 and n_2 = 2 b) n_1 = 6 and n_2 = 2 c) n_1 = 8 and n_2 = 1 d) n_1 = 8 and n_2 = 2

356. If the radius of inner most electronic orbit of a hydrogen atom is 5.3 $\times$ 10^{-11} m, then the radii of n = 2 orbit is
a) 1.12 $\mathring{A}$ b) 2.12 $\mathring{A}$ c) 3.22 $\mathring{A}$ d) 4.54 $\mathring{A}$

357. If the binding energy per nucleon in ${}_3\mathrm{Li}^7$ and ${}_2\mathrm{He}^4$ nuclei are respectively 5.60 MeV and 7.06 MeV, then the energy of proton in the reaction ${}_3\mathrm{Li}^7 + \mathrm{p}^{3/4} \rightarrow 2{}_2\mathrm{He}^4$ is ______________ .
a) 19.6 MeV b) 2.4 MeV c) 8.4 MeV d) 17.3 MeV

358. Sometimes a radioactive nucleus decays into a nucleus which itself is radioactive. An example is :

$$^{38}Sulphur \xrightarrow[=2.48]{half-life} {}^{38}Cl \xrightarrow[=0.62h]{half-life} {}^{38}Ar(stable)$$

Assume that we start with 1000 ^{38}S nuclei at time t = 0. The number of ^{38}Cl is of count zero at t = 0 and will again be zero at t =∞ . At what value of t, would the number of counts be a maximum?

a) 1.65 h b) 2.62 h c) 3.24 h d) 3.95 h

359. The acronym LASER stands for

a) Light Amplification by Stimulated Emission of Radiation

b) Light Amplitude by Stimulated Emission of Radiation

c) Light Amplification by Strong Emission of Radiation

d) Light Amplification by Stimulated Emission of Radiowave

360. Consider an electron in the nth orbit of a hydrogen atom in the Bohr model. The circumference of the orbit can be expressed in terms of de-Broglie wavelength 1 of that electron as:

a) $(0.529)n\lambda$ b) $\sqrt{n\lambda}$ c) $(13.6)\lambda$ d) $n\lambda$

361. The half-life of radium is 1600yr. The fraction of a sample of radium that would remain after 6400 year.

a) $\frac{1}{4}$ b) $\frac{1}{2}$ c) $\frac{1}{8}$ d) $\frac{1}{16}$

362. The binding energy per nucleon in deuterium and helium nuclei are 1.1 MeV and 7.0 MeV, respectively. When two deuterium nuclei fuse to form a helium nucleus the energy released in the fusion is:

a) 30.2 MeV b) 23.6 MeV c) 2.2 MeV d) 28.0 MeV

363. Consider α and β particles and γ-rays each having an energy of 0.5 MeV. In the increasing order of penetrating power, the radiation are respectively

a) α, β, γ b) α, γ, β c) β, γ, α d) γ, β, α

364. 1 mg radium has 2.68 x 10^{18} atoms. Its half life is 1620 years. How many radium atoms will disintegrate from 1 mg of pure radium in 3240 years?

a) 2.01 x 10^9 b) 2.01 x 10^{18} c) 1.01 X 10^9 d) 1.01 x 10^{18}

365. Complete the series ^{6}He ⟶ e^- + ^{6}Li $^+$

a) neutrino b) antineutrino c) proton d) neutron

366. The energy equivalent of one atomic mass unit is :

a) 1.6 x 10^{-19}J b) 6.02 x 10^{23}J c) 931 MeV d) 9.31 MeV

367. In a radioactive decay process, the negatively charged emitted β-particles are ______________ .

a) The electrons produced as a result of the decay of neutrons inside the nucleus

b) The electrons produced as a result of collisions between atoms

c) The electronics orbiting around the nucleus d) The electrons present inside the nucleus

368. Energy released in the fission of a single $_{92}U^{235}$ nucleus is 200 MeV. The fission rate of a $_{92}U^{235}$ filled reactor operating at a power level of 5 W is ______________ .

a) $1.56 \times 10^{-10}\ \mathrm{s}^{-1}$ b) $1.56 \times 10^{11}\ \mathrm{s}^{-1}$ c) $1.56 \times 10^{-16}\ \mathrm{s}^{-1}$ d) $1.56 \times 10^{-17}\ \mathrm{s}^{-1}$

369. For the ground state, the electron in the H-atom has an angular momentum=-h, according to the simple Bohr model. Angular momentum is a vector and hence there will be infinitely many orbits with the vector pointing in all possible directions. In actuality this is not true,

a) because Bohr model gives incorrect values of angular momentum

b) because only one of these would have aminimum energy

c) angular momentum must be in the direction of spin of electron

d) because electrons go around only in horizontal orbits

370. A nucleus of Ux_1 has a half life of 24.1 days. How long a sample of Ux_1 will take to change to 90% of Ux_1.

a) 80 days b) 40 days c) 20 days d) 10 days

371. The first model of atom in 1898 was proposed by

a) Ernst Rutherford b) Albert Einstein c) J. J. Thomson d) Niels Bohr

372. The first use of quantum theory to explain the structure of atom was made by

a) Heisenberg b) Bohr c) Planck d) Einstein

373. The radius of electron orbit and the speed of electron in the ground state of hydrogen atom is 5.30×10^{-11} m and 2.2×10^{6} m s^{-1} respectively, then the orbital period of this electron in second excited state will be

a) 1.21×10^{-14} s b) 1.21×10^{-12} s c) 1.21×10^{-10} s d) 1.21×10^{-15} s

374. The mass number of He is 4 and that for sulphur is 32. The radius of sulphur nuclei is larger than that of helium by :

a) $\sqrt{8}$ b) 4 c) 2 d) 8

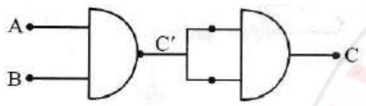
Ravi Maths Tuition Centre

Time : 1 Mins **SEMICONDUCTOR ELECTRONIC DEVICES 1** **Marks : 660**

Instruction

Click Here to Change your Own Instruction

1. A piece of copper and other of germanium are cooled from room temperature to 80 K, then:
   a) resistance of each will increase b) resistance of copper will decrease
   c) resistance of copper will increase while that of germanium will decrease
   d) resistance of copper will decrease while that of germanium will increase
2. The output from a NAND gate is divided into two in parallel and fed to another NAND gate. The resulting gate is a ______________ .



   a) NOR gate b) OR gate c) NOT gate d) AND gate
3. In the following circuit, the output Y for all possible inputs A and B is expressed by the truth table:

a)	b)	c)	d)
ABY	ABY	ABY	ABY
011	001	011	001
011	010	101	010
101	100	000	100
110	110	111	111

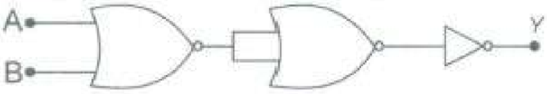
4. The radius of germanium (Ge) nuclide is measured to be twice the radius of ${}^{9}_{4}\mathrm{Be}$. The number of nucleons in Ge are:
   a) 74 b) 75 c) 72 d) 73
5. To obtain a p-type germanium semiconductor, it must be doped with
   a) Phosphorus b) Indium c) Antimony d) Arsenic
6. The following truth table belongs to which of the following four gates?

Input	Output
A B	Y
1 1	0
1 0	0
0 1	0
0 0	1

   a) NOR b) XOR c) NAND d) OR

7. For transistor action, which of the following statements is correct?
   a) The base region must be very thin and lightly doped.
   b) Base, emitter and collector regions should have same doping concentrations.
   c) Base, emitter and collector regions should have same size.
   d) Both emitter junction as well as the collector junction are forward biased.

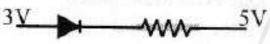
8. The given electrical network is equivalent to:



   a) AND gate b) OR gate c) NOR gate d) NOT gate

9. A transistor has a current amplification factor (current gain) of 50. In a common emitter amplifier circuit, the collector resistance is chosen as 5 Ω and the input resistance is 1Ω. The output voltage if input voltage is 0.01 V is
   a) -2 V b) -5 V c) -2.5 V d) -1 V

10. The input resistance of a silicon transistor is 100 Ω. Base current is changed by 40 μA which results in a change in collector current by 2 mA. This transistor is used as a common emitter amplifier with a load resistance of 4 kΩ. The voltage gain of the amplifier is :
   a) 3000 b) 4000 c) 1000 d) 2000

11. A forward biased diode is:
   a) 

   b) 

   c) 

   d) 

12. An amplifier has a voltage gain of 100. The voltage gain in dB is
   a) 20 dB b) 40 dB c) 30 dB d) 50 dB

13. In a junction diode, the holes are due to:
   a) Protons b) Extra electrons c) Neutrons d) Missing electrons

14. The manifestation of band structure in solids is due to
   a) Heisenberg uncertainty principle b) Pauli's exclusion principle
   c) Bohr's correspondence principle d) Boltzmann law

15. A P-N junction photodiode is made of a material with a band gap of 2.0 eV. The minimum frequency of radiation that can be absorbed by the material is nearly:
   a) 10×10^{14} Hz b) 5×10^{14} Hz c) 1×10^{14} Hz d) 20×10^{14} Hz

16. In pure semiconductor, the number of conduction electrons is 6×10^{18} per cubic metre. How many holes are there in a sample of size 1 cm x 1 cm x 1 mm?
   a) 3×10^{10} b) 6×10^{11} c) 3×10^{11} d) 6×10^{10}

17. Which one of the following bonds produces a solid that reflects light in the visible region and whose electrical conductivity decreases with temperature and has high melting point?
   a) metallic bonding b) van der Wall's bonding c) ionic bonding d) covalent bonding

18. An oscillator is nothing but an amplifier with:
   a) positive feedback b) negative feedback c) large gain d) no feedback

19. The output of OR gate is 1 :
   a) if either input is zero b) if both inputs are zero c) if either or both input are 1
   d) only if both inputs are 1

20. In which of the following devices, the Eddy current effect is not used?
a) Magnetic braking in train b) Electromagnet c) Electric heater d) Induction furnace

21. The number density of electrons and holes in pure silicon at 27°C are equal and its value is $2.0 \times 10^{16} m^{-3}$. On doping with indium the hole density increases to $4.5 \times 10^{22} m^{-3}$, the electron density in doped silicon is:
a) $10 \times 10^{9} m^{-3}$ b) $8.89 \times 10^{9} m^{-3}$ c) $11 \times 10^{9} m^{-3}$ d) $16.78 \times 10^{9} m^{-3}$

22. The part of the transistor which is heavily doped to produce large number of majority carriers is:
a) emitter b) base c) collector
d) any of the above depending upon the nature of transistor

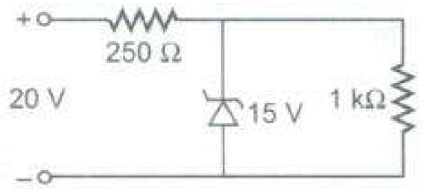
23. The transfer characteristics of a base biased transistor has the operation regions, namely, cutoff, active region and saturation region. For using the transistor as an amplifier it has to operate in the
a) active region b) cutoff region c) saturation region d) cutoff and saturation

24. For transistor action:
(1) Base, emitter and collector regions should have similar size and doping concentrations.
(2) The base region must be very thin and lightly doped.
(3) The emitter-base junction is forward biased and base-collector junction is reverse based.
(4) Both the emitter-base junction as well as the base-collector junction are forward biased.
a) (3)(4) b) (4)(1) c) (1)(2) d) (2)(3)

25. If a small amount of antimony is added to germanium crystal:
a) it becomes a p-type semiconductor b) the antimony become an acceptor atom
c) there will be more free electrons than holes in the semiconductor
d) its resistance is increased

26. In a p-n junction photocell, the value of the photoelectromotive force produced by monochromatic light is proportional to:
a) The voltage applied at the p-n junction b) The barrier voltage at the p-n junction
c) The intensity of the light falling on the cell d) The frequency of the light falling on the cell

27. A zener diode, having breakdown voltage equal to 15V, is used in a voltage regulator circuit shown in figure. The current through the diode is :



a) 10 mA b) 15 mA c) 20 mA d) 5 mA

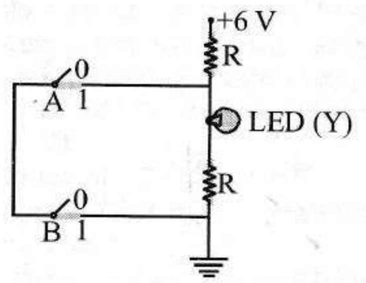
28. The barrier potential of a P-N junction depends on:
(1) type of semi conductor material
(2) amount of doping
(3) temperature
Which one of the following is correct?
a) (2) only b) (2) and (3) only c) (1), (2) and (3) d) (1) and (2) only

29. In an n-p-n transistor 10^{10} electron enter the emitter in 10^{-6} s. If 2% of the electrons are lost in the base, the current amplification factor is

a) 0.02 b) 7 c) 33 d) 4.9

30. In forward bias the width of depletion layer in a p-n junction diode:
a) Increases b) Decreases c) Remains constant d) First increases then decreases

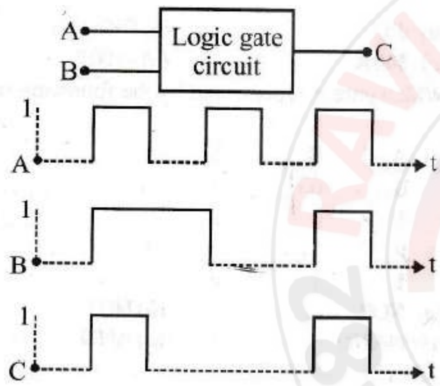
31. The correct Boolean operation represented by the circuit diagram drawn is:



a) OR b) NAND c) NOR d) AND

32. Which of the following is added as an impurity, into the silicon, produces n-type semiconductor?
a) Phosphorous b) Aluminium c) Magnesium d) Both b and c

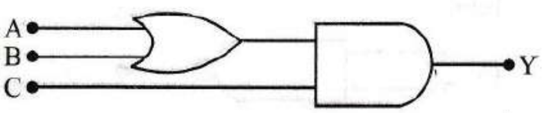
33. The following figure shows a logic gate circuit with two inputs A and B and the output C. The voltage waveforms of A, B and C are as shown below



The logic circuit gate is:
a) NAND gate b) NOR gate c) OR gate d) AND gate

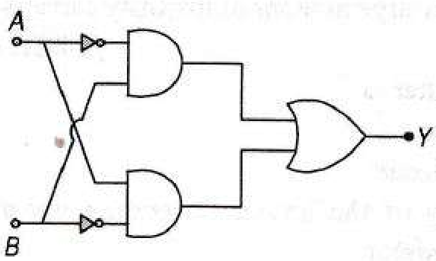
34. Zener diode is used for:
a) amplification b) rectification c) stabilisation d) producing oscillations in an oscillator

35. To get an output Y = 1 from the circuit shown below, the input must be



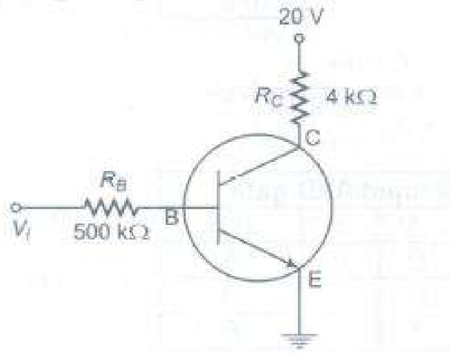
a)	b)	c)	d)
ABC	ABC	ABC	ABC
011	001	101	100

36. The following circuit represents.



a) OR gate b) XOR gate c) AND gate d) NAND gate

37. In the circuit shown in the figure, the input voltage Vi is 20V, V_{BE} = 0 and V_{CE} = O. The values of I_B, I_C and p are given by:



a) I_B=20 μA, I_C=5 mA, β=250   b) I_B=25 μA, I_C=5 mA, β=200

c) I_B=40 μA, I_C=10 mA, β=250   d) I_B=40 μA, I_C=5 mA, β=125

38. p-n junction is said to be forward biased, when

a) the positive pole of the battery rs connected to n-semiconductor and p-semiconductor

b) mechanical force is applied in the forward directon

c)

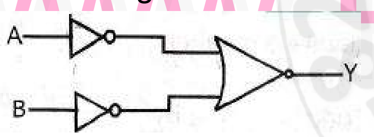
the positive pole of the battery is joined to the p-semiconductor and negative pole to the n-semiconductor

d) the positive pole of the battery is joined to the n-semiconductor and p-semiconductor

39. The input resistance of a common emitter transistor amplifier, if the output resistance is 500 k Ω , the current gain a = 0.98 and the power gain is 6.0625 x 10^6 , is

a) 198Ω   b) 300Ω   c) 100Ω   d) 400Ω

40. For the logic circuit shown, the truth table is:



a)	b)	c)	d)
ABY	ABY	ABY	ABY
001	000	000	001
010	010	011	011
100	100	101	101
110	111	111	110

41. What happensduring regulationactionofa Zenerdiode?

a) The current through the series resistance (R_s) changes.

b) The resistance offered by the Zener changes.   c) The Zener resistance is constant.

d) Both (a) and (b)

42. C and Si both have same lattice structure, having 4 bonding electrons in each. However, C is insulator whereas Si is intrinsic semiconductor. This is because:

a) In case of C the valence band is not completely filled at absolute zero temperature.

b) In case of C the conduction band is partly filled even at absolute zero temperature.

c)
The four bonding electrons in the case of C lie in the second orbit, whereas in the case of Si they lie in the third.
d)
The four bonding electrons in the case of C lie in the third orbit, whereas for Si they lie in the fourth orbit.

43. In p-n-p transistor circuit, the collector current is 10mA. If 90%of the holes reach the collector, the emitter and base currents respectively are
a) 10 mA, 1mA b) 22 mA, 11mA c) 11mA, 1mA d) 20 mA, 10mA

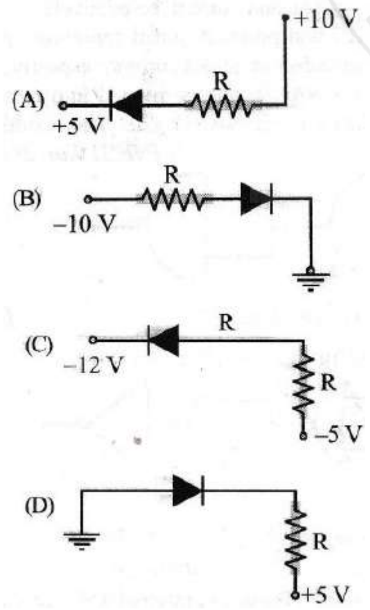
44. In a p-n junction diode, change in temperature due to heating:
a) Does not affect resistance of p-n junction b) Affects only forward resistance
c) Affects only reverse resistance d) Affects the overall V-I characteristics of P-N junction

45. Application of a forward bias to a p-n junction:
a) Widens the depletion zone
b) Increases the potential difference across the depletion zone
c) Increases the number of donors on the n side
d) Increases the electric field in the depletion zone

46. A block of pure silicon at 300 K has a length of 10 cm and an area of 1.0 cm^2. A battery of emf 2 V is connected across it. The mobility of electrons is 0.14 $m^2 V^{-1} S^{-1}$and their number density is 1.5 x $10^{16} m^{-3}$ • The electron current is
a) 6.72 x 10^{-4}A b) 6.72 x 10^{-5} A c) 6.72 X 10^{-6}A d) 6.72 x 10^{-7} A

47. Find the wavelength of light that may excite an electron in the valence band of diamond to the conduction band. The energy gap is 5.50 eV.
a) 226 nm b) 312 nm c) 432 nm d) 550 nm

48. In the following figure, the diodes which are forward biased, are:



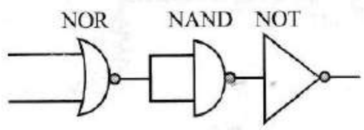
a) (C) only b) (C) and (A) c) (B) and (D) d) A), (B) and (D)

49. A transistor is operated in common emitter configuration at constant collector voltage V_c = 1.5V such that a change in the base current from 100 mA to 150 mA produces a change in the collector current from 5 mA to 10 mA. The current gain (b) is:
a) 75 b) 100 c) 50 d) 67

50. A Zener diode is specified as having a breakdown voltage of 9.1 V, with a maximum power dissipation of 364 mW What is the maximum current the diode can handle?
a) 40 mA b) 60 mA c) 50 mA d) 45 mA

51. For amplification by a triode, the signal to be amplified is given to:
a) the cathode b) the grid c) the glass-envelope d) the anode

52. The circuit is equivalent to



a) AND gate b) NAND gate c) NOR gate d) OR gate

53. Diamond is very hard, because
a) it is covalent solid b) it has large cohesive energy c) high melting point
d) insoluble in all solvents

54. Two amplifier are connected one after the other in series (cascade). The first amplifier has a voltage gain 10 and the second has a voltage gain of 20. If the input signal is 0.01 V, the output ac signal will be
a) 4V b) 1V c) 2V d) 6V

55. When Arsenic is added as an impurity to silicon the resulting material is:
a) n-type semiconductor b) p-type semiconductor c) n-type conductor d) insulator

56. In P-N junction photocell, the value of the photoelectromotive force produced by monochromatic light is proportional to:
a) voltage applied at the P-N junction b) the barrier voltage at the P-N junction
c) intensity of the light falling on the cell d) frequency of the light falling on the cell

57. The current amplification factor $\alpha$of a common base transistor and the current amplification factor β of a common emitter transistor are not related by
a) $\alpha = \frac{\beta}{1+\beta}$ b) $\beta = \frac{\alpha}{1-\alpha}$ c) $\frac{1}{\alpha} - \frac{1}{\beta} = 1$ d) $\beta = \frac{\alpha}{1+\alpha}$

58. In a full wave junction diode rectifier the input ac has rms value of 20 V. The transformer used is a step up transformer having primary and secondary turn ratio 1 : 2. The de voltage in the rectified output is
a) 12V b) 24V c) 36V d) 42V

59. A pure Si crystal has 5 x 10^{22}atoms m^{-3}.It is doped by 1 ppm concentration of pentavalent As. The number of holes is $(n_i^2 = n_p n_e)$ (Take n_i = 1.5 x $10^{16}m^{-3}$
a) 4.5 x $10^9 m^{-3}$ b) 4.5 x $10^6 m^{-3}$ c) 2.5 x $10^9 m^{-3}$ d) 2.5 x $10^6 m^{-3}$

60. Region without free electrons and holes in a p-n junction is
a) n-region b) p-region c) depletion region d) none of these

61. For a p-type semiconductor, which of the following statements is true?
a) Holes are the majority carriers and trivalent atoms are the dopants.
b) Holes are the majority carriers and pentavalent atoms are the dopants.
c) Electrons are the majority carriers and.pentavalent atoms are the dopants.
d) Electrons are the majority carriers and trivalent atoms are the dopants.

62. A transistor is operated in common emitter configuration at V_C = 2 V such that a change in the base current from 100 μA - 300 μA produces a change in the collector current from 10 mA to 20 mA. The current gain is :

a) 50 b) 75 c) 100 d) 25

63. For a cubic crystal structure which one of the following relations indicating the cell characteristics is correct?

a) $a \neq b \neq c$ and $a = b = g = 90°$ b) $a = b = c$ and $a \neq b \neq g = 90°$

c) $a = b = c$ and $a = b = g = 90°$ d) $a \neq b \neq c$ and $a \neq b$ and $g \neq 90°$

64. When n-type semiconductor is heated:

a) number of electrons increases while that of holes decreases

b) number of holes increases while that of electrons decreases

c) number of electrons and holes remain same

d) number of electrons and holes increases equally

65. In p-type semiconductor, the majority charge carriers are:

a) Holes b) Electrons c) Protons d) Neutrons

66. In p-n junction:

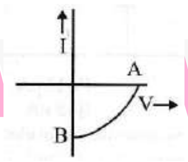
a) The potential of the p and n side becomes higher alternately

b) The p-side is at higher electrical potential than the n-side

c) The n-side is at higher electrical potential than the p-side

d) Both the p and n sides are at the same potential

67. The given graph represents V-I characteristic for a semiconductor device.



Which of the following statement is correct?

a)

It is V-I characteristic for solar cell where, point A represents open circuit voltage and point B short circuit current.

b)

It is for a solar cell and point A and B represent open circuit voltage and current, respectively.

c)

It is for a photodiode and points A and B represent open circuit voltage and current, respectively.

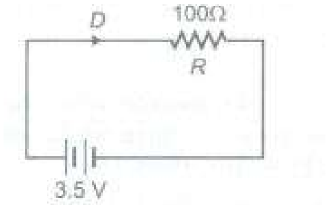
d)

It is for a LED and points A and B represent open circuit voltage and short circuit current, respectively.

68. Three photo diodes D_1, D_2 and D_3 are made of semiconductors having band gap of 2.5 eV, 2 eV and 3 eV, respectively. Which one will be able to detect light of wavelength 6000Å?

a) D_1 b) D_2 c) D_3 d) D_1 and D_2both

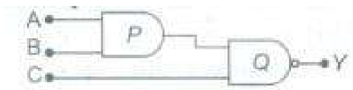
69. In the given figure, a diode D is connected to an external resistance R =100 Ω and an e.m.f of 3.5V. If the barrier potential developed across the diode is 0.5 V, the current in the circuit will be:



a) 35 mA b) 30 mA c) 40 mA d) 20 mA

70. For a common emitters transistor amplifier, the audio signal voltage across the collector resistance of 2 kΩ is 2 V. Suppose the current amplification factor of the transistor is 100, the base current if base resistance is 1kΩ is
a) $10\mu A$ b) $20\mu A$ c) $5\mu A$ d) $2\mu A$

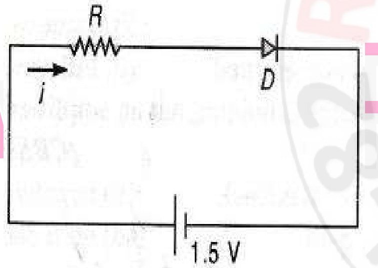
71. What is the output Y in the following circuit, when all the three inputs A,B,C are first 0 and then 1?



a) 0,1 b) 0,0 c) 1,0 d) 1,1

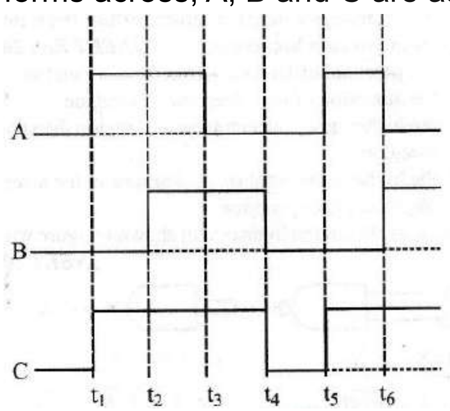
72. What will be input of A and B for the Boolean expression $(\overline{A + B} \cdot (\overline{A. B}) = 1$?
a) (0, 0) b) (0, 1) c) (1, 0) d) (1, 1)

73. The diode used in the circuit shown in the figure has a constant voltage drop of 0.5 V at all currents and a maximum power rating of 100 milliwatt. What should be the value of the resistor R, connected in series with the diode, for obtaining maximum current i?



a) 200 W b) 6.67 W c) 5 W d) 15 W

74. The figure shows a logic circuit with two inputs A and B and the output C. The voltage wave forms across, A, B and C are as given. The logic circuit gate is:



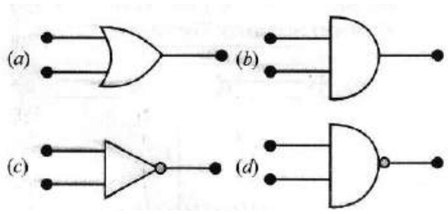
a) OR gate b) NOR gate c) AND gate d) NAND gate

75. Three amplifiers X, Y and Z are connected in series. If the voltage gains of X, Y and Z are 10, 20 and 30 respectively and the input signal is 1mV peak value, then what is the output signal voltage (peak value) if dc supply voltage is 10V?
a) 4V b) 5V c) 6V d) 7V

76. To use a transistor as an amplifier:
    a) the emitter base junction is forward biased and the base collector junction is reversed biased
    b) no bias voltage is required   c) both junctions are forward biased
    d) both junctions are reverse biased

77. A transistor is operated in common-emitter configuration at V_c = 2V such that a change in the base current from 100 mA to 200 mA produces a change in the collector current from 5 mA to 10 mA. The current gain is ____________ .
    a) 100   b) 150   c) 50   d) 75

78. Symbolic representation of four logic gate are shown as



Pick out which ones are for AND, NAND and NOT gates, respectively:
    a) (ii), (iii) and (iv)   b) (iii), (ii) and (i)   c) (iii), (iii) and (iv)   d) (ii), (iv) and (iii)

79. The following truth table corresponds to the logical gate:

Input		Output
A	**B**	**Y**
0	0	0
0	1	1
1	0	1
1	1	1

a) NAND   b) OR   c) AND   d) XOR

80. The input resistance of a transistor is 1000 Ω on charging its base current by 10 μA the collector current increases by 2 mA. If a load resistance of 5 kΩ is used in the circuit, the voltage gain of the amplifier is
    a) 100   b) 500   c) 1000   d) 1500

81. Barrier potential of a p-n junction diode does not depend on:
    a) Doping density   b) Diode design   c) Temperature   d) Forward bias

82. The intrinsic semiconductor becomes an insulator at:
    a) 0^oC b) 0 K   c) 300 K   d) -100^oC

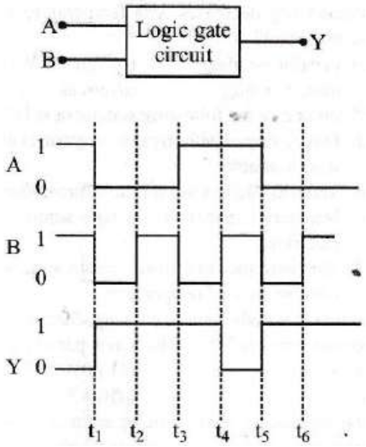
83. A P-N photodiode is fabricated from a semiconductor with a band gap of 2.5 eV. It can detect a signal of wavelength
    a) 4000 nm   b) 6000 nm   c) 4000 Å   d) 6000 Å

84. When a n-p-n transistor is used as an amplifier, then
    a) The electrons flow from emitter to collector   b) The holes flow from emitter to collector
    c) The electrons flow from collector to emitter   d) The electrons flow from battery to emitter

85. An N-P-N transistor conducts when:
    a) both collector and emitter :are negative with respect to the base.
    b) both collector and emitter are positive with respect to the base

c) collector is positive and emitter is negative with respect to the base
d) collector is positive and emitter is at same potential as the base

86. The following figure shows a logic gate circuit with two inputs A and B and the output Y. The voltage waveforms of A, B and Y are given:



The logic gate is:
a) NAND gate b) NOR gate c) OR gate d) AND gate

87. An intrinsic semiconductor has a resistivity of 0.50 Ω m at room temperature. Find the intrinsic carrier concentration if the mobilities of electrons and holes are 0.39 $m^2 V^{-1} S^{-1}$ and 0.11 $m^2 V^{-1} S^{-1}$ respectively:
a) $1.2 \times 10^{18} m^{-3}$ b) $2.5 \times 10^{19} m^{-3}$ c) $1.9 \times 10^{20} m^{-3}$ d) $3.1 \times 10^{21} m^{-3}$

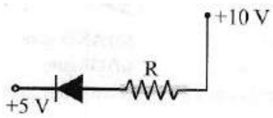
88. In a p-n junction:
a) The potential of the p and n -sides becomes higher alternately
b) The p-side is at higher electrical potential than the n side
c) The n-side is at higher electrical potential than the p-side
d) Both the p and n-sides are at the same potential

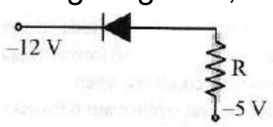
89. If a change of 100μA in the base current of an n-p-n transistor causes a change of 10 mA in its collector current, its ac current gain is
a) 50 b) 100 c) 200 d) 150

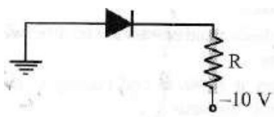
90. In a CE transistor amplifier, the audio signal voltage across the collector resistance of 2kW is 2V. If the base resistance is 1kW and the current amplification of the transistor is 100, the input signal voltage is:
a) 0.1 V b) 1.0 V c) 1 mV d) 10 mV

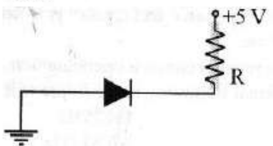
91. The emitter of transistor is doped the heaviest because it
a) acts as a supplier of charge carriers b) dissipates maximum power
c) has a larger resistance d) has a small resistance

92. Of the diodes shown in following diagrams, which one is reverse biased?

a) 

b) 

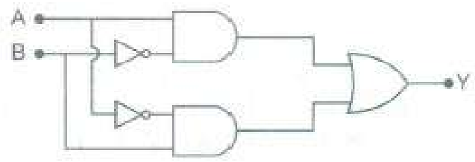
c) 

d) 

93. Choose the only false statement from the following:

a) In conductors, the valence and conduction bands may overlap
b) Substances with energy gap of the order of 10 eV are insulators
c) The resistivity of semiconductor increases with increase in temperature.
d) The conductivity of semiconductor increases with increase in temperature

94. In the combination of the following gates the output Y can be written in terms of inputs A and B as:



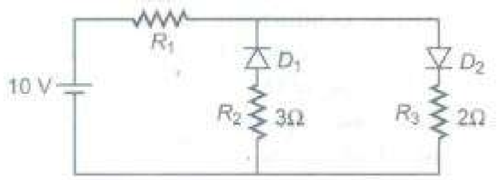
a) $\bar{A}.B$+A.B b) A.$\bar{B}$+$\bar{A}$.B c) $\overline{A.B}$ d) $\overline{A+B}$

95. In forward biasing of the p-n junction
a) the positive terminal of the battery is connected to p-side and the depletion region becomes thick
b) the positive terminal of the battery is connected to n-side and the depletion region becomes thin
c) the positive terminal of the battery is connected to n-side and the depletion region becomes thick
d) the positive terminal of the battery is connected to p-side and the depletion region becomes thin

96. The ac current gain of a transistor is 120. What is the change in the collector current in the transistor whose base current changes by 100μA?
a) 6mA b) 12mA c) 3mA d) 24mA

97. The probability of electrons to be found in the conduction band of an intrinsic semiconductor of finite temperature
a) increases exponentially with increasing band gap.
b) decreases exponentially with increasing band gap.
c) decreases with increasing temperature.
d) is independent of the temperature and band gap.

98. The given circuit has two ideal diodes connected as shown in the figure below. The current flowing through the resistance R_1 will be:



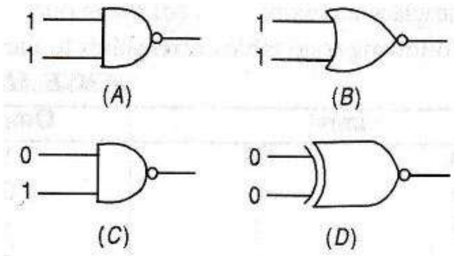
a) 1.43 A b) 3.13 A c) 2.5 A d) 10.0 A

99. In an n-p-n circuit transistor, the collector current is 10mA. If 80% electron emitted to reach the collector, then

a) the emitter current will be 7.5 mA b) the emitter current will be 12.5 mA
c) the base current will be 3.5 mA d) the base current will be 1.5 mA

100. In the case of a common emitter transistor amplifier, the ratio of the collector current to the emitter current I_c/I_e 0.96. The current gain of the amplifier is _______________ .
a) 6 b) 48 c) 24 d) 12

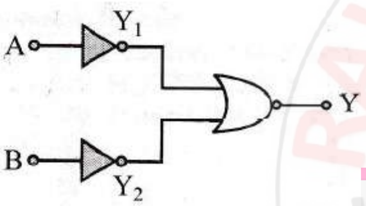
101. Which one of the following gates will have an output of 1?



a) A b) B c) C d) D

102. The peak voltage in the output of a half-wave diode rectifier fed with a sinusoidal signal without filter is 10V. The d.c. component of the output voltage is _______________.
a) 20/pV b) $10/\sqrt{2}$V c) 10/pV d) 10V

103. Which logic gate is represented by the following combination of logic gate?



a) NAND b) AND c) NOR d) OR

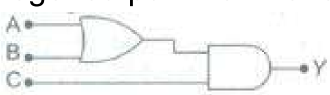
104. For a common emitter circuit if I_C/I_E = 0.98 then current gain for common emitter circuit will be.
a) 49 b) 98 c) 4.9 d) 25.5

105. When a p-n junction diode is reverse biased the flow of current across the junction is mainly due to:
a) diffusion of charges b) drift charges c) depends on the nature of material
d) both drift and diffusion of charges

106. Which of the following statements is incorrect for the depletion region of a diode?
a) There the mobile charges exist.
b) Equal number of holes and electrons exist,making the region neutral.
c) Recombination of holes and electrons has taken place. d) None of these

107. In a common emitter transistor amplifier the audio signal voltage across the collector is 3 V. The resistance of collector is 3 kΩ If current gain is 100 and the base resistance is 2 kΩ, the voltage and power gain of the amplifier is:
a) 200 and 1000 b) 15 and 200 c) 150 and 15000 d) 20 and 2000

108. Toget output 1 for the following circuit, the correct choice for the input is:

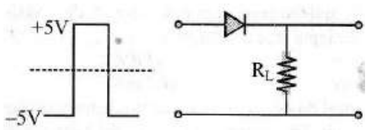


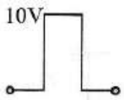
a) A = 0, B = 1, C = 0 b) A = 1, B = 0, C = 0 c) A = 1, B = 1, C = 0 d) A = 1, B = 0, C = 1

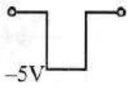
109. In n-type semiconductor when all donor states are filled, then the net charge density in the donor states becomes

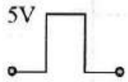
a) 1 b) >1 c) <1, but not zero d) zero

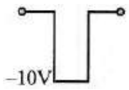
110. If in a p-n junction, a square input signal of 10V is applied as shown, then the output across R_L will be:



a) 

b) 

c) 

d) 

111. A transistor has a current gain of 30. If the collector resistance is 6 kΩ input resistance is 1 kΩ, its voltage gain is:

a) 90 b) 180 c) 45 d) 360

112. In a half wave rectifier circuit operating from 50 Hz mains frequency, the fundamental frequency in the ripple would be

a) 25 Hz b) 50 Hz c) 70.7Hz d) 100 Hz

113. Carbon, silicon and germanium atoms have four valence electrons each. Their valence and conduction bands are separated by energy band gaps represented by $\left(E_g\right)_C$, $\left(E_g\right)_{Si}$ and $\left(E_g\right)_{Ge}$ respectively. Which one of the following relationships is true in their case?

a) $\left(E_g\right)_C > \left(E_g\right)_{Si}$ b) $\left(E_g\right)_C < \left(E_g\right)_{Si}$ c) $\left(E_g^g\right)_C = \left(E_g^g\right)_{Si}$ d) $\left(E_g^g\right)_C < \left(E_g\right)_{Ge}$

114. Which of the following gates corresponds to the truth table given below?

Input		Output
A	**B**	**Y**
1	1	0
1	0	1
0	1	1
1	0	1

a) NAND b) OR c) AND d) XOR

115. The maximum wavelength of electromagnetic radiation, which can create a hole-electron pair in germanium. (Given that forbidden energy gap in germanium is 0.72 eV)

a) 1.7×10^{-6} m b) 1.5×10^{-5} m c) 1.3×10^{-4} m d) 1.9×10^{-5} m

116. The increases in the width of depletion region in a p-n junction diode is due to:

a) Increase in forward current b) Forward bias only c) Reverse bias only
d) Both forward bias and reverse bias

117. The depletion layer in the p-n junction region is caused by:

a) drift of holes b) diffusion of charge carriers c) migration of impurity ions
d) drift of electrons

118. The device that can act as a complete electronic circuit is:

a) junction diode b) integrated circuit c) junction transistor d) zener diode

119. The breakdown in a reverse biased p-n junction diode is more likely to occur due to

a) large velocity of the minority charge carriers if the doping concentration is small

b) large velocity of the minority charge carriers if the doping concentration is large

c) strong electric field in a depletion region if the doping concentration is small

d) none of these

120. Which one of the following is the weakest kind of the bonding in solids?
a) Ionic b) Metallic c) van der Waals d) Covalent

121. A potential barrier of 0.3 V exists across a p-n junction. If the depletion region is 1 urn wide, what is the intensity of electric field in this region?
a) $2 \times 10^5 Vm^{-1}$ b) $3 \times 10^5 Vm^{-1}$ c) $4 \times 10^5 Vm^{-1}$ d) $5 \times 10^5 Vm^{-1}$

122. The correct relationship between the two current gains a and b in a transistor is ______________ .
a) $b = \frac{1+\alpha}{\beta}$ b) $\alpha = \frac{\beta}{1+\alpha}$ c) $\alpha = \frac{\beta}{1-\beta}$ d) $\beta = \frac{\alpha}{1+\alpha}$

123. The transfer ratio b of a transistor is 50. The input resistance of the transistor when used in the common emitter configuration is 1 kW. The peak value of the collector AC current for an AC input voltage of 0.01 V peak is:
a) 100 mA b) 0.01 mA c) 0.25 mA d) 500 mA

124. For an electronic valve, the plate current i and plate voltage V in the space charge limited region are related as:
a) i is proportional to $V^{3/2}$ b) i is proportional to $V^{2/3}$ c) i is proportional to V
d) i is proportional to V^2

125. In a common emitter (CE) amplifier having a voltage gain G, the transistor used has trans conductance 0.03 mho and current gain 25. If the above transistor is replaced with another one with trans conductance 0.02 mho and current gain 20, the voltage gain will be:
a) 2G/3 b) 1.5G c) G/3 d) 5G/4

126. In an unbiased p-n junction, holes diffuse from the p-region to n-region because of:
a) The potential difference across the p-n junction
b) The attraction of free electrons of n-region
c) The higher hole concentration in p-region than that in n-region
d) The higher concentration of electrons in the r-region than that in the p-region

127. Pure Si at 500 K has equal number of electrons n_e and holes. n_h concentration of 1.5×10^{16} m^{-3}. Doping by Indium increases nh to 4.5×10^{22} m^{-3}. The doped semiconductor is of :
a) n-type wit electron concentration $n_e = 5 \times 10^{22}$ m^{-3}
b) p-type wit electron concentration $n_e = 2.5 \times 10^{10}$ m^{-3}
c) n-type wit electron concentration $n_e = 2.5 \times 10^{23}$ m^{-3}
d) n-type wit electron concentration $n_e = 5 \times 10^{9}$ m^{-3}

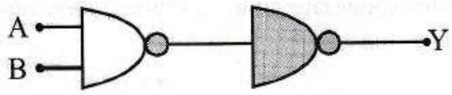
128. In a n-type semiconductor, which of the following statement is true?
a) Electrons are minority carriers and pentavalent atoms are dopants.
b) Holes are minority carriers and pentavalent atoms are dopants.
c) Holes are majority carriers and trivalent atoms are dopants.
d) Electrons are majority carriers and trivalent atoms are dopants.

129. Radiowaves of constant amplitude can be generated with

a) Rectifier b) Oscillator c) FET d) Filter

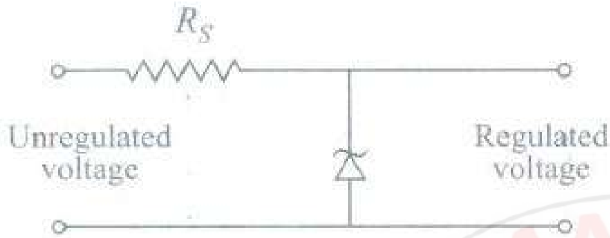
130. In Boolean algebra, if A = 1 and B = 0, then the value of $A + \bar{B}$ is
a) A b) A.B c) A + B d) both (a) and (c)

131. Following diagram performs the logic function of



a) XOR gate b) AND gate c) NAND gate d) OR gate

132. A Zener diode of power rating 1 W is to be used as a voltage regulator. If Zener has a breakdown of 5 V and it has to regulate voltage which fluctuated between 3 V and 7 V, what should be the value of R_S for safe operation?



a) 5Ω b) 10Ω c) 15Ω d) 20Ω

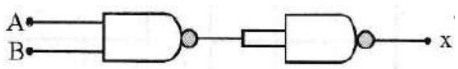
133. If a full wave rectifier circuit is operating from 50 Hz mains, the fundamental frequency in the ripple will be.
a) 100 Hz b) 25 Hz c) 50 Hz d) 70.7 Hz

134. The voltage gain of an amplifier with 9% negative feedback is 10. The voltage gain without feedback will be:
a) 90 b) 10 c) 125 d) 100

135. Which one of the following statement is false?
a) Pure Si doped with trivalent impurities gives ap-type semiconductor
b) Majority carriers in a n-type semicon-ductor are holes
c) Minority carriers in a p-type semicon-ductor are electrons
d) The resistance of intrinsic semicon-ductor decreases with increase of temperature

136. The number of beta particles emitted by a radioactive substance is twice the number of alpha particles emitted by it. The resulting daughter is an ______________ .
a) isomer of parent b) isotone of parent c) isotope of parent d) isobar of parent

137. The output (X) of the logic circuit shown in figure will be:



a) $X = A \cdot B$ b) $X = A \cdot B$ c) $X = A + B$ d) $X = \bar{A}, \bar{B}$

138. Boolean algebra is essentially based on
a) number b) truth c) logic d) symbol

139. Sodium has body centred packing. Distance between two nearest atoms is $3.7\mathring{A}$. The lattice parameter is:

a) $4.3\mathring{A}$ b) $3.6\mathring{A}$ c) $8.6\mathring{A}$ d) $6.8\mathring{A}$

140. Transmission of light in optical fibre is due to:

a) Scattering b) Diffraction c) Polarisation d) Multiple total internal reflections

141. When an n-p-n transistor is used as an amplifier then:
a) the electrons flow from emitter to collector b) the holes flow from emitter to collector
c) the electrons flow from collector to emitter d) the electrons flow from battery to emitter

142. In a transistor connected in common emitter mode, $R_C = 4K\Omega$, $R_I = 1K\Omega$, $I_C = 1mA$ and $I_B = 20$ μA .The voltage gain is
a) 100 b) 200 c) 300 d) 400

143. When a triode is used as an amplifier the phase difference between the input signal voltage and the output is:
a) zero b) $\frac{\pi}{4}$ c) $\frac{\pi}{2}$ d) P

144. The cause of the potential barrier in a p-n diode is:
a) Depletion of positive charges near the junction
b) Concentration of positive charges near the junction
c) Depletion of negative charges near the junction
d) Concentration of positive and negative charges near junction

145. In good conductors of electricity the type of bonding that exist is
a) Van der Walls b) covalent c) ionic d) metallic

146. The potential difference across the collector of a transistor, used in common emitter mode is 1.5 V, with the collector resistance of 3 kΩ , the emitter current is [β = 50]
a) 0.70 mA b) 0.49 mA c) 1.1 mA d) 1.9 mA

147. For CE transistor amplifier, the audio signal voltage across the collector resistance of 2kΩ is 4V. If the current amplification factor of the transistor is 100 and the base resistance is 1 kΩ, then the input signal voltage is
a) 10 mV b) 20 mV c) 30 mV d) 15 mV

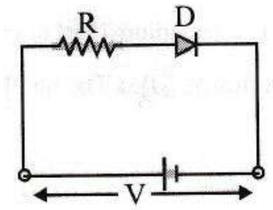
148. Which of the following equations correctly represents the temperature variation of energy gap between the conduction and valence bands for Si?
a) $E_g(T) = 0.70 - 2.23 \times 10^{-4}T$ eV b) $E_g(T) = 0.70 + 2.23 \times 10^{-4}T$ eV
c) $E_g(T) = 1.10 - 3.60 \times 10^{-4}T$ eV d) $E_g(T) = 1.10 + 3.60 \times 10^{-4}T$ eV

149. In a common base amplifier the phase difference between the input signal voltage and the output voltage is:
a) zero b) $\frac{\pi}{4}$ c) $\frac{\pi}{2}$ d) P

150. A common emitter amplifier has a voltage gain of 50, an input impedance of 100Ω and an output impedance of 200 Ω The power gain of the amplifier is :
a) 1000 b) 1250 c) 100 d) 500

151. A potential barrier of 0.50 V exists in a p-n junction. If the depletion region is 5.0×10^{-7}m thick, what is the electric field in this region?
a) 10^6 V/m b) 10^7 V/m c) 10^5 V/m d) 10^4 V/m

152. A d.c. battery of V volt is connected to a series combination of a resistor R and an ideal diode D as shown in the figure. The potential difference across -R will be:



a) 2V when diode is forward biased b) Zero when diode is forward biased
c) V when diode is reverse biased d) V when diode is forward biased

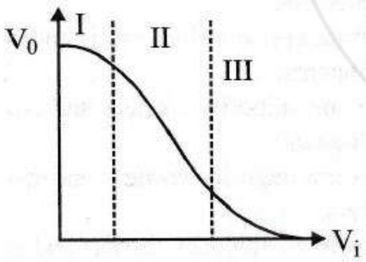
153. A semiconductor has equal electron and hole concentration of 6×10^8 per m^3 . On doping with certain impurity, electron concentration increases to 9×10^{12}per m^3. The new hole concentration is
a) 2×10^4per m^3 b) 2×10^2per m^3 c) 4×10^4per m^3 d) 4×10^2per m^3

154. When p-n junction diode is reverse biased the flow of current across the junction is mainly due to:
a) diffusion of charges b) drift of charges c) depends on the nature of material
d) both drift and diffusion of charges

155. Reverse bias applied to a junction diode:
a) increases the minority carrier current b) lower the potential barrier
c) raise the potential barrier d) increases the majority carrier current

156. If the energy of a photon of sodium light (λ = 589 nm) equals the band gap of semiconductor, the minimum energy required to create hole electron pair
a) 1.1eV b) 2.1eV c) 3.2eV d) 1.5eV

157. Transfer characteristics [output voltage (V_0) vs input voltage (V_1)] for a base biased transistor in CE configuration is as shown in the figure. For using transistor as a switch, it is used:

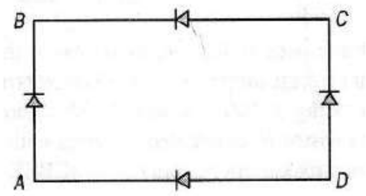


a) in region III b) both in region (I) and (III) c) in region II d) in region (I)

158. Mobilities of electrons and holes in a sample of intrinsic germanium at room temperature are 0.54 $m^2 V^{-1} s^{-1}$ and 0.18 $m^2 V^{-1} s^{-1}$ respectively. If the electron and hole densities are equal to $3.6 \times 10^{19} m^{-3}$ the germanium conductivity is
a) 4.14 Sm^{-1} b) 2.12 Sm^{-1} c) 1.13 Sm^{-1} d) 5.6 Sm^{-1}

159. The current gain for a transistor working as common base amplifier is 0.96. If the emitter current is 7.2 mA, then the base current is ______________ .
a) 0.29 mA b) 0.35 mA c) 0.39 mA d) 0.43 mA

160. In figure the input is across the terminals A and C and the output is across B and D. Then the output is:



a) zero b) same as the input c) half wave rectified d) full wave rectified

161. Which gate is represented by the following truth table?

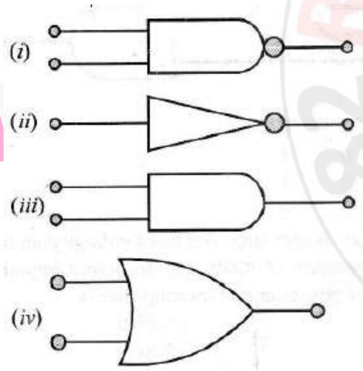
A	B	Y
0	0	1
1	0	1
0	1	1
1	1	0

a) XOR b) NOT c) NAND d) AND

162. A semi-conducting device is connected in a series circuit with a resistance. a current is found to pass through the circuit. If the polarity of the battery is reversed, the current drops to almost zero. The device may be

a) a p-n junction b) an intrinsic semi-conductor c) a p-tpe semi-conductor
d) an n-type semiconductor

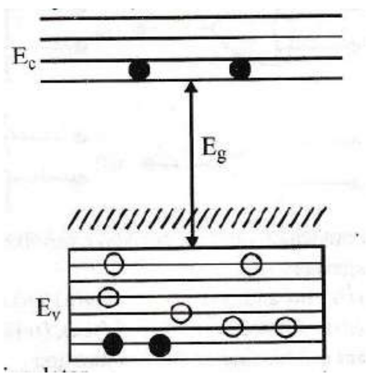
163. The symbolic representation of four logic gates are given below:



The logic symbols for OR, NOT and NAND gates are respectively:

a) (iv), (i), (iii) b) (iv), (ii), (i) c) (i), (iii), (iv) d) (iii), (iv), (ii)

164. In the energy band diagram of a material shown below, the open circles and filled circles denote holes and electrons respectively. The material is"



a) an insulator b) a metal c) an n-type semiconductor d) a p-type semiconductor

165. A p-n photodiode is made of a material with a band gap of 2 eV .The minimum frequency of the radiation that can be absorbed by the material is nearly (hc = 1240 eV nm)

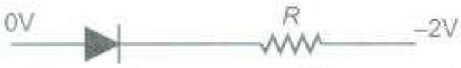
a) 1×10^{14} Hz b) 20×10^{14} Hz c) 10×10^{14} Hz d) 5×10^{14} Hz

166. The current gain for a common emitter amplifier is 69. If the emitter current is 7 mA, the base current is
a) 0.1 mA b) 1 mA c) 0.2 mA d) 2 mA

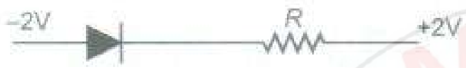
167. In semiconductors, at room temperature:
a) the conduction band is completely empty
b) the valence band is partially empty and conduction band is completely filled
c) the valence band is partially empty and the conduction band is partially filled
d) the valence band is completely filled

168. A transistor connected in common emitter mode, the voltage drop across the collector is 2 V and β is 50, the base current if R_c is 2 kΩ is
a) 40μA b) 20μA c) 30 μA d) 15μA

169. Which one of the following represents forward bias diode?

a) 

b) 

c) 

d) 

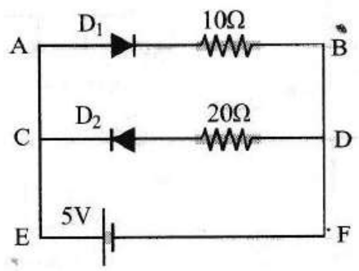
170. Depletion layer consists of:
a) Electrons b) Protons c) Mobile charge carriers d) Immobile ions

171. At absolute zero, Si acts as:
a) Non-metal b) Metal c) Insulator d) None of the above

172. The power gain for common base amplifier is 800 and the voltage amplification factor is 840. The collector current when base current is 1.2mA is
a) 24 mA b) 12 mA c) 6 mA d) 3 mA

173. One way in which the operation of a n-p-n transistor differs from that of a p-n-p:
a) The emitter junction is reversed biased in n-p-n
b) The emitter junction injects minority carriers into the base region of the p-n-p
c)
The emitter injects holes into the base of the p-n-p and electrons into the base region of n-p-n
d) The erritter injects holes into the base of n-p-n

174. Two ideal diodes are connected to a battery as shown in the circuit. The current supplied by the battery is:



a) 0.75 A b) zero c) 0.25 A d) 0.5 A

Ravi Maths Tuition Centre

Time : 1 Mins **MOTION IN A STRAIGHT LINE AND PLANS 1** **Marks : 368**

1. The water drops fall at regular intervals from a tap 5 m above the ground. The third drop is leaving the tap at an instant when the first drop touches the ground. How far above the ground is the second drop at that instant? (Takeg:10m/s^2)
   a) 1.25m b) 2.50m c) 3.75m d) 5.00m

2. The distance havelled by particle starting from rest and moving with an acceleration $\frac{4}{3}$ ms^{-1} in the second is __________
   a) 6m b) 4m c) $\frac{10}{3}$ m d) $\frac{19}{3}$ m

3. The motion of a pticle almg a straight line is described by equation x = 8+12t-t^3 where x is in metere and t and second. The reterdation of the particle when its velocity becomes zero, is ____________
   a) 24ms^{-1} b) zero c) 6ms^{-2} d) 12ms^{-2}

4. The displacement x of a particle varies with time t as x = $ae^{-\alpha t}+be^{\beta t}$, where a, b, α and β are positive constant j. The velocity of the particle will __________ .
   a) be independent of a and b b) drop to zero when a = b c) go on decreasing with time d) go on increasing with time

5. Two bodies,Aofmass 1 kg and B of mass 3 kg, are dropped from heights of l6 m and 25 m, respectively. The ratio of the time taken by them to reach the ground is ___________
   a) 12/5 b) 5/12 c) 4/5 d) 5/4

6. The position x of a particle varies with time t, as x = at^2- bt^3. The acceleration of the particle will be zero time t equals to _________
   a) zero b) $\frac{a}{3b}$ c) $\frac{2a}{3b}$ d) $\frac{a}{3}$

7. A particle moving along x-axis has acceleration f at time t, given by $f=f_0\left(1-\frac{t}{T}\right)$ where f$_o$ and T are constant. The particle at t = 0 has zero velocity. In the time interval between t = 0 and the instant when f= 0, the particle's velocity (v$_x$) is _______
   a) $\frac{1}{2}f_0\ T^2$ b) $f_0\ T^2$ c) $\frac{1}{2}f_0\ T$ d) $f_0\ T$

8. A particle of unit mass undergoes one-dimensional motion such that its velocity varies according to v(x) = b^{x-2n} where b and n are constants and x is the position of the particle. The acceleration of the particle as d function of x, is given by _________
   a) $-2nb^2x^{-4n-1}$ b) $-2b^2x^{-2n+1}$ c) $-2nb^2e^{-4n+1}$ d) $-2nb^2x^{-2n-1}$

9. A particle has initial velocity $(3\hat{i}+4\hat{j})$ and has acceleration $(0.4\hat{i}+0.3\hat{j})$. It's speed after 10 s is ______________ .
   a) 7 units b) 7$\sqrt{2}$ units c) 8.5 units d) 10 units

10. A car moves a distance of 200 m. It covers the first-half of the distance at speed 40 km/h and the second half of distance at speed v km/h. The average speed is 48 km/h. Find the value of v ___________ .
a) 56 km/h b) 60 km/h c) 50 km/h d) 48 km/h

11. A particle starts its motion from rest under the action ola constant force. If the distance covered in first 10 seconds is S_1 and that covered in the first 20 seconds is S_2 then ____________
a) $S_2 = 3\,S_1$ b) $S_2 = 4\,S_1$ c) $S_2 = S_1$ d) $S_2 = 2\,S_1$

12. A body is moving with velocity 30 m/s towards east. After 10 seconds its velocity becomes 40 mis towards north. The average acceleration of the body is ___________
a) $1 m/s^2$ b) $7 m/s^2$ c) $7 m/s^2$ d) $5 m/s^2$

13. A stone is thrown vertically upward with kinetic energy K. The kinetic energy at the highest point is ______________
a) $\frac{K}{2}$ b) $\frac{\sqrt{K}}{2}$ c) K d) zero

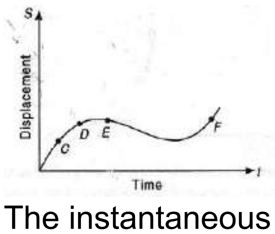
14. A car covers the first-half of the distance between two places at 40 km/h and other half at 60 km/h. The average speed of the car is ____________ .
a) 40 km/h b) 48 km/h c) 50 km/h d) 60 km/h

15. A body is thrown vertically upwards from the ground. It reaches a maximum height of 20 m in 5s. After what time it will reach the ground from its maximum height position?
a) 25s b) 5s c) 10s d) 20s

16. A particle covers half of its total distance with speed v_1 and the rest half distance with speed v_2. Its average speed during the cmplete journey is ________
a) $\frac{v_1 v_2}{v_1+v_2}$ b) $\frac{2v_1 v_2}{v_1+v_2}$ c) $\frac{2v_1^2 v_2^2}{v_1^2+v_2^2}$ d) $\frac{v_1+v_2}{2}$

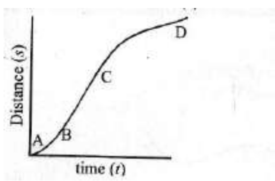
17. A ball is thrown vertically downward with a velocity of 20m/s from the top of a tower. It hits the ground after some time with a velocity of 80 m/s. The height of the tower is ____________
a) 300m b) 360m c) 340m d) 320m

18. The displacement-time graph of moving particle is shown below.



The instantaneous velocity of the particle is negative at the point _________
a) D b) F c) C d) E

19. The displacement 'x' (in meter) of a particle of mass 'm' (in kg) moving in one dimensions under the action of a force, is related to time 't (in sec) by t = $\sqrt{3}$ + 3 . The displacement of the particle when its velocity is zero, will be _____________.
a) 2m b) 4m c) 6m d) zero

20.


A particle shows distance-time curye as given in this figure. The maximum instantaneous velocity ofthe particle is arround the part ___________

a) B b) C c) D d) A

21. A boy standing at the top of a tower of 20 m height drops a stone. Assuming g : 10 ms^{-2}, the velocity with which it hits the ground is ___________ .

a) 10.0 m/s b) 20.0 m/s c) 40.0 m/s d) 5.0 m/s

22. A stone released with zero velocity from the top of a tower, reaches the ground in 4s. The height of the tower is __________(g = 10 m/s^2)

a) 20 m b) 40 m c) 80 m d) 160 m

23. A body starts from rest, what is the ratio of the distance travelled by the bOdy during the 4th and 3rd s?

a) $\frac{7}{5}$ b) $\frac{5}{7}$ c) $\frac{7}{3}$ d) $\frac{3}{7}$

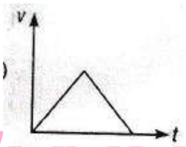
24. A particle moves along a straight line such that its displacement at any time t is given by s = $\left(t^3-6t^2+3t+4\right)$ m. The velocity when the acceleration is zero, is __________

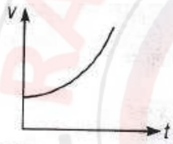
a) $3ms^{-1}$ b) $-12ms^{-1}$ c) $42ms^{-1}$ d) $-9ms^{-1}$

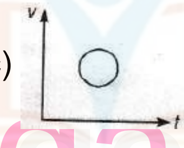
25. A bus is moving with a speed of 10 ms^{-1} on a straight road. A scooterist wishes to overtake the bus in 100 s. If the bus is at a distance of 1 km from the scooterist, with what speed should the scooterist chase the bus?

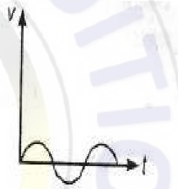
a) 40 ms^{-1} b) 25 ms^{-1} c) 10 ms^{-1} d) 20 ms^{-1}

26. Which of the followrng curves does not represent motion in one dimension?

a) 

b) 

c) 

d) 

27. The position x of a particle with respect to time t along x-axis is given by x = $9t^2$ - t^3 where x is in metres and t in second. What will be the position of this particle when it achieves maximum speed along the +ve x direction ___________

a) 54m b) 81m c) 24m d) 32m

28. A bus travelling the first one-third distance at a speed of 10 km/h, the next one-third at 20 krn/h and the last one- third at 60 km/h. The average speed of the bus is _________ .

a) 9 km/h b) 16 km/h c) 18 km/h d) 48 km/h

29. A particle moves in a straight line with a constant acceleration. It changes its velocity from 10 ms^{-1} to 20 ms^{-1} while passing through a distance 135 m in 1 second. The value of t is __________ .

a) 10 b) 1.8 c) 12 d) 9

30. If a car at rest, accelerates uniformly to a speed of 144 km/h in 20 s, it covers a distance of ___________ .

a) 2880m b) 1440m c) 400m d) 20m

31. What will be the ratio of the distance moved by a freely falling body from rest in 4th and 5th second of journey?

a) 4:5 b) 7:9 c) 16:25 d) 1:1

32. A ball is dropped from a high rise platform at r = 0 starting from rest. After 6 seconds another ball is thrown downwards from the same platform with a speed v. The two balls meet at t = 18s. What is the value of v? (take g: 10 m/s^2)

a) 75 m/s b) 55 m/s c) 40 m/s d) 60 m/s

33. A body dropped from top of a tower fall through 40 m during the last two seconds of its fall. The heigt of tower is__________ (g = 10 m/s^2)
a) 60 m b) 45 m c) 80 m d) 50 m

34. A man throws balls with the same speed vertically upwards one after the other at an interval of 2 seconds. What should be the speed of the throw so that more than two balls are in the sky at any time? [Given g: 9.8 m/s^2]
a) Only with speed 19.6 m/s b) More than 19.6 m/s c) At least 9.8 m/s
d) Any speed less than 19.6 m/s

35. Three different objects of masses m_1, m_2 and m_3 are allowed to fall from rest and from the same point O along three different frictionless paths. The speeds of the three objects on reaching the ground will be in the ratio of ____________
a) $m_1: m_2 : m_3$ b) $m_1: 2m_2 : 3m_3$ c) 1:1:1 d) $\frac{1}{m_1} : \frac{1}{m_2} : \frac{1}{m_3}$

36. Preeti reached the metro station and found that the escalator was not working. She walked up the stationary escalator in time t_1. On other days, if she remains stationary on the moving escalator, the escalator takes her up in time t_2. The time taken by her to walk up on the moving escalator will be _________
a) $\frac{t_1+t_2}{2}$ b) $\frac{t_1t_2}{t_2-t_1}$ c) $\frac{t_1t_2}{t_2+t_1}$ d) $t_1 - t_2$

37. A car moves from X to y with a uniform speed Vu and, returns to Y with a uniform speed vr. The average speed for this round trip is ___________.
a) $\sqrt{v_u v_d}$ b) $\frac{v_d v_u}{v_d+v_u}$ c) $\frac{v_u+v_d}{2}$ d) $\frac{2v_d v_u}{v_d+v_u}$

38. If a ball is thrown vertically upwards with speed a, the distance covered during the last seconds of its ascent is ______________
a) $(u+gt)t$ b) ut c) $\frac{1}{2}gt^2$ d) $ut - \frac{1}{2}gt^2$

39. A particle along a straight line OX. At a time t (in seconds) the distance x (in metres) of the particle from O is given by x= 40+12t-t^3. How long would the particle fiavel before coming to rest?
a) 40m b) 56m c) 16m d) 24m

40. A particle moves a distance x in time t according to equation x : (t + 5)$^{-1}$. The acceleration of particle is proportional to ____________
a) (a) (velocity)$^{3/2}$ b) (distance)^2 c) (distance) ^{2} d) velocity$^{2/3}$

41. A car moving with a speed of 40 km/h can be stopped after 2 m by applying brakes. If the same car is moving with a speed of 80 km/h. What is the minimum stopping distance?
a) 8m b) 2m c) 4m d) 6m

42. Two cars P and Q start form a point at the same time in a straight line and their positions are represented,by Xp(t) = at + bt^2 and Xq(t) = ft - t^2 . X wnat time do the cars have the same velocity?
a) $\frac{a-f}{1+b}$ b) $\frac{a+f}{2(b-1)}$ c) $\frac{a+f}{2(1+b)}$ d) $\frac{f-a}{2(1+b)}$

43. A car accelerates from rest at a constant rate a for some time, after which it decelerates at a constant rate b and comes to rest. If the total time elapsed is I, then the maximum velocity acquired by the car is ________

a) $\left(\frac{\alpha^2+\beta^2}{\alpha\beta}\right)t$ b) $\left(\frac{\alpha^2-\beta^2}{\alpha\beta}\right)t$ c) $\frac{(\alpha+\beta)t}{\alpha\beta}$ d) $\left(\frac{\alpha\beta t}{\alpha+\beta}\right)$

44. A ball is thrown vertically upward. It has a speed of 10 m/sec when it has reached one half of its maximum height. How high does the ball rise?
a) 10m b) 5m c) 15m d) 20m

45. A train of 150 m length is going towards North direction at a speed of 10 m/s. A parrot flies at the speed of 5 m/s towards South direction parallel to the railways track. The time taken by the parrot to cross the train is ___________ .
a) 12s b) 8s c) 15s d) 10s

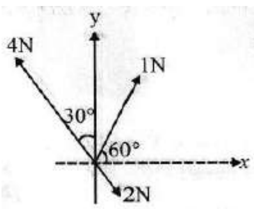
46. The speed of a swimmer in still water is 20 m/s. The speed of river water is 10 m/s and is flowing due east. If he is standing on the south bank and wishes to cross the river along the shortest path the angle at which he should make his strokes w.r.t. north is given by __________ .
a) 0^o b) 60^owest c) 45^owest d) 30^owest

47. A car is moving along a straight road with a uniform acceleration. It passes through two points P and Q separated by a distance with velocity 30 km/h and 40 km/h respectively. The velocity of the car midway between p and Q is ___________ .
a) 33.3 km/h b) $20\sqrt{2}$ km/h c) $25\sqrt{2}$ km/h d) 0.35 km/h

48. A man of 50 kg mass is standing in a gravity free space at a height of 10 m above the floor. He throws a stone of 0.5 kg mass downwards with a speed 2 m/s. When the stone reaches the floor, the distance of the man above the floorwill be _____________ .
a) 9.9m b) 10.1m c) 10m d) 20m

49. If a ball is thrown vertically upwards with a velocity of 40 m/s, then velocity of the ball after 2s will be (g = 10 m/s^2)
a) 15m/s b) 20m/s c) 25m/s d) 28m/s

50. A stone falls freely under gravity. It covers distances h_1, h_2 and h_3 in the first 5 seconds, the next 5 seconds and the nxet 5 seconds respectively. The relation between h_1, h_2 and h_3 __________
a) $h_1=\frac{h_2}{3}=\frac{h_3}{5}$ b) $h_2=3h_1\ and\ h_3=3h_2$ c) $h_1=h_2=h_3$ d) $h_1=2h_2=3h_3$

51. 

Three forces acting on a body are shown rn the figure. To have the resultant force only along the y-direction, the magnitude of the minimum additional force needed is __________ .
a) $\sqrt{3}$ N b) 0.5 N c) 1.5 N d) $\frac{\sqrt{3}}{4}$ N

52. The magnitudes of vectors A, B and C are 3, 4 and 5 units. respectively. if A + B = C, the angle between A and B is ____________ .
a) $\frac{\pi}{2}$ b) $\cos^{-1}(0.6)$ c) $\tan^{-1}\left(\frac{7}{5}\right)$ d) $\frac{\pi}{4}$

53. If a unit vector is represented by $0.5\hat{i}-0.8\hat{j}+c\hat{k}$, then the value of c is _________
a) 1 b) $\sqrt{0.11}$ c) $\sqrt{0.01}$ d) 0.39

54. A particle moving with velocity $\vec{v}$ is acted by three forces shown by the vector triangle PQR. The velocitv of the particle will __________
a) Decrease b) Remain constant c) Change according to the smallest force $\vec{OR}$
d) Increase

55. Two particles of mass M and m are moving in a circle of radii R and r. If their time-periods are same, what will be the ratio of their linear velocities?
a) MR:mr b) M:m c) R:r d) 1:1

56. A bus is moving on a straight road towards North with a uniform speed of 50 km/h. If the speed remains unchanged after turning through 90°, the increase in the velocity of bus in the turning process is __________
a) 70.7 km/h along South-West direction b) zero c) 50 km/h West
d) 70.7 km/h North-West direction

57. Aparticle has initial velocity $(2\vec{i}+3\vec{j})$ and acceleration $(0.3\vec{i}+0.2\vec{j})$. The magnitude of velocity after 10 seconds wiil be __________ .
a) $9\sqrt{2}\ units$ b) $5\sqrt{2}\ units$ c) 5 units d) 9 units

58. A person swims in a river aiming to reach exactly opposite point on the bank of a river. His speed of swimming is 0.5 m/s at an angle 120° with the direction of flow of water. The speed of water in stream is __________
a) 1.0m/s b) 0.5m/s c) 0.25m/s d) 0.43m/s

59. The maximum range of a gun of horizontal terrain is i 6 km. If g=10 ms^{-2}, then muzzle velocity of a shell must be __________
a) 160 ms^{-1} b) $200\sqrt{2}$ ms^{-1} c) 400 ms^{-1} d) 800 ms^{-1}

60. The resultant of A $\times$ 0 will be equal to __________ .
a) zero b) A c) zero vector d) unit vector

61. If the angle between the vectors $\vec{A}\ and\ \vec{B}$ is θ, the value of the product $(\vec{B}\times\vec{A})\cdot\vec{A}$ is equal to __________
a) $BA^2\sin\theta$ b) $BA^2\cos\theta$ c) $BA^2\sin\theta\cos\theta$ d) zero

62. A boat is sent across a river with a velocity of 8 km h^{-1}. If the resultant velocity of boat is 10 km h^{-1}, then velocity of river is __________ .
a) (a) l2.8 kmh^{-1} (b) (c) (d) b) 6 kmh^{-1} c) 8 kmh^{-1} d) 10 kmh^{-1}

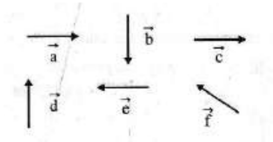
63. The angle between the vector
$\vec{A}=3\hat{i}+4\hat{j}+5\hat{k}$ and $\vec{B}=3\hat{i}+4\hat{j}-5\hat{k}$ will be __________
a) 45° b) 90° c) 180° d) 0

64. Vectors $\vec{A},\vec{B}\ and\ \vec{C}$ are such that $\vec{A}\cdot\vec{B}=0$ and $\vec{A}\cdot\vec{C}=0$ then the vector parallel to $\vec{A}$ is __________
a) $\vec{B}\ and\ \vec{C}$ b) $\vec{A}\times\vec{B}$ c) $\vec{B}+\vec{C}$ d) $\vec{B}\times\vec{C}$

65. $\vec{A}$ and $\vec{B}$ are two vectors and θ is the angle between them if $|\vec{A}\times\vec{B}|=\sqrt{3}(\vec{A}\cdot\vec{B})$ the value θ is __________
a) 45° b) 30° c) 60° d) 90°

66. The position vector of a particle is r $= (a \cos wt)\hat{i} + (a \sin wt)\hat{j}$. The velocity of the particle is ____________ .
    a) directed towards the origin b) directed away from the origin
    c) parallel to the position vector d) perpendicular to the position vector
67. A particle is moving such that its position coordinate (x,y) are
    (2m 3m) at time r = 0
    (6m, 7m) attime t = 2s and
    (13m, 14m) at time r = 5s.
    Average velocity vector $\left(\vec{V}_{av}\right)$ from t = 0 to t = 5s is ___________ .
    a) $\frac{1}{5}(13\hat{i} + 14\hat{j})$ b) $\frac{7}{3}(\hat{i} + \hat{j})$ c) $2(\hat{i} + \hat{j})$ d) $\frac{11}{5}(\hat{i} + \hat{j})$
68. A bullet is fired from a gun with a speed of 1000 m/s in order to hit a target 100 m away. At what height above the target should the gun be aimed? (The resistance of air is negligible and g =10 m/s^2)
    a) 5cm b) 10cm c) 15cm d) 20cm
69. From a 10 m high building a stone 'A' is dropped, and simultaneously another identical stone 'B' is thrown horizontally with an initial speed of 5 ms^{-1}. Which one of the following statements is true?
    a) It is not possible to calculate which one of the two stones will reach the ground first
    b) Both the stones ('A' and 'B') will reach the ground simultaneously
    c) 'A' stone reaches the ground earlier than 'B'
    d) 'B' stone reaches the ground earlier than 'A'

70. For angles of projection of a projectile (45°-θ) and (45° + θ), the horizontal ranges described by the projectile are in the ratio of ______________ .
    a) 1:3 b) 1:2 c) 2:1 d) 1:1
71. The ratio of resolving powers of an optical microscope for two wavelength $\lambda_1 = 4000$ and $\lambda_2 = 6000$ is ____________
    a) 8:27 b) 9:4 c) 3:2 d) 16:81
72. When milk is churned, cream gets separated due to ____________.
    a) centripetal force b) centrifugal force c) frictional force d) gravitational force
73. An electric fan has blades of length 30 cm measured from the axis of rotation. If the fan is rotating at 120 rev/min, the acceleration of a point on the tip of the blade is ____________ .
    a) 1600 ms^{-2} b) 47.4 ms^{-2} c) 23.7 ms^{-2} d) 50.55 ms^{-2}
74. Six vectors, $\vec{a}$ through $\vec{d}$ haue the magnitudes and directions, indicated in the figure. Which of the following statements is true _________



    a) $\vec{b} + \vec{c} = \vec{f}$ b) $\vec{d} + \vec{c} = \vec{f}$ c) $\vec{d} + \vec{e} = \vec{f}$ d) $\vec{e} + \vec{b} = \vec{f}$
75. When an object is shot from the bottom of a long smooth inclined plane kept at an angle 60° with horizontal, it can travel a distance x$_1$ along the plane. But when the inclination is decreased to 30° and the same object is shot with the same velocity, it can havel x$_2$ distance.

Then $x_1 : x_2$ will be ____________

a) $1 : \sqrt{2}$ b) $\sqrt{2} : 1$ c) $1 : \sqrt{3}$ d) $1 : 2\sqrt{3}$

76. A ship A is moving Westwards with a speed of 10 km h^{-l} and a ship B 100 km South of A is moving Northwards with a speed of l0 km h^{-l}. The time after which the distance between them becomes shortest, is ___________ .

a) 5 h b) $5\sqrt{2}$ h c) $10\sqrt{2}$ h d) 0 h

77. A particle moves along a circle of radius $\left(\frac{20}{\pi}\right)\mathrm{m}$ with constant tangential acceleration. If the velocity of the particle is 80 m/s at the end of the second revolution after motion has begun, the tangential acceleration is _____________

a) 40pm/s^2 b) 40m/s^2 c) 640pm/s^2 d) 160pm/s^2

78. What is the linear velocity, if angular velocity vector $w = 3\hat{i} - 4\hat{j} + \hat{k}$ and position vector r = $5\hat{i} - 6\hat{j} + 6\hat{k}$?

a) $6\hat{i} - 2\hat{j} - 3\hat{k}$ b) $-18\hat{i} - 13\hat{j} + 2\hat{k}$ c) $18\hat{i} + 13\hat{j} + 2\hat{k}$ d) $6\hat{i} - 2\hat{j} + 8\hat{k}$

79. A missile is fired for maximum range with an initial velocity of 20 m is. If g = 10 m/s^2, the range of the missile is _____________ .

a) 40m b) 50m c) 60m d) 20m

80. A body of 3 kg moves in the XY plane under the action of a force given by $6t\hat{i} + 4t\hat{j}$. Assuming that the body is at rest at title t = 0, the velocity of the body at t = 3s is _____________ .

a) $6\hat{i} + 6\hat{j}$ b) $18\hat{i} + 6\hat{j}$ c) $18\hat{i} + 12\hat{j}$ d) $12\hat{i} + 18\hat{j}$

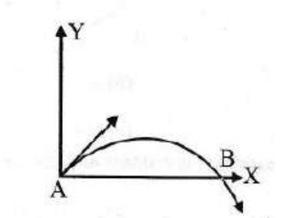
81. The horizontal range and the maximum height of a projectile are equal. The angle of projection of the projectiles is____________

a) $\theta = \tan^{-1}\left(\frac{1}{4}\right)$ b) $\theta = \tan^{-1}(4)$ c) $\theta = \tan^{-1}(2)$ d) $\theta = 45^\circ$

82. A child is swinging a swing. Minimum and maximum heights of swing from earth's surface are 0.75 m and 2 m respectively. The maximum velocity of this swing is ____________ .

a) 5 m/s b) 10 m/s c) 15 m/s d) 20 m/s

83. The velocity of a projectile at the initial point A is $(2\hat{i} + 3\hat{j})$ m/s. It's velocity (in m/s) at point.B is ____________



a) $-2\hat{i} + 3\hat{j}$ b) $2\hat{i} - 3\hat{j}$ c) $2\hat{i} + 3\hat{j}$ d) $2\hat{i} - 3\hat{j}$

84. If $|\vec{A} \times \vec{B}| = \sqrt{3A \cdot B}$ then the value of $|\vec{A} \times \vec{B}|$ is ____________

a) $\left(A^2 + B^2 + \sqrt{3}AB\right)^{1/2}$ b) $\left(A^2 + B^2 + AB\right)^{1/2}$ c) $\left(A^2 + B^2 + \frac{AB}{\sqrt{3}}\right)^{1/2}$ d) A+B

85. Find the torque of a force F = $-3\hat{i} + \hat{j} + 5\hat{k}$ acting at the point $\mathbf{r} = 7\hat{i} + 3\hat{j} + \hat{k}$.

a) $-21\hat{i} + 3\hat{j} + 5\hat{k}$ b) $-14\hat{i} - 3\hat{j} + \hat{k}$ c) $4\hat{i} + 4\hat{j} + 6\hat{k}$ d) $14\hat{i} - 38\hat{j} + 16\hat{k}$

86. A projectile is fired at an angle of 45° with the horizontal. Elevation angle of the projectile at its highest point as seen from the point of projection is _______

a) 60° b) $\tan^{-1}\left(\frac{1}{2}\right)$ c) $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$ d) 45°

87. Which of the following is not a vector quantiry?

a) Speed b) Velocity c) Torque d) Displacement

88. The vectors $\vec{A}$ and $\vec{B}$ are such that $|\vec{A}+\vec{B}| = |\vec{A}-\vec{B}|$. The angle between the two vectors is ___________ .

a) 60° b) 75° c) 45° d) 90°

89. A particle starting from the origtn (0,0) moves in a straight line in the (x, y) plane. Its coordinates at a later time are ($\sqrt{3}$, 3). The path of the particle makes with the x-axis an angle of ____________

a) 45° b) 60° c) 0° d) 30°

90. Two boys are standing at the end A and B of a ground where AB = α . The boy at B starts running in a direction perpendicular to AB with velocity v_1. The boy at A starts running simultaneously with velocity v_2 and catches the other boy at time r, where r is ___________

a) $a/\sqrt{v^2+v_1^2}$ b) $a/(v+v_1)$ c) $a/(v-v_1)$ d) $\sqrt{a^2/(v^2-v_1^2)}$

91. Two particles A and B are connected by a rigid rod AB. The rod slides along perpendicular rails as shown here. The velocity of A to the right is 10 m/s. What is the velocity of.B when angle a =60°?

a) 9.8m/s b) 10m/s c) 5.8m/s d) 17.3m/s

92. The speed of a boat is 5 km/h in still water. It crosses a river of width 1.0 km along the shortest possible path in 15 min. The velocity of the river water is (in km/h)

a) 5 b) 1 c) 3 d) 4

93. A car runs at a constant speed on a circular track of radius 100 m, taking 62.8 seconds in every circular loop. The average velocity and average speed for each circular loop respectively is ____________

a) 0,10m/s b) 10m/s, 10m/s c) 10m/s,0 d) 0,0

94. A particle moves in a circle of radius 5 cm with constant speed and time period 0.2 π s. The acceleration of the particle is _________

a) 5m/s^2 b) 15m/s^2 c) 25m/s^2 d) 35m/s^2

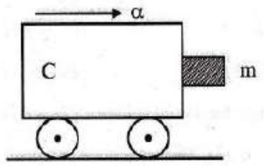
95. The vector sum of two forces is perpendicular to their vector differences. In that case, the forces _____________

a) cannot be predicted b) are equal to each other c) are equal to each other in magnitude d) are not equal to each other in magnitude

96. The circular motion of a particle with constant speed is __________

a) periodic but not simple harmonic b) simple harmonic but not periodic c) periodic and simple harmonic d) neither periodic nor simple harmonic

97. A block of mass m is in contact with the cart C as shown in the figure.



The coefficient of static friction between the block and the cart is μ. The acceleration α of the cart that will prevent the block from falling satisfies _________

a) $\alpha > \frac{mg}{\mu}$ b) $\alpha > \frac{g}{\mu m}$ c) $\alpha \geq \frac{g}{\mu}$ d) $\alpha < \frac{g}{\mu}$

98. A body is whirled in a horizontal circle of radius 20 cm. It has an angular velocity of 10 rad/s. What is its linear velocity at any point on circular path?

a) $\sqrt{2}$ m/s b) 2 m/s c) 10 m/s d) 20 m/s

99. A stone tied to the end of a string of 1 m long is whirled in a horizontal circle with a constant speed. If the stone makes 22 revolutions in 44 seconds, what is the magrritude and direction ofacceleration ofthe stone?

a) p^{2}ms^{-2} and direction along the radius towards the centre

b) p^{2}ms^{-2} and direction along the radius away from the centre

c) p^{2}ms^{-2} and direction along the tangent to the circle

d) p^2/4ms^{-2} and direction along the tangent to the circle

100. A stone is tied to a string of length 1 and is whirled in a vertical circle with the other end of the string as the centre. At a certain instant of time, the stone is at its lowest position and has a speed u. The magnitude of the change in velocity as it reaches a position where the string is horizontal (g being acceleration due to gravity) is ___________.

a) $\sqrt{2g\ell}$ b) $\sqrt{2u^2 - g\ell}$ c) $\sqrt{u^2 - g\ell}$ d) $u - \sqrt{u^2 - 2g\ell}$

101. If the magnitude of sum of two vectors is equal to the magnitude of difference of the two vectors, the angle between these vectors is ___________

a) 90^o b) 45^o c) 180^o d) 45^o

102. Two bodies of same mass are projected with the same velocity at an angle 30^o and 60^o respectively. The ratio of their horizontal ranges will be ___________

a) 1:1 b) 1:2 c) 1:3 d) 2:$\sqrt{2}$

103. If a vector $2\hat{i} + 3\hat{j} + 8\hat{k}$ is perpendicular to the vector $4\hat{j} - 4\hat{i} + \alpha\hat{k}$ of, then the value of a is ___________

a) 1/2 b) -1/2 c) 1 d) -1

104. A particle of mass m is projected with velocity v making an angle of 45^o with the horizontal. When the particles lands on the level ground the magnitude of the change in its momentum will be ______________

a) 2mv b) $\mathrm{mv}/\sqrt{2}$ c) mv$\sqrt{2}$ d) zero

Ravi Maths Tuition Centre

Time : 1 Mins **MECHANICAL PROPERTIES OF SOLIDS AND FLUIDS 1** **Marks : 313**

1. The graph shows the behaviour of a length of wire in the for which the substance obeys Hooke's law. P and Q represent

a) P = applied force, Q = extension b) P = extension, Q = applied force
c) P = extension, Q = stored elastic energy d) P = stored elastic energy, Q = extension
2. A wire of length 2 m is made from 10 cm^3 of copper. A force F is applied so that its length increases by 2 mm. Another wire of length 8 m is made from the same volume of copper. If the force F is applied to it, its length will increase by
a) 0.8 cm b) 1.6 cm c) 2.4 cm d) 3.2 cm
3. Elasticity is due to
a) decrease of PE with separation between atoms/molecules
b) increase of PE with separation between atoms/molecules c) asymmetric nature of PE curve
d) None of the above
4. The temperature of a wire is doubled. The Young's modulus of elasticity
a) will also double. b) will become four times c) will remain same d) will decrease.
5. Two rods of different materials having coefficient of thermal expansion α_1, α_2 and Young's modulus Y_1, Y_2 respectively are fixed between two rigid massive walls. The rods are heated such that they undergo the same increase in temperature. There is no bending of the rods. If a $\alpha_1 : \alpha_2 = 2 : 3$, the thermal stresses developed in the two rods are equal provided $Y_1 : Y_2$ is equal to
a) 2: 3 b) 1: 1 c) 3: 2 d) 4 : 9
6. The length of a wire increases by 1% by a load of 2 kg-wt. The linear strain produced in the wire will be
a) 0.02 b) 0.001 c) 0.01 d) 0.002
7. A material has Poisson's ratio 0.5. If a uniform rod of it suffers a longitudinal strain of 2×10^{-3}, then the percentage change in volume is
a) 0.6 b) 0.4 c) 0.2 d) Zero
8. A and B are two wires. The radius of A is twice that of B. They are stretched by the same load. Then, the stress on B is
a) equal to that on A b) four times that on A c) two times that on A d) half that on A
9. You have four wires A, B, C, D of same material having same area of cross - section such that length of A > B > C > D, the breaking force of
a) A > B > C > D b) A < B < C < D c) A = B = C = D d) A/B - C/D
10. With the increase in temperature, the Young's modulus of a material
a) increases b) decrease c) remains same d) fluctuates

11. A mild steel wire of length 2L and cross-sectional area A is stretched, well within elastic limit, horizontally between two pillars figure. A mass m is suspended from the mid point of the wire. Strain in the wire is

a) $\frac{x^2}{2L^2}$ b) $\frac{x}{L}$ c) $\frac{x^2}{L}$ d) $\frac{x^2}{2L}$

12. Elastic limit is equal to

a) Young's modulus b) Modulus of rigidity c) stress d) strain

13. A uniform cube is subjected to volume compression. If each side is decreased by 1%, then bulk strain is

a) 0.01 b) 0.06 c) 0.02 d) 0.03

14. A wire of length L, area of cross section A is hanging from a fixed support. The length of the wire changes to L_1 when mass M is suspended from its free end. The expression for Young's modulus is___

a) $\frac{mgL}{A(L_1-L)}$ b) $\frac{mgL_1}{AL}$ c) $\frac{Mg(L_1-L)}{AL}$ d) $\frac{MgL}{AL_1}$

15. Brittle substanceare those in which there is

a) no elastic b) no breaking point c) small gap between elastic limit and breaking point
d) large gap between elastic limit and breaking point

16. One end of uniform wire of length L and of weight W is attached rigidly to a point in the roof and a weight WI is suspended from its lower end. If s is the area Of cross-section of the wire. the stress in the wire at a height (3L/4) from its lower end is

a) W_1/s b) [W_1/s+W/4]s c) [W_1+3W/4]s d) W_1+W/s

17. Two wires of the same material and length but diameter in the ratio 1: 2 are stretched by the same load. The ratio of elastic potential energy per unit volume for the two wires is

a) 1 :1 b) 2 : 1 c) 4 : 1 d) 16 : 1

18. Four wires of the same material are Stretched by the same load. The dimensions are given below. Which of them will elongate the most

a) length 100 cm, diameter 1 mm b) length 200 cm, diameter 2 mm c) length 300 cm, diameter 3 mm
d) length 400 cm, diameter 0.5 mm

19. A metal wire is first stretched beyond its elastic limit then released it:

a) Loses its elastic property completely and it will not contract b) Will contact to its length
c) Will contract to its length at elastic limit d) Will but final length Will be greater than original length

20. In solids, inter-atomic forces are

a) totally repulsive b) totally attractive c) combination of (a) and (b) d) None of these

21. A spring is stretched by applying a load to its free end. The strain produced in the spring is

a) volumetric b) shear c) longitudinal and shear d) longitudinal

22. Elasticity of a material can be altered by

a) annealing b) hammering c) adding impurities d) All of the above

23. A rigid bar of mass M is supported symmetrically by three wires each of length l. Those at each end are of copper and the middle one is of iron. The ratio of their diameters, if each is to have the same tension, is equal to

a) $\frac{Y_{\text{Copper}}}{Y_{\text{Iron}}}$ b) $\sqrt{\frac{Y_{\text{Iron}}}{Y_{\text{Copper}}}}$ c) $\sqrt{\frac{Y^2_{\text{Iron}}}{Y^2_{\text{Copper}}}}$ d) $\frac{Y_{\text{Iron}}}{Y_{\text{Copper}}}$

24. A copper and a steel wire of the same diameter are connected end to end. A deforming force F is applied to this composite wire which causes a total elongation of 1cm. The two wires will have

a) the same stress and strain b) the same stress but different strain c) the same strain but different stress
d) different strains and stress

25. The approximate depth of an ocean is 2700 m. The compressibility of water is $45.4 \times 10^{-11}\ \text{Pa}^{-1}$ and density of water is $10^3\ \text{kg/m}^3$. What fractional compression of water will be obtained at the bottom of the ocean?

a) 1.0×10^{-2} b) 1.2×10^{-2} c) 1.4×10^{-2} d) 0.8×10^{-2}

26. The Young's modulus of a Wire is numerically equal to the stress Which Will
    a) Not change the length of the wire b) Double the length of the wire c) Increase the length by 50%
    d) Change the radius of the wire to half
27. Bulk modulus of water is 2 x 10^9 N/m^2. The pressure required to increase the density of water by 0.1 % in N/m^2 is
    a) 2 x 10^9 b) 2 x 10^8 c) 2 x 10^6 d) 2 x 10^4
28. Wire A and B are made from the same material A has twice the diameter and three times the length of B. If the elastic limits are not reached, when each is stretched by the same tension, the ratio of energy stored in A to that in B is:
    a) 2: 3 b) 3 : 4 c) 3: 2 d) 6 : 1
29. A wire of length L and cross section A is make of material of Young's modulus Y.It is stretched by an amount x. the work done is
    a) $\frac{YxA}{2L}$ b) $\frac{Yx^2A}{L}$ c) $\frac{Yx^2A}{2L}$ d) $\frac{2Yx^2A}{L}$
30. The maximum load a wire can withstand without breaking, when its length is reduced to half of its original length, will
    a) be double b) be half c) be four times d) remain same
31. The reciprocal of Bulk modulus (1/K) is called
    a) Young's modulus b) modulus of rigidity c) Hooke's law d) compressibility
32. The load versus elongation graph for four wires of the same material is shown in the fig. The thinnest wire is represented by the line.

    a) OC b) OD c) OA d) OB
33. The adjoining figure shows how the extension e of a wire varies with the applied F. If L is the original length of the A its cross sectional area and Y is the Young modulus of the material of the wire. the slope of the graph is

    a) YL/A b) YA^2/L c) YL^2A d) YA/L e) A/YL
34. Young's modulus of a wire depends on
    a) its material b) its length c) its area of cross-section d) both (b) and (c)
35. Which of the following statements is incorrect?
    a) Young's modulus and shear modulus are relevant only for solids
    b) Bulk modulus is relevant for liquids and gases.
    c) Metals have larger values of Young's modulus than elastomers
    d) Alloys have larger values of Young's modulus than metals.
36. The property of a body by virtue of which it tends to regain its original size and shape of a body when applied force is removed, is known as
    a) fluidity b) elasticity c) plasticity d) rigidity
37. Ductile substances are those in which
    a) there is no elastic limit b) there is no breaking point c) Hooke's law is not applicable
    d) there is a large gap between elastic limit and breaking point
38. The energy stored in a stained wire is given by
    a) 1/2 stress x strain b) 1/2 load x elongation c) 1/2 stress / strain d) 1/2 load / eloongation

39. A uniform bar of square cross-section is lying along a frictionless horizontal surface. A horizontal force is applied to pull it from one of its ends, then
a) the bar is under same stress throughout its length
b) the bar is not under any stress because force has been applied only at one end
c) the bar simply moves without any stress in it
d) the stress developed gradually reduces to zero at the end of the bar where no force is applied

40. Modulus of rigidity of ideal liquids is
a) infmity b) Zero c) unity d) some finite small non-zero constant value

41. Rigidity modulus of steel is η and its Young's modulus is Y. A piece of steel of cross-sectional area a is stretched into a wire of length L are a/10. Then
a) Y increases and η decreases b) Y and η remain the same c) Y decreases and η increases
d) Both Yand η increases

42. A copper rod of 88 cm and an aluminium rod of unknown length have their increase in length independent of increase in temperature. The length of aluminium rod is: $\left(a_{Cu} = 1.7 \times 10^{-5}\ K^{-1}\right.$ and $\left.a_{Al}^{-2.2} \times 10^{-5}\ K^{-1}\right)$____
a) $113.9\ cm$ b) $88\ cm$ c) $68\ cm$ d) $6.8\ cm$

43. When an elastic material with Young's modulus Y is subjected to stretching stress S, elastic energy stored per unit volume of the material is_____
a) $YS/2$ b) $S^2Y/2$ c) $S^2/2Y$ d) $S/2Y$

44. Copper of fixed volume ' V ' is drawn into wire of length ' T '. When this wire is subjected to a constant force ' P ', the extension produced in the wire is Dl'. Which of the following graphs is a straight line?
a) Dl versus 1/l b) Dl versus l^2 c) Dl versus $1/l^2$ d) Dl versus l

45. K is a force constant of a spring. The work done in increasing its extension from l_1 to l_2 will be:
a) $K(l_1 - l_2)$ b) $K(l_1 + l_2)/2$ c) $K\left(l_1^2 + l_1^2\right)$ d) $K\left(l_2^2 + l_1^2\right)/2$

46. If both the length and radius of the wire are doubled. how does the rnodulus of elasticity change?
a) becomes one fourth b) halved c) doubled d) remains unchanged

47. A wire of length L arid radius r is rigidly fixed at one end. On stretching the other end of the wire with a force F, the increase in its length is l. If another wire of same material but of length 2L and radius 2r is stretched with a force of 2F, the increase in its length will be
a) l b) 2l c) l/2 d) l/4

48. One end of a uniform wire of length L and of weight W is attached rigidly to a point in the roof and weight W_1 is suspended from the lower end. If S is the area of cross-section of the wire, the stress in the wire at a height 3/4 from its lower end is;
a) W_1/S b) $(W_1 + W/4)S$ c) $(W_1 + 3W/4)/S$ d) $W_1 + W)/S$

49. The nature of molecular forces resembles with the nature of the
a) gravitational force b) nuclear force c) electromagnetic force d) weak force

50. Stress-strain curves for the material A and B are shown below Then,

a) A is brittle material b) B is ductile material c) B is brittle rrraterial d) Both (a) and (b)

51. Young's modulus of a material has the same unit as
a) stress b) energy c) compressibility d) pressure

52. A rod elongates by l when a body of mass M is suspended from it. The work done is:
a) Mgl b) $\frac{1}{2}Mgl$ c) 2Mgl d) Zero

53. A cube of aluminium of side 0.1m is subjected to a shearing force of 100 N.The top face of the cube is displaced through 0.02 cm with respect to the bottom face. The shearing strain would be

a) 0.02 b) 0.1 c) 0.005 d) 0.002

54. Dimensional formula of stress is same as that of
a) impulse b) strain c) force d) pressure

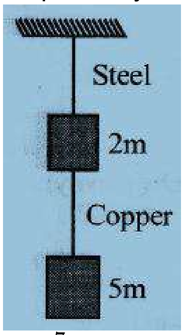
55. You have a wire whose area of cross section is $5mm^2$ and get stretched by 0.2mm by a certain load.If another wire of the same material has 3/2 times its area of cross section, the extension for the same load will be
a) 0.2mm b) 0.24mm c) 0.133mm d) 0.03mm

56. A rope of nylon of radius 1.5cm has a breaking strength of 1.6×10^5N.The breaking strength of a similar rope of radius 7.5mm shall be
a) 1.6×10^5N b) 0.8×10^5N c) 0.4×10^5N d) 0.2×10^5N

57. A wire suspended vertically from one end, is stretched by attaching a weight 200 N to the lower end. The weight stretches the wire by 1 mm. The energy gained by the wire is
a) 0.1 J b) 0.2 J c) 0.4 J d) 4 k

58. In steel, the Young's modulus and the strain at the breaking point are $2 \times 10^{11}Nm^2$ and 0.15, respectively. The stress at the breaking point for steel is therefore
a) 1.33×10^{11} Nm^{-2} b) 1.33×10^{12} Nm^{-2} c) 7.5×10^{-13} Nm^{-2} d) 3×10^{10} Nm^{-2}

59. If the ratio of diameters, lengths and Young's modulus of steel and copper wires shown in the figure are p, q and s respectively, then the corresponding ratio of increase in their lengths would be______



a) $\frac{7q}{(5sp)}$ b) $\frac{5q}{(7sp^2)}$ c) $\frac{7q}{(5sp^2)}$ d) $\frac{2q}{(5sp)}$

60. Two wires A and B are of the same material. Their lengths are in the ratio 1: 2 and the diameter are in the ratio 2: 1. If they are pulled by the same force, then increase in length will be in the ratio____
a) 2: 1 b) 1: 4 c) 1: 8 d) 8: 1

61. A steel rod of length 1m and radius 10mm is stretched by a force 100 kN along its length. The stress produced in the rod is $Y_{Steel} = 2 \times 10^{11}$ Nm^{-2} .
a) 3.18×10^6 Nm^{-2} b) 3.18×10^7 Nm^{-2} c) 3.18×10^8 Nm^{-2} d) 3.18×10^9 Nm^{-2}

62. A wire of diameter 1 mm breaks under a tension of 1000 N. Another wire of same material as that of the first one, but of diameter 2 mm breaks under a tension of
a) 500 N b) 1000 N c) 10000 N d) 4000 N

63. When a pressure of 100 atmosphere is applied on a spherical ball of rubber, then its volume reduces to 0.01 %. The bulk modulus of the material of the rubber in dyne cm^{-2} is
a) 10×10^{12} b) 100×10^{12} c) 1×10^{12} d) 20×10^{12}

64. The value of Bulk modulus for a perfectly right body is
a) infinity b) zero c) one d) ±1

65. On suspending a weight Mg, the length l of elastic wire having area of cross-section A, becomes double the initial length. The instantaneous stress action on the wire is
a) Mg / A b) Mg / 2A c) 2Mg / A d) 4Mg / A

66. The potential energy U between two molecules as a function of the distance r between them has been shown in the adjoining figure The two molecules are

a) attracted when r lies between A and B and repelled when r lies between Band C
b) attracted when r lies between Band C and repelled when r lies between A and B.
c) attracted when they reach B. d) repelled when they reach B.

67. Which of the following is not a unit of Young's modulus?
a) Nm^{-2} b) Mega Pascal (MPa) c) dyne cm^{-2} d) Nm^{-1}

68. When an elastic material with Young's modulus y is subjected to a stretching Stress S. the elastic energy stored per unit volume of the material is:
a) YS/2 b) $S^2Y/2$ c) $S^2/2Y$ d) S/2Y

69. On applying a stress of 20 x 10^8 Nm^2 , the length of a perfectly elastic wire is doubled. Its Young's modulus will be
a) 40 x 10^8 Nm^{-2} b) 20 x 10^8 Nm^{-2} c) 10 x 10^8 Nm^{-2} d) 5 x 10^8 Nm^{-2}

70. A wire fixed at the upper end stretches by length l by applying a force F. The work done in stretching is
a) F/2l b) Fl c) 2Fl d) Fl/2

71. Two wires A and B of the same material have radii in the ratio 2 : 1 and lengths in the ratio 4 : 1. The ratio of the normal forces required to produce the same change in the lengths of these two wires is
a) 1 : 1 b) 2 : 1 c) 1: 2 d) 1 : 4

72. A steel ring of radius r and cross-section area A is shifted on to a wooden disc of radius R(R > r). If Young's modulus be E, then the force with which the steel ring is expanded is
a) AER/r b) AE(R - r)/r c) E(R - r)/Ar d) Er/AR

73. A spring of force constant k is cut into two equal parts. The force constant of each part is
a) k/2 b) k c) 2k d) 4k

74. The compressibility of water is 4×10^{-5} per unit atmospheric pressure. The decrease in volume of 100 cm^3 of water under a pressure of 100 atmosphere will be___
a) 0.4 cm^3 b) $1 \times 10^{-5} \text{ cm}^3$ c) 0.025 cm^3 d) 0.004 cm^3

75. The upper end of a wire of radius 4 mm and length 100 cm is clamped and its other end is twisted through an angle of 30°.Then, angle of shear is
a) 12° b) 0.12° c) 1.2° d) 0.012°

76. In the given figure, if the dimension of the wire are the same and materials are different, Young's modulus is more for

a) A b) B c) Both d) None of these

77. A wire is stretched to double its length. The strain is
a) 2 b) 1 c) Zero d) 0.5

78. Elasticity is shown by materials because inter-atomic or inter-molecular forces
a) increases when a body is deformed b) decreases when a body is deformed
c) remains same when a body is deformed d) becomes non-zero when a body is deformed

79. When a block of mass M is suspended by a long wire of length L, the length of the wire becomes L + l. The elastic potential energy stored in the extended wire is____

a) mgI b) $\frac{1}{2}\mathrm{mgl}$ c) $\frac{1}{2}\mathrm{mgL}$ d) mgl

80. The upper face of a (side 4cm) is displaced 2 mm parallel to itself when 100 N forces are applied at the and lower faces. The lower face is fixed. The strain produced in the cube is

a) 5 b) 0.5 c) 0.05 d) 0.005

81. A long spring is stretched by 2 cm and its potential energy is V. If the spring is stretched by 10 cm, its potential energy will be:

a) V/5 b) V/25 c) 5 V d) 25 V

82. The following four wires are made of the same material. Which of these will have the largest extension when the same tension is applied?

a) $Length = 100 \text{ cm}, diameter = 1 \text{ mm}$ b) $Length = 200 \text{ cm}, diameter = 2 \text{ mm}$
c) $Length = 300 \text{ cm}, diameter = 3 \text{ mm}$ d) $Length = 50 \text{ cm}, diameter = 0.5 \text{ mm}$

Ravi Maths Tuition Centre

Time : 1 Mins **WAVE OPTICS 1** **Marks : 695**

1. A concave lens is used to form an image of a real object.The maximum distance of the image from the optical centre is:
   a) 4f b) 2f c) f d) infinite
2. From a single slit, the first diffraction minima is obtained at 30° for a light of 6500 $\overset{o}{A}$ wavelength. The width of the slit is
   a) 3250 $\overset{o}{A}$ b) 1.3 μ c) 5.4 x 10^{-4} km d) 1.2 x 10^{-2} cm .
3. The reason of interference is
   a) phase difference b) change of amplitude c) change of velocity d) intensity
4. Unit of angular dispersion is
   a) Radian b) Radian / metre c) No unit d) None
5. Consider the diffraction pattern for a small pinhole. As the size of the hole is increased
   a) The size decrease b) The intensity increase c) The size increase
   d) The intensity decrease
6. Light of wavelength $6000\ \overset{\circ}{A}$ falls on a plane reflecting surface. The reflected wavelength is
   a) $6000\ \overset{\circ}{A}$ b) $< 6000\ \overset{\circ}{A}$ c) $> 6000\ \overset{\circ}{A}$ d) cannot say
7. The angle between pass axis of polarizer and analyzer is 45°. The percentage of polarized light passing through analyzer is
   a) 100% b) 50% c) 25% d) 75%
8. In all optical instruments, we use
   a) ray optics b) wave optics c) physical optics d) none of these
9. Which of the following can be used to control the intensity, in sunglasses, window panes etc?
   a) Transverse wave b) Polaroids c) Plane polarised wave d) Polarised wave
10. A real image of half the size is obtained in a concave spherical mirror with a radius of curvature of 40cm. The distance of object and its image will be
    a) 30cm and 60cm b) 60cm and 30cm c) 15cm and 30cm d) 30cm and 15cm
11. In order to increase the magnifying power of a microscope

a) The focal powers of the objective and the eye piece should be large
b)
Objective should have small focal length and the eyepiece should have large focal lenght.
c) Both should have large focal lengths
d)
The objective should have large focal length and eyepiece should have small focal length

12. For a biconvex lens, an image lies at same distance as the obect is from lens; image is real and inverted.What can be said about the object
a) placed at focus b) placed between f & 2f c) placed at 2f d) placed beyond 2f
13. The linear magnification of a convex mirror is
a) always positive b) always negative
c) sometimes positive and sometimes negative d) cannot predict
14. The wavefront due to a source situated at infinity is
a) spherical b) cylindrical c) planar d) circular
15. In Young's double slit experiment, distance between slits in kept 1mm and a screen is kept 1m apart from slits. If wavelength of light used is 500 nm, then fringe spacing is
a) 0.5 mm b) 0.5 cm c) 0.25 mm d) 0.25 cm
16. A ray of light falls on a transparent slab of $\mu = 1.0$. If reflected and refracted rays are mutually perpendicular, what is the angle of incidence?
a) 45° b) 60° c) 30° d) 90°
17. The lens used for correcting myopia is
a) concave b) convex c) Plano concave d) none of these
18. Total internal reflection takes place when light is incident
a) on a concave mirror b) from air on a plan glass surface at a certain given angle
c) from air on a plan surface at any angle
d) from inside glass placed in water at a certain given angle
19. The final image in an astronomical telescope (w.r.t. object) is
a) virtual and erect b) real and erect c) real and inverted d) virtual and inverted
20. A pencil of light rays falls on a plane mirror and form a real image, so the incident rays are
a) parallel b) diverging c) converging d) statement is false
21. The refractive indices of glass and water with respect to air 3/2 and 4/3 respectively.What is the refractive index of glass w.r.t water?
a) 1/2 b) 9/8 c) 8/9 d) None

22. Two light waves superimposing at the mid-point of the screen are coming from coherent sources of light with phase difference π rad. Their amplitudes are 2 cm each. The resultant, amplitude at the given point will be
a) 8 cm b) 2 cm c) 4 cm d) Zero
23. Sound waves are not electromagnetic waves as
a) they cannot undergo interference b) they cannot undergo diffraction
c) they cannot be polarized d) they cannot pass through vacuum
24. A source of light lies on the angle bisector of two plane mirror included at angle . The value of θ so that the light reflected from one mirror does not reach the other mirror does not reach each other mirror will be
a) $\theta \geq 120^\circ$ b) $\theta \geq 90^\circ$ c) $\theta \geq 90^\circ$ d) None of the above
25. The final image formed by a terrestrial telescope is
a) erect b) inverted c) sometimes erect and sometimes inverted
d) none of the above
26. Which is not true for the image formed in a plane mirror? The image is
a) virtual b) erect c) laterally inverted d) closer to the mirror than the object
27. Consider the sunlight incident on a pinhole of width.$10^3 A$ The image of a pinhole seen on a screen shall be
a) A sharp white ring b) Different from geometrical image
c) A diffused central spot, white in colour
d) diffused coloured region around a sharp central white spot
28. Ray diverging from a point source on a wavefront are
a) cylindrical b) spherical c) plane d) cubical
29. The phase difference between the two light waves reaching at a point P is 100 π. Their path difference is equal to
a) 10 λ b) 25 λ c) 50 λ d) 100 λ
30. The speed of light is
a) less in denser medium b) more in denser medium
c) independent of the optical density of the medium d) none of the above
31. In the propagation of light waves, the angle between the direction of vibration and plane of polarisation is
a) 0^o b) 90^o c) 45^o d) 80^o
32. In Young's double-slit experiment, the intensity at the central maximum is 10 if one of the slit is covered, then the intensity at the central maximum become:
a) $\frac{I_0}{2}$ b) $\frac{I_0}{\sqrt{2}}$ c) $\frac{I_0}{4}$ d) I_0
33. Resolving power of microscope depends upon
a) wavelength of light used (directly proportional)
b) wavelength of light used (inversely proportional c) frequency of light used

d) focal length of objective

34. Which of the following is a correct representation of deviation and dispersion of light by a prism

a) b) c) d)

35. The phenomenon of interference is based on

a) conservation of momentum b) conservation of energy.

c) conservation of momentum and energy d) quantum nature of light

36. What happens, if the monochromatic light used in Young's double slit experiment is replaced by white light?

a) No fringes are observed b) All bright fringes become while

c) All bright fringes have colour between violet and red

d) Only the central fringe is white and all other fringes are coloured.

37. As an object gets closer to the focal point of a converging lens from infinity, its image

a) Becomes smaller b) Remains of the same size c) Gets farther the lens

d) Get closer to the lens

38. In the above question, the relation remains the same whether

a) image is real or virtual b) refracting surface is convex or concave

c) light is going from rarer to denser medium or from denser to rarer medium

d)

object is close to or far off from the refracting surface choose the wrong statement

39. A small link dot on a paper is seen through a glass slab of thickness 4 cm and refractive index 1.5. The dot appears to be raised by

a) 1 cm b) 2 cm c) 3 cm d) 1.33 cm

40. Two distinct light bulbs as sources

a) can produce an interference pattern

b) cannot produce a sustained interference pattern

c) can produce an interference pattern, if they produce light of same frequency

d)

can produce an interference pattern onlywhen the light produced by them is monochromatic in nature

41. The relation governing refraction of light from rarer to denser medium at a spherical refracting surface is

a) $-\frac{\mu_1}{u}+\frac{\mu_2}{v}=\frac{\mu_2-\mu_1}{R}$ b) $\frac{\mu_1}{u}+\frac{\mu_2}{v}=\frac{\mu_2-\mu_1}{R}$ c) $\frac{\mu_1}{u}-\frac{\mu_2}{v}=\frac{\mu_2-\mu_1}{R}$ d) none of these

42. In a young's double slit experiment, the source is white light. One of the holes is covered by a red filter and another by a blue filter. In this case

a) There shall be alternate interference pattern of red and blue

b) There shall be alternate interference pattern of red distinct from that for blue

c) There shall be no interference fringes

d) There shall be alternate interference pattern of red mixing with one for blue

43. When light travels from an optically rarer medium to an optically denser medium, the velocity decreases because of change in

a) wave length b) frequency c) amplitude d) phase

44. The relation between focal length f and radius of curvature R of a spherical mirror is

a) $f = R$ b) $f = R/2$ c) $f = 2R$ d) none of these

45. The formation of rainbow is a natural example of

a) Interference b) Dispersion c) Diffraction d) Reflection

46. A beaker containing a liquid appears to be half full when it is actually one third full.The refractive index of liquid is

a) 7/6 b) 6/5 c) 3/2 d) 5/4

47. Which one of the following phenomena is not explained by Huygens' construction of wavefront?

a) Refraction b) Reflection c) Diffraction d) Origin of spectra

48. A bi convex lens can form a virtual image if the object is placed

a) between f and lens b) between f and 2f c) beyond 2f d) at infinity

49. If m_0 and m_e are the magnifications produced by an objective lens and eye lens of a microscope, the magnifying power of the telescope is

a) $m_0 - m_e$ b) $m_0 + m_e$ c) $m_0 \times m_e$ d) m_0 / m_e

50. For a telescope, larger the diameter of the objective lens

a) greater is the resolving power b) smaller is the resolving power

c) greater is the magnifying power d) smaller is the magnifying power

51. The velocity of light in glass whose refractive index (μ_g) is 1.5 is 2×10^8 m/s.In certain liquid, the velocity of light is found to be 2.6×10^8m/s.The refractive index (μ_ω) of that liquid is

a) 1.5 b) 1.2 c) 1 d) 2.1

52. A prism has a refracting angle of 60^0.When a ray is incident at 50^0, it suffers minimum deviation (δ_m) is

a) 45^0 b) 60^0 c) 55^0 d) 40^0

53. What is the focal length of the a bi convex lens of radius curvature 40cm.(μ = 1.5)

a) 50cm b) 40cm c) -30cm d) -40cm

54. The magnifying power of a telescope can be increased by using

a) objective of large focal length b) objective of small focal length

c) eye lens of small focal length d) all of the above

55. When unpolarised light beam is incident from air onto glass (n = 1.5) at the polarising angle.

a) Reflected beam is polarised completely
b) Reflected and refracted beams are partially polarised
c) Refracted beam is plane polarised d) Whole beam of light is refracted

56. The image of a distant object as seen through an astronomical telescope is
a) Erect b) Inverted c) Perverted d) None of these

57. Huygens' principle of secondary wavelets may be used to
a) find the velocity of light in vacuum. b) explain the particle's behaviour of light
c) find the new position of a wavefront d) explain photoelectric effect

58. In the phenomenon of interference, energy is
a) destroyedat destructive interference b) created at constructive interference
c) conserved but it is redistributed d) same at all points

59. Ratio of intensities of two waves is 9 : 1. If these waves are superimposed, what is the ratio of maximum and minimum intensities?
a) 9 : 1 b) 3 : 1 c) 4 : 1 d) 5 : 3

60. Image formed by a convex lens is virtual and erect when the object is placed
a) at F b) between F and the lens c) beyond 2F d) at 2F

61. Optical fibres are based on the phenomenon of
a) reflection b) refraction c) dispersion d) total internal reflection

62. A blue cross on a white background is illuminated with white light and is observed through a red filter.What is seen?
a) A red cross on a black background b) A black cross on a red background
c) A red cross on a blue background d) A blue cross on a red background

63. Which of the following mirrors forms a virtual smaller image?
a) plane mirror b) concave mirror c) plane and concave mirrors
d) convex mirror

64. The source of light is moving towards observer with relative velocity of 3 kms^{-1}. The fractional change in frequency of light observed is
a) 3×10^{-3} b) 3×10^{-5} c) 10^{-5} d) None of these

65. Which of the following is false for a prism placed in position of minimum deviation?
a) $i_1 = i_2$ b) $r_1 = r_2$ c) $i_1 = r_1$ d) All above

66. Two coherent mono chromatic light beams of intensities I and 4I superimpose. The maximum and minimum possible intensities in the resulting beam are:
a) 5I and I b) 5I and 3I c) 3I and I d) 9I and I

67. Angular dispersion of a prism depends upon
a) Angle of the prism b) Material of the prism c) Both d) None of these

68. Two thin lenses of power P_1 and P_2 are placed and a distance d apart.The power of the combination is:
a) $P_1 + P_2$ b) $P_1 - P_2$ c) $P_1 + P_2 - dP_1 P_2$ d) $d(P_1 + P_2) - P_1P_2$

69. The linear magnification of a concave mirror is
a) always positive b) always negative
c) positive or negative depending upon the position of the object d) cannot say

70. A telescope uses an objective lens of focal length f_0 and an eye lens of focal length f_e. In normal adjustment, distance between the two lenses is
a) f_o/f_e b) f_e/f_o c) $(f_o - f_e)$ d) $(f_o + f_e)$

71. The image formed by a concave lens is
a) always virtual b) Always real c) Always inverted d) May virtual or real

72. The minimum distance between an object and its real image formed by a convex lens of focal length cannot be
a) Greater than 4f b) Greater than 2f c) Less than 6f d) Less than 4f

73. The direction of wavefront of a wave with the wave motion is
a) parallel b) perpendicular c) opposite . d) at an angle of θ

74. In Young's double-slit experiment, the intensity is I at a point, where the path difference is $\frac{\lambda}{6}$ (λ - wavelength of light used). If I0 denotes the maximum intensity then $\frac{I}{I_0}$ is equal to
a) $\frac{\sqrt{3}}{2}$ b) $\frac{1}{2}$ c) $\frac{3}{4}$ d) $\frac{1}{\sqrt{2}}$

75. The image formed by objective of a compound microscope is
a) Virtual and enlarged b) Virtual and diminished c) Real and diminished
d) Real and enlarged

76. A lens is behaving as convex lens in air and concave in water, then its refractive index is
a) Small than air b) Greater than both air and water
c) Greater than air, but less than water d) Almost equal to water

77. An interference pattern is observed by Young's double slit experiment. If now the separation between coherent sources is halved and the distance of screen from coherent sources is doubled, the new fringe width
a) becomes double b) becomes one-fourth c) remains the same
d) becomes four times

78. A divergent lens is one which
a) Collect rays b) Spreads rays c) Forms real image
d) Neither collects nor spreads rays

79. Angle of deviation caused by a prism is lens for
a) Violet colour b) Yellow colour c) Red colour d) Is same for all colours

80. An object is held in front of a concave mirror between F and C. The image formed is
a) at F b) at C c) beyond C d) none of the above

81. If a source is at infinity, then wavefronts reaching to observer are

a) cylindrical b) spherical c) plane d) conical

82. For any position of an object, image formed in a convex mirror is
a) virtual b) erect c) smaller in size
d) as far behind the mirror as the object is in front

83. Consider sunlight incident on a pinhole of width 10^3A. The image of the pinhole seen on a screen shall be
a) a sharp white ring b) same as the geometrical image
c) a diffused central spot, white in colour
d) diffused coloured region around a sharp central white spot.

84. In a single diffraction pattern observed on a screen placed at D m distance from the slit of width d m, the ratio of the width of the central maxima to the width of other secondary maxima is
a) 2 : 1 b) 1 : 2 c) 1 : 1 d) 3 : 1

85. The focal length of a double convex lens is equal to radius of curvature of either surface. The refractive index of its material is
a) 3/2 b) 1 c) 4/3 d) none of these

86. If two sources have a randomly varying phase difference Φ(t), the resultant intensity will be given by
a) $I_0\sqrt{2}$ b) $\frac{I_0}{2}$ c) $2I_0$ d) $\frac{I_0}{\sqrt{2}}$

87. A double slit interference experiment is carried out in air and the entire arrangement is dipped in water. The fringe width
a) increases b) decreases c) remains unchanged.
d) fringe pattern disappears.

88. In a room fitted with a green bulb, a red cloth will appear to be:
a) Yellow b) Orange c) Black d) Blue

89. In a vessel of depth 15cm, liquid is poured till the liquid appears to be at half the depth, the liquid level is5cm from the top.Calculate the refractive index of the liquid.
a) 1.33 b) 3.30 c) 1.5 d) 1.7 e) 2

90. When compact disk is illuminated by a source of white light, coloured lines are observed. This is due to
a) dispersion b) diffraction c) interference d) refraction

91. In a concave mirror, an object is placed at a distance d_1 from the focus and the real image is formed at a distance d_2 from the focus. then the focal length of the nirror is:
a) $\sqrt{d_1d_2}$ b) d_1d_2 c) $(d_1/d_2)^{/2}$ d) $\sqrt{d_1/d_2}$

92. The axial or longitudinal magnification of a lens is
a) V/u b) V^2/u^2 c) $2V^2/u^2$ d) u/V

93. The Doppler effect is produced if

a) the source is in motion b) the detector is in motion c) Both (a) and (b)
d) None of the above

94. A thin film of oil is spread on the surface of water. The beautiful colours exhibited in the light of sun is due to
a) dispersion of light b) polarisation of light c) interference of light
d) diffraction of light

95. The resolving power of teleoscope is
a)
Directly proportional to the diameter (aperture) of the objective lens and inversely proportional to the wavelength of light used
b)
Directly proportional to the diameter of the objective lens and also directly proportional to the wavelength of the light used
c)
Directly proportional to the wavelength of light used and inversely proportional to the diameter of the objective lens
d) None of these

96. In a compound microscope, the distance between objective lens and eye lens is
a) fixed b) variable c) infinite d) 1 metre

97. What is path difference for destructive interference?
a) $n\lambda$ b) $n(\lambda+1)$ c) $(2n+1)\frac{\lambda}{2}$ d) $(n+1)\frac{\lambda}{2}$

98. What focal length should be reading spectacles have for a person whose near point is 50 cm?
a) 25 cm b) 50 cm c) -50 cm d) -25 cm

99. A laser beam is coherent because it contains
a) waves of several wavelengths. b) incoherent waves of a single wavelength.
c) coherent waves of several wavelengths
d) coherent waves of a single wavelength.

100. An astronomical telescope has a large aperture to
a) Reduce spherical aberration b) Have high resolution
c) Increase span of observation d) Have low dispersion

101. If two mirrors are kept at 6° to each other, then the number of image formed by them is
a) 5 b) 6 c) 7 d) 8

102. An astronomical telescope has a magnifying power of 10. In normal adjustment, distance between the objective and eye piece is 22 cm. The focal length of objective lens is
a) 10 cm b) 22 cm c) 20 cm d) 2 cm

103. Two identical and independent sodium lamps act as
a) coherent source b) Either (a)and (b) c) incoherent sources d) None of these

104. When exposed to sunlight, thin films of oil on water often exhibit brilliant colours due to the phenomenon of
a) interference b) diffraction c) dispersion d) polarisation

105. f_r for green f_g and for blue f_b which statement is correct?
a) $f_r < f_g$ b) $f_g < f_r$ c) $f_b \geq f_r$ d) none of these

106. A plano convex lens of glass (μ= 3/2) has focal length f and radius of curvature of curved surface = R.The relation between f and R is
a) f = R b) f = R/2 c) f = 3R/2 d) f = 2R

107. Two waves are said to be coherent if they have.
a) same phase and different amplitude.
b) different frequency phase and amplitude
c) same frequency but different amplitude.
d) same frequency, phase and amplitude

108. What is the refractive index of a medium in which light travels with a speed of $2 \times 10^8\ m/s$?
a) 3/2 b) 2/3 c) 1 d) none of these

109. If a glass rod is immersed in a liquid of the same refractive index, then it will
a) look bent b) disappear c) look longer d) none of these

110. Consider a light beam incident from air to a glass slab at Brewster's angle as shown in Figure.
A polaroid is placed in the path of the emergent ray at point P and rotated about an axis passing through the centre and perpendicular to the plane of the polaroid.

a)
For a particular orientation there shall be darkness as observed through the polaroid
b)
The intensity of light as seen through the polaroid shall be independent of the rotation.

c)
The intensity of light as seen through the polaroid shall go through a minimum but not zero for two orientations of the polaroid.
d)
The intensity of light as seen through the polaroid shaU go through a minimum for four orientations of the polaroid.

111. Polarizing angle for a medium is 60°. Its refractive index is
a) 1.732 b) 1 c) 1.414 d) 2

112. Polarisation of light proves
a) corpuscular nature of light b) quantum nature of light.
c) transverse wave nature of light d) longitudinal wave nature of light.

113. A lens behaves as converging lens in air and a diverging lens in water.The μ of the material of the lens is
a) 1.33 b) > 1.33 c) < 1.33 d) 1

114. Refractive index of diamond is about
a) 1.33 b) 1.5 c) 1 d) 2.45

115. For light diverging from a point source
a) The wavefront is spherical
b) The intensity decrease in proportion to the distance squared
c) The wavefront is parabolic
d) The intensity at the wavefront does not depend on the distance

116. When an object is held between pole and focus of concave mirror, the image formed is
a) virtual and diminished b) virtual and enlarged c) real and inverted
d) real and enlarged

117. One dioptre is the power of a lens of focal length
a) 1 cm b) 1 m c) -1 cm d) -1 m

118. In diffraction from a single slit the angular width of the central maxima does not depends on
a) λ of light used b) width of slit c) distance of slits from the screen D
d) ratio of λ and slit width.

119. The ratio of maximum and minimum intensities of two sources is 4 : 1.The ratio of their amplitudes is
a) 1 : 81 b) 3 : 1 c) 1 : 9 d) 1 : 16

120. The sky appear blue because
a) Red light is absorbed b) Blue light is scattered the most
c) Blue light is absorbed d) It is its natural colour

121. Resolving power of telescope can be increased by increasing

a) the wavelength b) the diameter of objective c) the diameter of eyepiece
d) the focal length of eyepiece

122. According to Huygens' principle, each point of the wavefront is the source of
a) secondary disturbance b) primary disturbance c) third disturbance
d) fourth disturbance

123. The phenomenon of polarisation indicates the light is of
a) longitudinal nature b) transverse nature c) particle nature d) None of these

124. A convex lens of glass is immersed in water.Compared to its power in air, its power in water will
a) Diminish for red light and increase for blue light b) Not change at all
c) Increase d) Diminish

125. Consider sunlight incident on a slit of width 10^4 A. The image seen through the slit shall darkness as observed through the polaroid
a) Be a fine sharp slit white in colour at the centre
b) A bright slit white at the centre diffusing to zero intensities at the edges
c) A bright slit white at the centre diffusing to regions of different colours
d) only be a diffused slit white in colour

126. Diamond sparkles because of
a) scattering of light b) reflection of light c) TIR of light d) None

127. The splitting of white light into several colours on passing through a glass prism is due to
a) refraction b) reflection c) interference d) diffraction

128. In Young's double slit experiment, if the monochromatic source of yellow light is replaced by red light, the fringe width
a) increases b) decreases. c) remains unchanged. d) the fringes disappear

129. Wavelength of light frequency 100Hz is
a) 2×10^6 m b) 3×10^6 m c) 4×10^6 m d) 5×10^6 m

130. The focal length of a convex lens (μ = 3/2) in air is 20cm.When immersed in water (μ = 4/3) its, focal length will be
a) 80cm b) 26.7cm c) 20cm d) 5cm

131. In going from a rarer to a denser medium, light loses some speed. What happens to energy carried by the light waves?
a) decreases b) increases c) remains the same d) none of the above

132. For a total magnification of 175 from a compound microscope, the magnification produced by objective is 7. What should be the magnification produced by eye piece?
a) 7 b) 25 c) 175×7 d) none of these

133. Which of the following cannot be polarized?

a) X-rays b) radio waves c) sound waves d) light waves

134. The linear magnification of an image is m.The magnification for area will be
a) m b) m^2 c) $m^{1/2}$ d) m^4

135. Image of an object in a concave mirror is
a) always real b) always virtual c) always erect
d) real or virtual depending on position of object

136. An unpolarised beam of intensity I_0 is incident on a pair of nicols making angle of 60° with each other. The intensity of right emerging from the pair is
a) I_0 b) $\frac{I_0}{2}$ c) $\frac{I_0}{4}$ d) $\frac{I_0}{8}$

137. According to Huygens' principle, light is a form of
a) particle b) rays c) wave d) radiation

138. To get three images of a single object, t one should have two plane mirrors at an angle of:
a) 60° b) 90° c) 120° d) 30°

139. The angle of prism is 60^0 and the refractive index of the material of prism is 1.5.If angles of incidence and emergence at first and second refracting faces are i_1 and i_2, then for minimum deviation:
a) $i_1 = 0$ b) $i_1 < i_2$ c) $i_1 > i_2$ d) $i_1 = i_2$

140. For an aperture of 2mm and wavelength of 500nm, fresnel distance is
a) 5m b) 8m c) 10m d) 40m

141. One cannot see through fog because
a) fog absorbs light b) light is scattered by the droplets in fog
c) light duffers total internal reflection at the droplets in fog
d) the refractive index of fog is infinity

142. The ratio of the speed of an object to the speed of its real image of magnification m in the case of a convex mirror is
a) $-\frac{1}{m^2}$ b) m^2 c) -xm d) $\frac{1}{m}$

143. When diameter of objective of an astronomical telescope is doubled, its limit of resolution is
a) doubled b) quadrapled c) halved d) unaffected

144. Light seems to propagate in rectilinear path because
a) its speed is very large b) its wavelength is very small
c) reflected from the upper surface of atmosphere
d) it is not absorbed by atmosphere

145. Two lenses of focal lengths 20 cm and -40 cm are held in contact. The image of an object all infinity will be formed by the combination at
a) ∞ b) 20 cm c) 40 cm d) 60 cm

146. The image formed by a convex lens is

a) Always virtual b) Always real c) Always inverted d) May virtual or real

147. The angle of incidence at which reflected light is totally polarised for reflection from air to glass (refractive index n) is
a) $\sin^{-1}(n)$ b) $\sin^{-1}\left(\frac{1}{n}\right)$ c) $\tan^{-1}\left(\frac{1}{n}\right)$ d) $\tan^{-1}(n)$

148. The angle of polarisation (Brewster's angle) for an incident light when it is incident on a surface of refractive index (n) will be)
a) $\sin^{-1}(n)$ b) $\tan^{-1}(n)$ c) $\cos^{-1}(n)$ d) $\tan^{-1}\left(\frac{1}{n}\right)$

149. In the context of Doppler effect in light, the term red shift signifies
a) decrease in frequency b) increase in frequency c) decrease in intensity
d) increase in intensity

150. Refractive index of glass w.r.t. water is 9/8. What is the speed of light in water? Given speed of light in glass is $2 \times 10^8\ m/s$.
a) $2 \times 10^8\ m/s$ b) $3 \times 10^8\ m/s$ c) $2.25 \times 10^8\ m/s$ d) none of these

151. For total internal reflection, light must travel
a) from rarer to denser medium b) from denser to rarer medium c) in air only
d) in water only

152. A simple microscope consisting of a lens of focal f forms final image at distance of distinct vision d.Its magnifying power is
a) 1+(d/f) b) (d/f)-1 c) d/f d) 1-(d/f)

153. A plane mirror is approaching you at 5 cm per second. You can see your can see your image in it. At what speed will your image approach you?
a) 10 cm per sec. b) 5 cm per sec. c) 20 cm per sec. d) 15 cm per sec.

154. The correct mirror equation is
a) $\frac{1}{f}=\frac{1}{v}+\frac{1}{u}$ b) $\frac{1}{f}=\frac{1}{v}-\frac{1}{u}$ c) $\frac{1}{f}=\frac{1}{u}-\frac{1}{v}$ d) none of these

155. For a normal eye, distance of near point from the eye is
a) ∞ b) 25 cm c) 25 m d) none of these

156. Which one of the following phenomena confirms that light waves are transverse?
a) interference b) diffraction c) dispersion d) polarization

157. In Huygens' wave theory, the locus of all points in the same state of vibration is called
a) a half period zone b) oscillator c) a wavefronts d) a ray

158. Two thin lenses of focal length f_1 and f_2 are placed coaxially in contact.The combination acts as a single lens of focal length
a) $f_1 f_2 / (f_1+f_2)$ b) $\sqrt{f_1 f_2}$ c) $(f_1+f_2) / f_1 f_2$ d) $f_1+f_2 /2$

159. The focal length of a lens depends on
a) The radii of curvature of its surfaces b) The refractive index of its material
c) The refractive index of the medium surrounding the lens d) All the above facors

160. What should be the slit width to obtain 10 maxima of the double slit pattern within the central maxima of the single slit pattern of slit width 0.4 mm?
a) 0.4 mm b) 0.2 mm c) 0.6 mm d) 0.8 mm

161. In single slit diffraction pattern, how does the width of central maximum change when light of smaller wavelength is used?
a) decreases b) increases c) remains unaffected d) cannot be predicted

162. In case of linearly polarised light, the magnitude of the electric field vector
a) is parallel to direction of propagation b) does not change with time.
c) increase and decrease linearly with time. d) varies periodically with time

163. Figure shows a standard two slit arrangement with slits S_1, S_2, P_1, P_2 are the two minima points on either side of P (Figure). At P_2 on the screen, there is a hole and behind P2 is a second 2- slit arrangement with slits S_3, S_4 and a second screen behind them

a)
There would be no interference pattern on the second screen but it would be lighted.
b) The second screen would be totally dark.
c) There would be a single bright point on the second screen
d) There would be a regular two slit pattern on the second screen.

164. When a red flower is seen through a green glass, it appear
a) red b) green c) yellow d) black

165. The interference is produced by two waves of intensity ratio 16 : 9. The ratio of maximum and minimum intensities in interference pattern is
a) 4:3 b) 49:1 c) 25:7 d) 256:81

166. The power of the combination of a convex lens of focal length 50cm and concave lens of focal length 40cm is
a) +1 diopter b) -1 diopter c) 0 d) +0.5 diopter e) -0.5 diopter

167. When light is refracted into a denser medium
a) its wavelength and frequency both increases
b) its wavelength increases but frequency remains unchanged .
c) its wavelength decreases -,but frequency remains the same
d) its wavelength and frequency both decreases

168. A convergent lens is one which

a) Collect rays b) Spreads rays c) Forms real image d) Forms virtual image

169. If the width of slit is decreased in a single slit diffraction, then the width of central maxima will

a) increase b) decrease c) remain unchanged

d) not depend on the width of slot

170. The number of images observable between two parallel plane mirrors is

a) 2 b) 4 c) 11 d) Infinite

171. You are given a prism, a lens and a slab all made of same material.Which has maximum dispersive power

a) Prism b) Lens c) Slab d) All have equal dispersive powers

172. When a prism is placed in the position of minimum deviation, the ray of light within the prism

a) Goes parallel to the base b) Goes perpendicular to the base

c) Makes minimum angle with the base

d) Direction is not fixed relative to the base

173. Units of dispersive power is

a) Radian b) Radian / metre c) No units d) None

174. The correct formula for magnifying power of a simple microscope is

a) $m=\left(1+\frac{f}{d}\right)$ b) $m=\left(1-\frac{d}{f}\right)$ c) $m=\left(1+\frac{d}{f}\right)$ d) $m=\left(1-\frac{f}{d}\right)$

175. A monochromatic light refracts by the medium of refractive index 1.5 in vacuum. The wavelength of refracted wave will be

a) equal b) increases c) decrease

d) depend upon the intensity of refractedlight

176. If a lens is cut into two pieces perpendicular to the principal axis and only one part is used, the new focal length

a) Remains same b) Becomes 1/2 time c) Becomes 2 time d) Infinite

177. A convex mirror has a focal length 20 cm. A convergent beam tending to con verge to a point 20 cm behind the mirror on principal axis fall on it. The image is formed at

a) infinity b) 40cm c) 20cm d) 10cm

178. It is possible to observe total internal reflaction when a ray travels from

a) Air to water b) Air into glass c) Water into glass d) Glass into water

179. In Young's double slit experiment two disturbance arriving at a point P have phase difference of π / 2 The intensity of this point expressed as a fraction of maximum intensity I_0 is

a) $\frac{3}{2} I_0$ b) $\frac{1}{2} I_0$ c) $\frac{4}{3} I_0$ d) $\frac{3}{4} I_0$

Ravi Maths Tuition Centre

Time : 1 Mins **RAY OPTICS 1** **Marks : 1749**

1. For having large magnification power of a compound microscope
   a) length of the microscope tube must be small
   b) focal lengths of objective lens and ele-piece should be large
   c) focal lengths of objective lens and eye-piece should be small
   d) focal length of eye-piece must be smaller than the focal length of objective lens
2. The magnifying power of a convex lens of focal length 10 cm, when the image is formed at the near point is
   a) 6 b) 5.5 c) 4 d) 3.5
3. F_1 and F_2 are focal lengths of objective and eyepiece respectively, of the telescope. The angular magnification of the given telescope is equal to
   a) $\frac{F_1}{F_2}$ b) $\frac{F_2}{F_1}$ c) $\frac{F_1F_2}{F_1+F_2}$ d) $\frac{F_1+F_2}{F_1F_2}$
4. An object 2 cm high is placed at a distance of 16 cm from a concave mirror, which produces a real image 3 cm high. What is the focal length of the mirror?
   a) - 9.6 cm b) - 3.6 cm c) - 6.3 cm d) - 8.3 cm
5. A ray passing through or directed towards centre of curvature of a spherical mirror is reflected such that it trace back of its path, because
   a) it does not follow law of reflection b) angle of incidence is 0°
   c) centre of curvature is midway between object and pole
   d) distance of centre of curvature from focus is equal to its distance from pole
6. If the reflected ray is rotated by an angle of 4θ in clockwise direction then the mirror was rotated by
   a) 2θ in anti-clockwise direction b) 4θ in anti-clockwise direction
   c) 2θ in clockwise direction d) 4θ in clockwise direction
7. First and second focal lengths of spherical surface of n refractive index are f_1 and f_2 respectively. The relation between them, is
   a) $f_2 = f_1$ b) $f_2 = -f_1$ c) $f_2 = nf_1$ d) $f_2 = -nf_1$
8. The image formed by a convex mirror of focal length 30 cm is a quarter of the size of the object.The distance of the object from the mirror is
   a) 30 cm b) 90 cm c) 120 cm d) 60 cm
9. In vacuum, to travel distance d, light takes time t and in medium to travel distance 5d, it takes time T. The critical angle of the medium is
   a) $sin^{-1}\left(\frac{5T}{t}\right)$ b) $sin^{-1}\left(\frac{5t}{3T}\right)$ c) $sin^{-1}\left(\frac{5t}{T}\right)$ d) $sin^{-1}\left(\frac{3t}{5T}\right)$

10. A person has a minimum distance of distinct vision as 50 cm. The power of lenses required to read a book at a distance of 25 cm is
a) 3 D b) 1 D c) 2 D d) 4 D

11. An object is immersed in a fluid. In order that the object becomes invisible, it should
a) behave as a perfect reflector b) absorb all light falling on it
c) have refractive index one.
d) have refractive index exactly matching with that of the surrounding fluid

12. If $\mu_v = 1.5230$ and $\mu_R = 1.5145$ then dispersive power of a crown glass is
a) 0.0164 b) 0.00701 c) 0.0132 d) 0.0320

13. A passenger in an aeroplane
a) should see a rainbow
b) may see a primary and a secondary rainbow as concentric circles
c) may see a primary and a secondary rainbow as concentric arcs
d) should never see a secondary rainbow

14. A Concave mirror form the real image of an object which is magnified 4 times. The object is moved 3 cm away, the magnification of the image is 3 times. What is the focal length of the mirror?
a) 3 cm b) 12 cm c) 36 cm

15. Two thin lenses of focal lengths f_1 and f_2 are placed in contact with each other. Then, the equivalent focal length of the combination will be
a) $f_1 + f_2$ b) $\frac{1}{f_1+f_2}$ c) $\frac{f_1 f_2}{f_1+f_2}$ d) $\frac{f_1+f_2}{f_1 f_2}$

16. Limitation of reflecting telescope is
a) objective mirror focusses light inside the telescope tube
b) objective mirror focusses light outside the telescope tube
c) objective mirror has large focal length d) tube length is large

17. A ray of light incident at an angle θ on a refracting face of a prism emerges from the other face normally. If the angle of the prism is 5° and the prism is made of a material of refractive index 1.5 then the angle of incidence is
a) 7.5° b) 5° c) 15° d) 2.5°

18. Aglass slab (μ = 1.5) of thickness 6 cm is placed over a paper. What is the shift in the letters?
a) 4 cm b) 2 cm c) 1 cm d) None of these

19. Two convex and concave lens are in contact and having focal length 12 cm and 18 cm, respectively. Focal length of joint lens will be
a) 50 cm b) 45 cm c) 36 cm d) 18 cm

20. A person has a minimum distance of distinct vision as 50 cm. The power of lenses required to read a book at a distance of 25 cm is
a) 3 D b) 1 D c) 2 D d) 4 D

21. In optical fibres, the refractive index of the core is
a) greater than that of the cladding. b) equal to that of the cladding.
c) smaller than that of the cladding. d) smaller than that of the cladding.

22. The radius of curvature of the curved surface of a planoconvex lens is 20 cm. If the refractive index of the material of the lens be 1.5, then it will
a) act as a convex lens only for the objects that lie on its curved side
b) act as a concave lens for the objects that lie on its curved side
c) act as a convex lens irrespective of the side on which the object lies
d) act as a concave lens irrespective of side on which the object lies

23. A thin convergent glass lens(μ = 1.5) has a power of + 5.0 D. When this lens is immersed in aliquid of refractive index μ it acts as a divergence lens of focal length 100 cm. the value of μ should be
a) 3/2 b) 4/3 c) 5/3 d) 2

24. Speed of light in air is 3.0 x 10^8 m/s. Speed of light in the glass of refractive index 1.5 will be
a) 1.5 x 10^8 m/s b) 2.0 x 10^8 m/s c) 1.8 x 10^8 m/s d) 2.5 x 10^8 m/s

25. If c is the velocity of light in free space, then the time taken by light to travel a distance x in a medium refractive index μ is
a) $\frac{x}{c}$ b) $\frac{\mu x}{c}$ c) $\frac{x}{\mu c}$ d) $\frac{c}{\mu x}$

26. A compound microscope has two lenses. The magnifying power of one is 5 and the combined magnifying power is 100. The magnifying power of the other lens is
a) 10 b) 20 c) 50 d) 25

27. An infinitely long rod lies along with the axis of a concave mirror of focal length f. The near end of the rod is at a distance u > f from the mirror. Its image will have a length
a) $\frac{f^2}{u-f}$ b) $\frac{uf}{u-f}$ c) $\frac{f^2}{u+f}$ d) $\frac{uf}{u+f}$

28. A room (cubical) is made of mirrors. An insect is moving along the diagonal on the floor , such that the velocity of image of insect on two adjacent wall mirrors, is $10cms^{-1}$. The velocity of image of insect in ceiling mirror is
a) $10cms^{-1}$ b) $20cms^{-1}$ c) $\frac{10}{\sqrt{2}}cms^{-1}$ d) $10\sqrt{2}cms^{-1}$

29. A glass prism ABC (refractive index 1.5), immersed in water (refractive index 4/3). A ray of light is incident normally on face AB. If it is totally reflected at face AC, then
a) $sin\theta \geq \frac{8}{9}$ b) $sin\theta \geq \frac{2}{3}$ c) $sin\theta \geq \frac{\sqrt{3}}{2}$ d) $\frac{2}{3}$

30. The focal length of the objective of a terrestrial telescope is 80 ern and it is adjusted for parallel rays, then its power is 20. If the focal length of erecting lens is 20 cm, then full length of the telescope will be
a) 164 cm b) 124 cm c) 100 cm d) 84 cm

31. The image formed by a convex mirror of focal length 30 cm is a quarter of the size of the object.The distance of the object from the mirror is
a) 30 cm b) 90 cm c) 120 cm d) 60 cm

32. In the given figure, the angle of reflection is
a) 30^0 b) 60^0 c) 45^0 d) None of these

33. Calculate the focal length of a reading glass of a person, if the distance of distinct vision is 75 crn.
a) 75.2 cm b) 25.6 cm c) 100.4 cm d) 37.5 cm

34. A thin equiconvex lens of refractive index 3/2 and radius of curvature 30 em is put in water (refractive index = 4/3), its focal length is
a) 0.15 m b) 0.30 m c) 0.45 m d) 1.20 m

35. The length of an astronomical telescope for normal vision (relaxed eye) will be
a) $f_o - f_e$ b) $\frac{f_o}{f_e}$ c) $f_o \times f_e$ d) $f_o + f_e$

36. A glass slab (μ = 1.5) of thickness 6 cm is placed over a paper. What is the shift in the letters?
a) 4 cm b) 2 cm c) 1 cm d) None of these

37. A concave lens of focal length f forms an image which is 1/3 times the size of the object. Then, the distance of object from the lens is
a) 2f b) f c) $\frac{2}{3}f$ d) $\frac{3}{2}f$

38. The dispersive powers of glasses of lenses used in an achromatic pair are in the ratio 5 : 3. If the focal length of the concave lens' is 15 ern, then the nature and focal length of the other lens would be
a) convex, 9 cm b) concave, 9 cm c) convex, 25 cm d) concave, 25 cm

39. A plano-convex lens of curvature of 30 cm and refractive index 1.5 produces a real image of an object kept 90 cm from it. What is the magnification?
a) 4 b) 0.5 c) 1.5 d) 2

40. A microscope is having objective of focal length 1 cm and eye-piece of focal length 6 cm. If tube length is 30 cm and image is formed at the least distance of distinct vision, what is the magnification produced by the microscope.(take, D = 25 cm)
a) 6 b) 150 c) 25 d) 125

41. A person suffering from the defect astigmatism
a) cannot see any object
b) cannot see objects in two perpendicular directions simultaneously
c) cannot see near by Objects d) cannot see distant objects

42. Light from a point source in air falls on a spherical glass surface (n = 1.5 and radius of curvature = 20 cm). The distance of the light source from the glass surface is 100 cm. Image distance from the glass surface is
a) 20 cm b) 50 cm c) 100 cm d) 75 cm

43. Phenomena associated with scattering is/are
a) blue colour of the sky b) appearence of reddish sun during sunset and sunrise
c) both (a) and (b) d) None of the above

44. An object is located 4 m from the first of two thin converging lenses of focal lengths 2 m and 1 m, respectively. The lenses are separated by 3 m. The final image formed by the second lens is located from the source at a distance of
a) 8 m b) 5.5 m c) 6 m d) 6.5 m

45. The frequency of a light wave in a material and wavelength is 5000 A The refractive index of material will be
a) 1.40 b) 1.50 c) 3.00 d) 1.33

46. A microscope is having objective of focal length 1 cm and eye-piece of focal length 6 cm. If tube length is 30 cm and image is formed at the least distance of distinct vision, what is the magnification produced by the microscope.(take, D = 25 cm)
a) 6 b) 150 c) 25 d) 125

47. A concave lens of focal length f forms an image which is 1/3 times the size of the object. Then, the distance of object from the lens is
a) 2f b) f c) $\frac{2}{3}f$ d) $\frac{3}{2}f$

48. The equiconvex lens has focal length f. If it is cut perpendicular to the principal axis passing through optical centre, then focal length of each half is
a) $\frac{f}{2}$ b) f c) $\frac{3f}{2}$ d) 2f

49. A convex mirror of focal length f forms an image which is 1/n times the object. The distance of the object from the mirror is
a) (n-1)f b) $\left[\frac{n-1}{n}\right]f$ c) $\left[\frac{n+1}{n}\right]f$ d) (n+1)f

50. If the focal length of objective lens is increased, then magnifying power of
a) microscope will increase but that of telescope decrease
b) microscope and telescope both will increase
c) microscope and telescope both will decrease
d) microscope will decrease but that of telescope will increase

51. A ray of light strikes an air-glass interface at an angle of incidence (i = 60°) and gets refracted at an angle of refraction r. On increasing the angle of incidence (i > 60°), the angle of refraction r
a) remains same b) is equal to 60° c) increases d) decreases

52. Which of the following quantity remains unchanged after refraction?
a) Speed of light b) Intensity of light c) Wavelength of light d) Frequency of light

53. When a lens of refractive index n_1 is placed in a liquid of refractive index n_2 then the lens looks to be disappeared only, if
a) $n_1=n_2/2$ b) $n_1=3n_2/2$ c) $n_1=n_2$ d) $n_1=5n_2/2$

54. If lower half of a concave mirror is blackened, then
a) image distance increases b) image distance decreases c) image intensity increases
d) image intensity decreases

55. Two lamps of powers $P_1$and P_2 are placed on either side of apaper having an oil spot. The lamps are at 1m and 2 m respectively, On either side of the paper and the oil spot is invisible. What is the value of P_1/P_2?
a) 0.25 b) 0.40 c) 0.50 d) 0.60

56. The magnifying power of a microscope with an objective of 5 mm focal length is 400. The length of its tube is 20 cm. Then, the focal length of the eye-piece is
a) 200 cm b) 160 cm c) 2.5 cm d) 0.1 cm

57. A double convex lens of refractive index μ_1 is immersed in a liquid of refractive index μ_2. The lens will act as transparent plane sheet when

a) $\mu_1 = \mu_2$ b) $\mu_1 > \mu_2$ c) $\mu_1 < \mu_2$ d) $\mu_1 = \frac{1}{\mu_2}$

58. A combination is made of two lenses of focal lengths f_1 and f_2 and dispersive powers ω_1 and $\omega_2$respectively. The combination will be achromatic, if
a) $\omega_1 = 2\omega_2$ and $f_1 = 2f_2$ b) $2\omega_1 = 2\omega_2$ and $f_1 = 2f_2$ c) $\omega_1 = 2\omega_2$ and $f_1 = -2f_2$
d) $2\omega_1 = \omega_2$ and $2f_1 = f_2$

59. An object is immersed in a fluid. In order that the object becomes invisible, it should
a) behave as a perfect reflector b) absorb all light falling on it
c) have refractive index one.
d) have refractive index exactly matching with that of the surrounding fluid

60. A Convex lens and a concave lens, each having same focal length of 25 cm, are put in contact to form a combination of lenses. The power in dioptres of the combination is
a) infinite b) zero c) 25 d) 50

61. A thin convex lens of refractive index 1.5 has 20 cm focal length in air. If the lens is completely immersed in a liquid of refractive index 1.6, then its focal length will be
a) -160 cm b) -100 cm c) +10 cm d) +100 cm

62. A beam of light consisting of red, green and blue colours is incident on a right angled prism. The refractive index of the material of the prism for red, green and blue wavelengths are 1.39, 1.44 and 1.47 respectively. The prism will

a) separate the red colour part from the green and blue colours.
b) separate the blue colour part from the red and green colours
c) separate all the three colours from one another d) not separate the three colours at all

63. The angle of incidence for a ray of light at a refracting surface of a prism is 45°. The angle of prism is 60°. If the ray suffers minimum deviation through the prism, then the angle of minimum deviation and refractive index of the material of the prism respectively, are
a) $30°, \sqrt{2}$ b) $45°, \sqrt{2}$ c) $30°, \frac{1}{\sqrt{2}}$ d) $45°, \frac{1}{\sqrt{2}}$

64. A beam of light is incident on a glass slab in a direction as shown in the figure. The reflected light is analysed by a polaroid prism. On rotating the polaroid,
a) the intensity remains unchanged b) the intensity is reduced to zero and remains at zero
c) the intensity gradually reduced to zero and then again increases
d) the intensity increase continuously
e) the intensity increases initially and remains constant afterwards

65. In Galilean telescope, the final image formed is
a) real, inverted and enlarged b) virtual, inverted and enlarged c) real, erect and enlarged
d) virtual.'erect and enlarged

66. The magnifying power of the astronomical telescope for normal adjustment is 50. The focal length of the eyepiece is 2 cm. The required length of the telescope for normal adjustment is

a) 102 cm b) 100 cm c) 98 cm d) 25 cm

67. The resolving power of telescope whose lens has a diameter of 1.22 m for a wavelength of 5000 A is

a) 2 x 10^5 b) 2 x 10^6 c) 2 x 10^2 d) 2 x 10^4

68. Advantage of reflecting telescopes are

a) no chromatic aberration b) parabolic reflecting surfaces are used

c) weighs of mirror are much less than a lens of equivalent optical quality

d) All of the above

69. An object placed at 20 cm in front of a concave mirror produces three times magnified real image. What is the focal length of the concave mirror?

a) 15 cm b) 6.6 cm c) 10 cm d) 7.5 cm

70. When sun light is scattered by minute particles of atmosphere, then the intensity of light scattered away is proportional to

a) (wavelength ot light)^4 b) (frequency of light)^4 c) (wavelength of light)^2

d) (frequency of light)^2

71. Four lenses of focal lengths ± 15 cm and ± 150 cm are available for making a telescope. To produce the largest magnification, the focal length of the eyepiece should be

a) + 15 cm b) + 150 cm c) - 150 cm d) 15 cm

72. A car is moving with at a constant speed of 60 km h^{-1} on a straight road. Looking at the rear view mirror, the driver finds that the car following him is at a distance of 100 m and is approaching with a speed of 5 km h^{-1} In order to keep track of the car in the rear, the driver begins to glance alternatively at the rear and side mirror of his car after every 2 s till the other car overtakes. If the two cars were maintaining their speeds, which of the following statement (s) is/are correct?

a) The speed of the car in the rear is 65 km h^{-1}

b)

In the side mirror, the car in the rear would appear to approach with a speed of 5 km h^{-1} to the driver of the leading car

c)

In the rear view mirror, the speed of the approaching car would appear to decrease as the distance between the cars decreases

d)

In the side mirror, the speed of the approaching car would appear to increase as the distance between the cars decreases

73. Astigmatism is corrected by using

a) cylindrical lens b) plano-convex lens c) plano-concave lens d) convex lens

e) concave lens

74. The near point and far point of a person are 40 cm and 250 cm, respectively. Determine the power of the lens he/she should use while reading a book kept at distance 25 cm from the eye.

a) 2.5D b) 5D c) 1.5D d) 3.5D

75. Presbyopia can be removed by using

a) convex lens b) concave lens c) cylindrical lens d) bifocal lens

76. A plano-convex lens of curvature of 30 cm and refractive index 1.5 produces a real image of an object kept 90 cm from it. What is the magnification?
a) 4 b) 0.5 c) 1.5 d) 2

77. The. distance of moon form the earth is 3.8x 10^5 km. Supposing that the eye is most sensitive to .the light of wavelength 550 nm, the separation of two points on the moon that can be resolved by a 500 cm telescope is
a) 50 m b) 55 m c) 51 m d) 60 m

78. In reflection over a spherical mirror, ray parallel to principal axis, after reflection from mirror pass through
a) focus b) centre of curvature c) pole of mirror d) any point

79. Sparkling of diamond is due to
a) reflection. b) dispersion. c) total internal reflection.
d) high refractive index of diamond

80. A ray is incident at an angle of incidence i on one surface of a prism of small angle A and emerges normally from opposite surface. If the refractive index of the material of prism is μ , the angle of incidence i is nearly equal to
a) $\frac{A}{\mu}$ b) $\frac{A}{2\mu}$ c) μA d) $\frac{\mu A}{2}$

81. Dispersion of light is caused due to
a) intensity of light b) density of medium c) wavelength d) None of these

82. Two lenses of power 15D and -3 D are placed in contact. The focal length of the combinations is
a) 10 cm b) 15 cm c) 12 cm d) 18 cm e) 8.33 cm

83. Dispersive power depends upon
a) material of prism b) deviation produced by prism c) height of the prism
d) the angle of prism

84. Image formed on the retina is
a) real and inverted b) virtual and erect c) real and erect d) virtual and inverted

85. Under minimum deviation condition in a prism, if a ray is an incident at an angle 30°, then the angle between the emergent ray and the second refracting surface of the prism is
a) 0° b) 30° c) 45° d) 60°

86. The equiconvex lens has focal length f. If it is cut perpendicular to the principal axis passing through optical centre, then focal length of each half is
a) $\frac{f}{2}$ b) f c) $\frac{3f}{2}$ d) 2f

87. A concave shaving mirror has a radius of curvature of 35.0 cm. It is positioned so that the (upright) image of a man's face is 2.50 times the size of the face. How far is the mirror from the face?
a) 5.25 cm b) 21.0 cm c) 10.5 cm d) 42 cm

88. Astigmatism is corrected by using
a) cylindrical lens b) plano-convex lens c) plano-concave lens d) convex lens
e) concave lens

89. An object of size 7.5 cm is placed in front of a convex mirror of radius of curvature 25 cm at a distance of 40 cm.The size of the image should be
a) 2.3 cm b) 1.78cm c) 1 cm d) 0.8 cm

90. convex lens of focal length f is placed some, where in between an object and a screen. The distance between object and screen is x. If numerical value of magnification produced by lens is m, then focal length of lens is
a) $\frac{mx}{(m+1)^2}$ b) $\frac{mx}{(m-1)^2}$ c) $\frac{(m+1)^2}{m}$ d) $\frac{(m-1)^2}{m}$

91. Light travels in two media A and B with speeds 1.8 x 10^8 ms^{-1} and 2.4 x 10^8 ms^{-1} respectively. Then, the critical angle between them is
a) $sin^{-1}\left(\frac{2}{3}\right)$ b) $tan^{-1}\left(\frac{3}{4}\right)$ c) $tan^{-1}\left(\frac{2}{3}\right)$ d) $sin^{-1}\left(\frac{3}{4}\right)$

92. A vessel of depth 2 d cm is half filled with a liquid of refractive index $\mu_1$and the upper half with a liquid of refractive index μ_2The apparent depth of the vessel seen perpendicu.
a) $d\left[\frac{\mu_1\mu_2}{\mu_1+\mu_2}\right]$ b) $d\left[\frac{1}{\mu_1}+\frac{1}{\mu_2}\right]$ c) $2d\left[\frac{1}{\mu_1}+\frac{1}{\mu_2}\right]$ d) $2d\left[\frac{1}{\mu_1\mu_2}\right]$

93. In total internal reflection,
a)
light ray travelling through a denser medium is completely reflected back to denser medium
b) light ray travelling through a denser medium is completely refracted to rare medium
c) light ray is partially reflected back to denser medium and partially refracted to rare medium
d) light ray is absorbed completely by denser medium

94. convex lens of focal length f is placed some, where in between an object and a screen. The distance between object and screen is x. If numerical value of magnification produced by lens is m, then focal length of lens is
a) $\frac{mx}{(m+1)^2}$ b) $\frac{mx}{(m-1)^2}$ c) $\frac{(m+1)^2}{m}$ d) $\frac{(m-1)^2}{m}$

95. To correct myopia, the focal length of the concave lens should be
a) equal to the distance of far point b) less than the distance of far point
c) less than the distance of near point d) equal to the distance of near point

96. A ray of light passes through an equilateral glass prism in such a manner that the angle of incidence is equal to the angle of emergence and each of these angles is equal to 3/4 of the angle of the prism. The angle of deviation is
a) 45° b) 39° c) 20° d) 30°

97. In a compound microscope, the intermediate image is
a) virtual, erect and magnified b) real, erect and magnified c) real, inverted and magnified
d) virtual, erect and reduced

98. In a plano-convex lens, the radius of curvature of convex surface is 10 cm and the focal length of the lens is 30 cm. The refractive index of the material of the lens will be
a) 1.5 b) 1.66 c) 1.33 d) 3

99. A small coin is resting on the bottom of a beaker filled with a liquid . A ray of light from the coin travels up to the surface of the liquid and moves along its surface as shown in figure. How fast is the light travelling in the liquid?

a) $1.8 \times 10^8 ms^{-1}$ b) $2.4 \times 10^8 ms^{-1}$ c) $3.0 \times 10^8 ms^{-1}$ d) $1.2 \times 10^4 ms^{-1}$

100. For a normal eye, the least distance of distinct vision is

a) 0.25 m b) 0.50 m c) 25 m d) infinite

101. A converging lens is used to form an image on a screen. When the upper half of the lens is-covered by an opaque screen, then

a) half the image will disappear b) complete image will disappear

c) intensity of image will increase d) intensity of image will decrease

102. The minimum distance between an object and its real image formed by a convex lens is

a) 1.5 f b) 2 f c) 2.5 f d) 4 f

103. A ray of light is incident at an angle of 60° on one face of a prism of angle 30°. The ray emerging out of the prism makes an angle of 30° with the incident ray. The emergent ray is

a) normal to the face through which it emerges

b) inclined at 30° to the face through which it emerges

c) inclined at 60° to the face through which it emerges d) None of the above

104. Which of the following statement is correct for hypermetropia?

a) Near objects are not clearly visible b) Distant objects are not clearly visible

c) Concave lens is used for remedy of hypermetropia d) None of the above

105. A ray of light incident at an angle θ on a refracting face of aprism emerges from the other face normally. if the angle of the prism is 5^0 and the prism is made of a material of refractive index 1.5, the angle of incidence is

a) 7.5^0 b) 5^0 c) 15^0 d) 15^0

106. A beam of light composed of red and green rays is incident obliquely at a point on the face of a rectangular glass slab. When coming out on the opposite parallel face, then the red and green rays emerge from

a) two points propagating in two different non-parallel directions

b) two points propagating in two different parallel directions

c) one point propagating in two different directions

d) one point propagating in the same direction

107. The focal length of objective lens is increased then magnifying power of

a) Microscope will increase but that of telescope decreases

b) Microscope and telescope both will increase

c) Microscope and telescope both will decrease

d) Microscope will decrease but that of telescope will increase

108. A room (cubical) is made of mirrors. An insect is moving along the diagonal on the floor , such that the velocity of image of insect on two adjacent wall mirrors, is $10cms^{-1}$. The velocity of image of insect in ceiling mirror is

a) $10cms^{-1}$ b) $20cms^{-1}$ c) $\frac{10}{\sqrt{2}}cms^{-1}$ d) $10\sqrt{2}cms^{-1}$

109. An object is 8 cm high. It is desired to form a real image 4 cm high at 60 cm from the mirror. The type of mirror needed with the focal length is
a) convex mirror with focal length f = 40 cm b) convex mirror with focal length f = 20 cm
c) concave mirror with focal length f = - 40 cm
d) concave mirror with focal length f = - 20 cm

110. A metal coin is at bottom of a beaker filled with a liquid of refractive index = 4/3 to height of 6 cm. To an observer looking from above the surface of liquid, coin will appear at a depth
a) 1.5 cm b) 6.75 cm c) 4.5 cm d) 7.5 cm

111. A convex lens has mean focal length 20 cm.The dispersive power of the material of the lens is 0.02.The longitudinal chromatic aberration for an object at infity,is
a) 0.20 b) 0.40 c) 0.80 d) 10^3

112. Dispersion of light is caused due to
a) wavelength b) None of these c) intensity of light d) density of medium

113. Why sky appears blue?
a) Due to scattering b) Due to reflection c) Due to refraction
d) Due to total internal reflection

114. The sun light reaches us as white and not as its components because
a) air medium is dispersive b) air medium is non-dispersive
c) air medium scatter the sunlight d) air medium absorbs the sunlight
e) speed of light depends on wavelength in vacuum

115. A short pulse of white light is incident from air to a glass slab at normal incidence. After travelling through the slab, the first colour to emerge is
a) blue b) green c) violet d) red

116. In vacuum, to travel distance d, light takes time t and in medium to travel distance 5d, it takes time T. The critical angle of the medium is

a) $sin^{-1}\left(\frac{5T}{t}\right)$ b) $sin^{-1}\left(\frac{5t}{3T}\right)$ c) $sin^{-1}\left(\frac{5t}{T}\right)$ d) $sin^{-1}\left(\frac{3t}{5T}\right)$

117. A magnifying glass is used, as the object to be viewed can be brought closer to the eye than the normal near point. This results in
a) a larger angle to be subtended by the object at the eye and hence viewed in greater detail
b) the formation of a real inverted image. c) increase in the field of view.
d) infinite magnification at the near point.

118. A boy of height 1 m stands in front of a convex mirror. His distance from the mirror is equal to its focal length. The height of his image is
a) 0.25 m b) 0.33 m c) 0.5 m d) 0.67 m

119. The angle of incidence for a ray of light at a refracting surface of a prism is 45°. The angle of prism is 60°. If the ray suffers minimum deviation through the prism, then the angle of minimum deviation and refractive index of the material of the prism respectively, are

a) $45°, \sqrt{2}$ b) $30°, \frac{1}{\sqrt{2}}$ c) $45°, \frac{1}{\sqrt{2}}$ d) $30°, \sqrt{2}$

120. The aperture of a telescope is made large, because to
a) increase the intensity of image b) decrease the intensity of image
c) have greater magnification d) have lesser resolution

121. The image formed by an objective of a compound microscope is
a) virtual and diminished b) real and diminished c) real and enlarged
d) virtual and enlarged

122. For an optical arrangement as shown in the figure,Find the position and nature of image.
a) 32 cm b) 0.6 cm c) 6 cm d) 0.5 cm

123. What is the refractive index of a prism whose angle A=60^0 and angle of minimum deviation d_m=30^0?
a) $\sqrt{2}$ b) $\frac{1}{\sqrt{2}}$ c) 1 d) $\frac{1}{\sqrt{3}}$

124. A person wants a real image of his own, 3 times enlarged. Where should he stand in front of a concave mirror of radius of curvature of 30 cm?
a) 90 cm b) 10 cm c) 20 cm d) 30 cm

125. A microscope is focussed on a mark on a piece of paper and then, a slab of glass of thickness 3 cm and refractive index 1.5 is placed over the mark. How should the microscope be moved to get the mark in focus again?
a) 1 cm upward b) 4.5 cm downward c) 1 cm downward d) 2 cm upward

126. An object is placed at a distance of 0.5 m in front of a plane mirror. The distance between object and image will be
a) 0.25 m b) 0.5 m c) 1.0 m d) 2.0 m

127. Which of the following is not due to total internal reflection?
a) Difference between apparent and real depth of a pond b) Mirage on hot summer days
c) Brilliance of diamond d) Working of optical fibre

128. In an experiment to find focal length of a concave mirror, a graph is drawn between the magnitude of u and v. The graph looks like

a)  b)  c)  d) 

129. A short linear object of length L lies on the axis of a spherical mirror of focal length f at a distance u form the mirror. Its image has an axial length L' equal to

a) $L\left[\frac{f}{u-f}\right]^{1/2}$ b) $L\left[\frac{u+f}{f}\right]^{1/2}$ c) $L\left[\frac{u-f}{f}\right]^{2}$ d) $L\left[\frac{f}{u-f}\right]^{2}$

130. If the focal length of objective and eye lens are 1.2 cm and 3 cm respectively and the object is put 1.25 cm away from the objective lens and the final image is formed at infinity. The magnifying power of the microscope is
a) 150 b) 200 c) 250 d) 400

131. Aperture of human eye is 0.2 cm. The minimum magnifying power of a visual telescope, whose objective has diameter 100 cm, is
a) 500 b) 0.002 c) 0.02 d) 100

132. A convex mirror has focal length 20 cm. If an object is placed 20 cm away from the pole of mirror, then what is the distance between image formed and pole?
a) 40 cm b) 10 cm c) 20 cm d) At infinity

133. In optical fibres, the refractive index of the core is
a) greater than that of the cladding. b) equal to that of the cladding.
c) smaller than that of the cladding. d) smaller than that of the cladding.

134. The velocity of image when object and mirror both are moving towards each other with velocities 4 ms^{-1} and 5 ms^{-1} respectively, is
a) -14 ms^{-1} b) 15ms^{-1} c) -9 ms^{-1} d) 14 ms^{-1}

135. The real image which is exactly equal to the size of an object is to be obtained on a screen with the help of a convex lens of focal length 15 cm. For this, what must be in the distance between the object and screen?
a) 15 cm b) 30 cm c) 45 cm d) 60 cm

136. The length of the compound microscope is 14 ern, The magnifying power for relaxed eye is 25. If the focal length of eye lens is 5 cm, then the object distance for objective lens will be
a) 1.8 cm b) 1.5 cm c) 2.1 cm d) 2.4 cm

137. Two lenses are kept in contact with powers +2 D and -4 D. The focal length of this combination will be
a) +50 cm b) -50 cm c) -25 cm d) + 25 cm

138. An object approaches a convergent of lens from the left of the lens with a uniform speed 5m/s and stops at the focus. The image
a) moves away from the lens with a uniform speed 5 m/s
b) moves away from the lens with a uniform acceleration
c) moves away from the lens with a non-uniform acceleration
d) moves towards the lens with a non-uniform acceleration

139. If the critical angle for total internal reflection from a medium to vaccum is 30^0, the velocity of light in the medium is
a) $3 \times 10^8 ms^{-1}$ b) $1.5 \times 10^8 ms^{-1}$ c) $6 \times 10^8 ms^{-1}$ d) $\sqrt{3} \times 10^8 ms^{-1}$

140. A ray passing through or directed towards centre of curvature of a spherical mirror is reflected such that it trace back of its path, because
a) it does not follow law of reflection b) angle of incidence is 0°
c) centre of curvature is midway between object and pole
d) distance of centre of curvature from focus is equal to its distance from pole

141. For an optical arrangement as shown in the figure,Find the position and nature of image.
a) 32 cm b) 0.6 cm c) 6 cm d) 0.5 cm

142. If the reflected ray is rotated by an angle of 4θ in clockwise direction then the mirror was rotated by
a) 2θ in anti-clockwise direction b) 4θ in anti-clockwise direction
c) 2θ in clockwise direction d) 4θ in clockwise direction

143. Sparkling of diamond is due to
a) reflection. b) dispersion. c) total internal reflection.
d) high refractive index of diamond

144. The direction of ray of light incident on a concave mirror is shown by PQ while directions in which the ray would travel after reflection is shown by four rays marked 1, 2, 3 and 4 (figure). Which of the four rays correctly shows the direction of reflected ray?

a) 1   b) 2   c) 3   d) 4

145. Relation between focal length (f) and radius of curvature (R) of a spherical mirror is
a) R = f/2   b) f = 3R   c) f = R/2   d) f = R/4

146. A biconvex lens has a focal length f. It is cut into two parts along a line perpendicular to principal axis. The focal length of each part will be
a) f/2   b) f   c) (3/2)f   d) 2f

147. A glass-slab is immersed in water. What will be the critical angle for a light ray at glass-water interface? Where ${}_an_g = 1.50,\ {}_an_w = 1.33$and $\sin^{-1}$ (0.887)=62.5
a) 48.8°   b) 72.8°   c) 62.5°   d) 64.5°

148. An infinitely long rod lies along with the axis of a concave mirror of focal length f. The near end of the rod is at a distance u > f from the mirror. Its image will have a length
a) $\frac{f^2}{u-f}$ b) $\frac{uf}{u-f}$ c) $\frac{f^2}{u+f}$ d) $\frac{uf}{u+f}$

149. A compound microscope has two lenses. The magnifying power of one is 5 and the combined magnifying power is 100. The magnifying power of the other lens is
a) 10   b) 20   c) 50   d) 25

150. A car is moving with at a constant speed of 60 km h^{-1} on a straight road. Looking at the rear view mirror, the driver finds that the car following him is at a distance of 100 m and is approaching with a speed of 5 km h^{-1} In order to keep track of the car in the rear, the driver begins to glance alternatively at the rear and side mirror of his car after every 2 s till the other car overtakes. If the two cars were maintaining their speeds, which of the following statement (s) is/are correct?
a) The speed of the car in the rear is 65 km h^{-1}
b)
In the side mirror, the car in the rear would appear to approach with a speed of 5 km h^{-1} to the driver of the leading car
c)
In the rear view mirror, the speed of the approaching car would appear to decrease as the distance between the cars decreases
d)
In the side mirror, the speed of the approaching car would appear to increase as the distance between the cars decreases

151. The diameter of the moon is $3.5 \times 10^3 km$ and its distance from the earth is $3.8 \times 10^5 km$ .seen by a telescope having focal lengths of the objective and the eye piece as 40mm and 1.0 cm respectively, the angular diameter of the image of the moon will be approximately.
a) 2°   b) 10°   c) 20°   d) None of these

152. An object placed at 20 cm in front of a concave mirror produces three times magnified real image. What is the focal length of the concave mirror?

a) 15 cm b) 6.6 cm c) 10 cm d) 7.5 cm

153. In a plano-convex lens, the radius of curvature of convex surface is 10 cm and the focal length of the lens is 30 cm. The refractive index of the material of the lens will be

a) 1.5 b) 1.66 c) 1.33 d) 3

154. In a compound microscope, the intermediate image is

a) virtual, erect and magnified b) real, erect and magnified c) real, inverted and magnified d) virtual, erect and reduced

155. A diver at a depth 12 m inside water (μ = 4/3) sees the sky in a cone of semi-vertical angle

a) $\sin^{-1}\frac{4}{3}$ b) $\tan^{-1}\frac{4}{3}$ c) $\sin^{-1}\frac{3}{4}$ d) $90°$

156. Rainbow is caused due to

a) Refraction b) reflection c) dispersion d) All of these

157. When a ray of light enters from one medium to another, then which of the following does not change?

a) Frequency b) Wavelength c) Speed d) Amplitude

158. A luminous object is separated from a screen by distance d. A convex lens is placed between the object and the screen such that it forms a distinct image on the screen. The maximum possible focal length of this convex lens is

a) 4d b) 2d c) $\frac{d}{2}$ d) $\frac{d}{4}$

159. The refracting angle of a prism is A and refractive index of the material of the prism is cot (A/2). The angle of minimum deviation is

a) 180°- 3A b) 180°- 2A c) 90°- A d) 180°+ 2A

160. Two identical thin plano-convex glass lenses each having radius of curvature of 20cm are placed with their convex surfaces in contact at the centre.The intervening space is filled with oil of refractive index 1.7.The intervening space is filled with oil refractive index 1.7.The focal length of the combination is

a) -20 cm b) -25 cm c) -50 cm d) 50 cm

161. A glass slab consists of thin uniform layers of progressively decreasing refractive indices refractive index such that the refractive index of any layer is $\mu - m\Delta\mu$ Here, μ and $\Delta\mu$ denote the refractive index of 0th layer and the difference in refractive index between 'any two consecutive layers, respectively. The integer m = 0, 1, 2, 3, ... denotes the numbers of the successive layers. A ray of light from the 0th layer enters the 1st layer at an angle of incidence of 30°. After undergoing the mth refraction, the ray emerges parallel to the interface. If μ = 1.5 and $\Delta\mu$ = 0.015, then the value of m is

a) 20 b) 30 c) 40 d) 50

162. A prism has refractive angle 60°. When a light ray is incident on 50°, then minimum deviation is obtained. What is the value of minimum deviation?

a) 40° b) 45° c) 50° d) 60°

163. What can be the largest distance of an image of a real object from a convex mirror of radius of curvature is 20 cm?

a) 10 cm b) 20 cm c) Infinity d) zero

164. Under minimum deviation condition in a prism, if a ray is an incident at an angle 30°, then the angle between the emergent ray and the second refracting surface of the prism is
a) 0° b) 30° c) 45° d) 60°

165. A luminous object is separated from a screen by distance d. A convex lens is placed between the object and the screen such that it forms a distinct image on the screen. The maximum possible focal length of this convex lens is
a) 4d b) 2d c) $\frac{d}{2}$ d) $\frac{d}{4}$

166. Diameter of the objective of a telescope is 200 cm. What is the resolving power of a telescope? Take, wavelength of light = 5000A.
a) 6.56×10^6 b) 3.28×10^5 c) 1×10^6 d) 3.28×10^6

167. The refractive indices of water and glass with respect to air are 4/3 and 5/3, respectively. The refractive index of glass with respect to water will be
a) 1/3 b) 4/3 c) 5/4 d) 20/9

168. When light of wavelength λ is incident on an equilateral prism kept in, its minimum deviation position, it is found that the angle of deviation equals the angle of the prism itself The refractive index of the material of the prism for the wavelength λ is, then
a) $\sqrt{3}$ b) $\frac{\sqrt{3}}{2}$ c) 2 d) $\sqrt{2}$

169. In order to increase the angular magnification of a simple microscope, one should increase
a) the objectsize b) the aperture of the lens c) the focal length of the lens
d) the power of the lens

170. If the focal length of objective lens is increased, then magnifying power of
a) microscope will increase but that of telescope decrease
b) microscope and telescope both will increase
c) microscope and telescope both will decrease
d) microscope will decrease but that of telescope will increase

171. The image formed by an objective of a compound microscope is
a) virtual and diminished b) real and diminished c) real and enlarged
d) virtual and enlarged

172. The limiting angle of incidence for an optical ray that can be transmitted by an equilateral prism of refractive index $\mu = \sqrt{\frac{7}{3}}$ is given by (angles can be assumed to be small, so that sine of the angle is angle itself)
a) $\frac{\pi}{3}$ b) $\frac{\pi}{6}$ c) $\frac{2\pi}{3}$ d) $\frac{\pi}{2}$

173. There are certain material developed in laboratories which have a negative refractive index. A ray incident from air (medium 1) into such a medium (medium 2) shall follow a path given by

a)

b)

c)

d)

174. A beam of light consisting of red, green and blue colours is incident on a right angled prism. The refractive index of the material of the prism for red, green and blue wavelengths are 1.39, 1.44 and 1.47 respectively. The prism will

a) separate the red colour part from the green and blue colours.
b) separate the blue colour part from the red and green colours
c) separate all the three colours from one another d) not separate the three colours at all

175. An astronomical refractive telescope has an objective of focal length 20 m and an eyepiece of focal length 2 cm. Which one of the following is not correct?
a) The length of the telescope tube is 20.02 m b) The magnification is 1000
c) The image formed is inverted
d)
An objective of a larger aperture will increase the brightness and reduce chromatic aberration of the image

176. An astronomical refractive telescope has an objective of focal length 20 m and an eyepiece of focal length 2 cm. Which one of the following is not correct?
a) The length of the telescope tube is 20.02 m b) The magnification is 1000
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d)
An objective of a larger aperture will increase the brightness and reduce chromatic aberration of the image

177. In Galilean telescope, the final image formed is
a) real, erect and enlarged b) virtual, erect and enlarged c) real, inverted and enlarged
d) virtual, inverted and enlarged

178. Reflecting telescope consists of
a) convex mirror of large,aperture b) concave mirror of large aperture
c) concave lens of small aperture d) None of the above

179. The refractive index of the material of an equilateral prism is $\sqrt{3}$ What is the angle of minimum deviation?
a) 45° b) 60° c) 37° d) 30°

180. For the myopia defect in eye, it can be removed by
a) convex lens b) concave lens c) cylindrical lens d) toric lens

181. A man has height of 6 m. He observes image of 2 m height erect, then mirror used is
a) concave b) convex c) plane d) None of these

182. Aperture of human eye is 0.2 cm. The minimum magnifying power of a visual telescope, whose objective has diameter 100 cm, is
a) 500 b) 0.002 c) 0.02 d) 100

183. To correct myopia,the focal length of the concave lens should be
a) equal to the distance of far point b) less than the distance of far point
c) less than the distance of near point d) equal to the distance of near point

184. An astronomical telescope has an angular magnification of magnitude 5 for distant objects. The separation between the objective and the eyepiece is 36 cm and the final image is formed at infinity. The focal length f_o of the objective and the focal length Ie of the eyepiece are
a) f_o = 45 cm and f_e = - 9 cm b) f_o = -72 cm and f_e = 5 cm c) f_o = 50 cm and f_e = 10 cm
d) f_o = 30 cm and f_e = 6 cm

185. A metal coin is at bottom of a beaker filled with a liquid of refractive index = 4/3 to height of 6 cm. To an observer looking from above the surface of liquid, coin will appear at a depth
a) 1.5 cm b) 6.75 cm c) 4.5 cm d) 7.5 cm

186. A magician during a show makes a glass lens with n = 1.47 disappear in a trough of liquid. Refractive index of the liquid is
a) $\frac{4}{3}$ b) $\frac{12}{5}$ c) 1.47 d) 1.33

187. A glass slab has a critical angle of 30° when placed in air. What will be the critical angle when it is placed in liquid of refractive index 6/5?
a) 45° b) 37° c) 53° d) 60°

188. A magnifying glass is used, as the object to be viewed can be brought closer to the eye than the normal near point. This results in
a) a larger angle to be subtended by the object at the eye and hence viewed in greater detail
b) the formation of a real inverted image. c) increase in the field of view.
d) infinite magnification at the near point.

189. A Concave mirror form the real image of an object which is magnified 4 times. The object is moved 3 cm away, the magnification of the image is 3 times. What is the focal length of the mirror?
a) 3 cm b) 12 cm c) 36 cm

190. There are certain material developed in laboratories which have a negative refractive index. A ray incident from air (medium 1) into such a medium (medium 2) shall follow a path given by

a)  b)  c) 

d) 

191. The refractive index of the material of a prism is $\sqrt{2}$ and its refracting angle is 30^0 .One of the refracting surfaces of the prism is made a mirror inwards.A beam of monochromatic light entering the prism from the other face will retrace its path after reflection from the mirrored surface,if its angle of incidence on the prism is
a) 45^0 b) 60^0 c) 0^0 d) 30^0

192. Two lenses are in contact having focal length 25 cm and -40 crn. Find power of this combination.
a) -6.67 D b) -2.5 D c) +1.5 D d) +4 D

193. A thin prism of angle 7^0 and refractive index 1.5 is combined with another prism of angle θ and refractive index 1.7. The emergent ray goes undeviated. What is the value of θ ?
a) 3^0 b) 5^0 c) 9^0 d) 1^0

194. A plano-concave lens is made of glass of refractive index 1.5 and the radius of curvature of its curved face is 100 cm. What is the power of the lens?
a) +0.5 D b) -0.5 D c) -2 D d) +2 D

195. An object is placed at 10 cm from a lens and real image is formed with magnification of 0.5. Then the lens is
a) concave with focal length of 10/3 cm b) convex with focal length of 10/3 cm
c) concave with focal length of 10 cm d) convex with focal length of 10 cm

196. An object is seen through a simple microscope of focal length 12 cm. What will be the angular magnification produced, if the image is formed at the near point of the eye which is 25 cm away from it?
a) 6.08 b) 3.08 c) 9.03 d) 5.09

197. In the formation of a rainbow, the light from the sun on water droplets undergoes
a) dispersion only. b) only TIR. c) dispersion and TIR. d) scattering.

198. The real image which is exactly equal to the size of an object is to be obtained on a screen with the help of a convex lens of focal length 15 cm. For this, what must be in the distance between the object and screen?
a) 15 cm b) 30 cm c) 45 cm d) 60 cm

199. The phenomena involved in the reflection of radiowaves by ionosphere is similar to
a) reflection of light by a plane mirror
b) total internal reflection of light in air during a mirage
c) dispersion of light by water molecules during the formation of a rainbow
d) scattering of light by the particles of air

200. Our eyes are most sensitive for which of the following wavelength?
a) 4500 $\mathring{A}$ b) 5500$\mathring{A}$ c) 6500$\mathring{A}$
d) Equally sensitive for all wavelengths of visible spectrum

201. A Convex lens and a concave lens, each having same focal length of 25 cm, are put in contact to form a combination of lenses. The power in dioptres of the combination is
a) 25 b) 50 c) infinite d) zero

202. The magnification produced by an astronomical telescope for normal adjustment is 10 and the length of the telescope is 1.1 m. The magnification, when the image is formed at least distance of distinct vision is

a) 6 b) 14 c) 16 d) 18

203. The focal lengths of a converging lens are f_v and f_r for violet and red lights, respectively. Which of the following is correct?
a) $f_v < f_r$ b) $f_v = f_r$ c) $f_v > f_r$ d) It depends on the average refractive index

204. A plano-convex lens is made of refractive index of 1.6. The focal length of the lens is
a) 400 cm b) 200 cm c) 100 cm d) 50 cm

205. An astronomical telescope has an angular magnification of magnitude 5 for distant objects. The separation between the objective and the eyepiece is 36 cm and the final image is formed at infinity. The focal length f_o of the objective and the focal length le of the eyepiece are
a) f_o = 45 cm and f_e = - 9 cm b) f_o = -72 cm and f_e = 5 cm c) f_o = 50 cm and f_e = 10 cm
d) f_o = 30 cm and f_e = 6 cm

206. The magnifying power of a microscope with an objective of 5 mm focal length is 400. The length of its tube is 20 cm. Then, the focal length of the eye-piece is
a) 200 cm b) 160 cm c) 2.5 cm d) 0.1 cm

207. A vessel consists of two plane mirrors at right angles as shown in figure. The vessel is filled with water. The total deviation in incident ray is
a) 0° b) 60° c) 90° d) 180°

208. For having large magnification power of a compound microscope
a) length of the microscope tube must be small
b) focal lengths of objective lens and ele-piece should be large
c) focal lengths of objective lens and eye-piece should be small
d) focal length of eye-piece must be smaller than the focal length of objective lens

209. Resolving power of a microscope is given by
a) $\frac{2\mu sin\theta}{\lambda^2}$ b) $\frac{\mu sin\theta}{\lambda}$ c) $\frac{2\mu sin\theta}{\lambda}$ d) $\frac{2\mu cos\theta}{\lambda}$

210. A ray of light incident at an angle θ on a refracting face of aprism emerges from the other face normally. if the angle of the prism is 5^0 and the prism is made of a material of refractive index 1.5, the angle of incidence is
a) 7.5^0 b) 5^0 c) 15^0 d) 15^0

211. Angle of minimum deviation for a prism of refractive index 1.5 is equal to the angle of prism of given prism. Then, the angle of prism is
a) 80° b) 41°24' c) 60° d) 82°48'

212. First and second focal lengths of spherical surface of n refractive index are f_1 and f_2 respectively. The relation between them, is
a) $f_2 = f_1$ b) $f_2 = -f_1$ c) $f_2 = nf_1$ d) $f_2 = -nf_1$

213. The limiting angle of incidence for an optical ray that can be transmitted by an equilateral prism of refractive index $\mu = \sqrt{\frac{7}{3}}$ is given by (angles can be assumed to be small, so that sine of the angle is angle itself)
a) $\frac{\pi}{3}$ b) $\frac{\pi}{6}$ c) $\frac{2\pi}{3}$ d) $\frac{\pi}{2}$

214. The. distance of moon form the earth is 3.8x 10^5 km. Supposing that the eye is most sensitive to .the light of wavelength 550 nm, the separation of two points on the moon that can be resolved by a 500 cm telescope is

a) 50 m b) 55 m c) 51 m d) 60 m

215. Light travels in two media A and B with speeds 1.8 x 10^8 ms^{-1} and 2.4 x 10^8 ms^{-1} respectively. Then, the critical angle between them is

a) $sin^{-1}\left(\frac{2}{3}\right)$ b) $tan^{-1}\left(\frac{3}{4}\right)$ c) $tan^{-1}\left(\frac{2}{3}\right)$ d) $sin^{-1}\left(\frac{3}{4}\right)$

216. A thin convex lens of refractive index 1.5 has 20 cm focal length in air. If the lens is completely immersed in a liquid of refractive index 1.6, then its focal length will be

a) -160 cm b) -100 cm c) +10 cm d) +100 cm

217. The distance of the image from the focus of a lens is X and that of object is Y. What is the nature of the graph Y versus X ?

a) Straight line b) Ellipse c) Parabola d) Hyperbola

218. A short-sighted person can see distinctly only those objects which lie between 10 cm and 100 cm from him. The power of the spectacle lens required to see a distance object is

a) +0.5 D b) -1.0 D c) -10 D d) +4.0 D

219. A ray of light incident at an angle θ on a refracting face of a prism emerges from the other face normally. If the angle of the prism is 5° and the prism is made of a material of refractive index 1.5 then the angle of incidence is

a) 7.5° b) 5° c) 15° d) 2.5°

220. A plano-convex lens is made of refractive index of 1.6. The focal length of the lens is

a) 400 cm b) 200 cm c) 100 cm d) 50 cm

221. The distance of the image from the focus of a lens is X and that of object is Y. What is the nature of the graph Y versus X ?

a) Straight line b) Ellipse c) Parabola d) Hyperbola

222. Air bubble in water behaves as

a) sometimes concave, sometimes convex lens b) concave lens c) convex lens

d) always refracting surface

223. For the figure as shown below ,match the following columns.

a)

A	B	C
2	3	1

b)

A	B	C
2	1	3

c)

A	B	C
3	2	1

d)

A	B	C
3	1	2

224. For a normal eye, the cornea of eye provides a converging power of 40 D and the least converging power of the eye lens behind the cornea is 20 D. Using this information, the distance between the retina and the cornea-eye lens can be estimated to be

a) 5 cm b) 2.5 cm c) 1.67 cm d) 1.5 cm

225. Resolving power of a microscope is given by

a) $\frac{2\mu sin\theta}{\lambda^2}$ b) $\frac{\mu sin\theta}{\lambda}$ c) $\frac{2\mu sin\theta}{\lambda}$ d) $\frac{2\mu cos\theta}{\lambda}$

226. If light travels a distance x in t_1 sec in air and 10 x distance in t_2 see in a medium, the critical angle of the medium will be

a) $tan^{-1}\left(\frac{t_1}{t_2}\right)$ b) $sin^{-1}\left(\frac{t_1}{t_2}\right)$ c) $sin^{-1}\left(\frac{10t_1}{t_2}\right)$ d) $tan^{-1}\left(\frac{10t_1}{t_2}\right)$

227. A plot of angle of deviation D versus angle of incidence for a triangular prism is shown below. The angle of incidence for which the light ray travels parallel to the base is

a) 30° b) 60° c) 48° d) 36°

228. A thin lens of glass (μ = 1.5)of focal length ± 10 cm is immersed in water (μ = 1.33). The new focal length is

a) 20 cm b) 40 cm c) 48 cm d) 12 cm

229. A thin convergent glass lens(μ = 1.5) has a power of + 5.0 D. When this lens is immersed in a liquid of refractive index μ it acts as a divergence lens of focal length 100 cm. the value of μ should be

a) 3/2 b) 4/3 c) 5/3 d) 2

230. An object of 5 cm height is placed 1 m apart from a concave spherical mirror which has a radius of curvature of 20 cm. The size of the image is

a) 0.11 cm b) 0.5 cm c) 0.55 cm d) 0.60 cm

231. In a compound microscope, the focal length of the objective is 2.5 cm and of eye lens is 5 cm. If an object is placed at 3.75 cm before the objective and the image is formed at the least distance of distinct vision, then the distance between two lenses will be

a) 11.67 cm b) 12 cm c) 12.75 cm d) 13 cm

232. An astronomical telescope in normal adjustment receives light from a distance source S, the tube length is now decreased slightly, then

a) no image will be formed b) a virtual image of S will be formed at a finite distance

c) a large, real image of S will be formed behind the eye piece, far away from i

d) a small, real image of S will be formed behind the eye-piece closes to it

233. A concave shaving mirror has a radius of curvature of 35.0 cm. It is positioned so that the (upright) image of a man's face is 2.50 times the size of the face. How far is the mirror from the face?

a) 5.25 cm b) 21.0 cm c) 10.5 cm d) 42 cm

234. The r efracting angle of a prism is A and refractive index of the material of the prism is cot(A/2).The angle of minimum deviation is

a) 180°-3A b) 180°-2A c) 90°-A d) 180°+2A

235. A focal length of a lens is 10 cm. What is power of a lens in dioptre?

a) 0.1 D b) 10 D c) 15 D d) 1 D

236. For the figure as shown below ,match the following columns.

a)

A	B	C
2	3	1

b)

A	B	C
2	1	3

c)

A	B	C
3	2	1

d)

A	B	C
3	1	2

237. A thin prism P_1 with angle 6° and made from glass of refractive index 1.54 is combined with another thin prism P_2 of refractive index 1.72 to produce dispersion without deviation. The angle of prism P_2 will be

a) 5°24' b) 4°30' c) 6° d) 8°

238. The focal length of a converging lens is measured for violet, green and red colours. It is respectively f_v, f_g f_r we will find that

a) $f_v = f_r$ b) $f_v < f_r$ c) $f_v > f_r$ d) $f_g > f_r$

239. We combine two lenses, one is convex and other is concave having focal lengths f_1 and f_2 and their combined focal length is F. Combination of the lenses will behave like concave lens, if

a) $f_1 > f_2$ b) $f_1 = f_2$ c) $f_1 < f_2$ d) $f_1 \le f_2$

240. If the value of critical angle is 30° for total internal reflection from any medium to vacuum, then speed of light in that medium

a) 3×10^8 m/s b) 1.5×10^8 m/s c) 6×10^8 m/s d) 4.5×10^8 m/s

241. Mark the correct one.

a) Our eyes can distinguish between real and virtual image

b) Virtual image can also be taken on screen

c) If the incident rays are converging at a point, then the object is real d) None of the above

242. We combine two lenses, one is convex and other is concave having focal lengths f_1 and f_2 and their combined focal length is F. Combination of the lenses will behave like concave lens, if

a) $f_1 > f_2$ b) $f_1 = f_2$ c) $f_1 < f_2$ d) $f_1 \le f_2$

243. The minimum magnifying power of telescope is M. If the focal length of its eye lens is halved, the magnifying power will become

a) m/2 b) 2m c) 3m d) 4m

244. A small angled prism of refractive index 1.4 is combined with another small angled prism of refractive index 1.6 to produce dispersion without deviation. If the angle of first prism is 6°, then the angle of the second prism is

a) 8° b) 6° c) 4° d) 2°

245. A thin glass prism (μ = 1.5) is immersed in water (μ = 1.3). if the angle of deviation in air for a particular ray be D, then in water will be

a) 0.2 D b) 0.3 D c) 0.5 D d) 0.6 D

246. In the given figure, the angle of reflection is

a) 30^0 b) 60^0 c) 45^0 d) None of these

247. What is the refractive index of a prism whose angle $A=60^0$ and angle of minimum deviation $d_m=30^0$?

a) $\sqrt{2}$ b) $\frac{1}{\sqrt{2}}$ c) 1 d) $\frac{1}{\sqrt{3}}$

248. For the refraction shown below the correct relation is,

a) $\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$ b) $\frac{n_1}{v} - \frac{n_2}{u} = \frac{n_2 - n_1}{R}$ c) $\frac{n_1}{v} - \frac{n_2}{u} = \frac{n_1 - n_2}{R}$ d) $\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_1 - n_2}{R}$

249. A ray of light travelling in a transparent medium of refractive index μ on a surface separating the medium from air at an angle of incidence of 45^0 For which of the following value of μ the ray can undergo total internal reflection?
a) μ =1.33 b) μ =1.40 c) μ =1.50 d) μ =1.25

250. The frequency of a light wave in a material and wavelength is 5000 A The refractive index of material will be
a) 1.40 b) 1.50 c) 3.00 d) 1.33

251. The direction of ray of light incident on a concave mirror is shown by PQ while directions in which the ray would travel after reflection is shown by four rays marked 1, 2, 3 and 4 (figure). Which of the four rays correctly shows the direction of reflected ray?

a) 1 b) 2 c) 3 d) 4

252. A magnifying glass of focal length 5 cm is used to view an object by a person whose smallest distance of distinct vision is 25cm. If he holds the glass close to eye, then the magnification is
a) 5 b) 6 c) 2.5 d) 3

253. The radius of curvature of the curved surface of a planoconvex lens is 20 cm. If the refractive index of the material of the lens be 1.5, then it will
a) act as a convex lens only for the objects that lie on its curved side
b) act as a concave lens for the objects that lie on its curved side
c) act as a convex lens irrespective of the side on which the object lies
d) act as a concave lens irrespective of side on which the object lies

254. A short-sighted person can see distinctly only those objects which lie between 10 cm and 100 cm from him. The power of the spectacle lens required to see a distance object is
a) +0.5 D b) -1.0 D c) -10 D d) +4.0 D

255. Reflecting telescope consists of
a) convex mirror of large,aperture b) concave mirror of large aperture
c) concave lens of small aperture d) None of the above

256. For a normal eye, the least distance of distinct vision is
a) 0.25 m b) 0.50 m c) 25 m d) infinite

257. The aperture of a telescope is made large, because to
a) increase the intensity of image b) decrease the intensity of image
c) have greater magnification d) have lesser resolution

258. The refractive indices of water and glass with respect to air are 4/3 and 5/3, respectively. The refractive index of glass with respect to water will be
a) 1/3 b) 4/3 c) 5/4 d) 20/9

259. Two beams of red and violet colours made to pass separately through a prism (A = 60°). In the minimum deviation position, the angle of refraction inside the prism will be

a) greater for red colour b) equal but not 30° for both the colours
c) greater for violet colour d) 30° for both the colours

260. Raypf light transmitted from glass (n = 3/2) to water (n = 4/3). What is the value of critical angle?

a) $\sin^{-1}\left(\frac{1}{2}\right)$ b) $\sin^{-1}\sqrt{\frac{8}{9}}$ c) $\sin^{-1}\left(\frac{8}{9}\right)$ d) $\sin^{-1}\left(\frac{5}{7}\right)$

261. A rectangular block of glass ABCD has a refractive index 1.6. A pin is placed midway on the face AB When observed from the face AD, the pin shall

a) appear to be near A b) appear to be near D. c) appear to be at the centre of AD
d) not be seen at all.

262. A plano-convex lens has a maximum thickness of 6 cm. When placed on a horizontal table with the curved surface in contact with the table surface, then the apparent depth of the bottom most point of the lens is found to be 4 cm. If the lens is inverted such that the plane face of the lens is in contact with the surface of the table, then the apparent depth of the centre of the plane face is found to be $\frac{17}{3}$ cm. The radius of curvature of the lens is
a) 68 cm b) 75 cm c) 128 cm d) 34 cm

263. A plano-concave lens is made of glass of refractive index 1.5 and the radius of curvature of its curved face is 100 cm. What is the power of the lens?
a) +0.5 D b) -0.5 D c) -2 D d) +2 D

264. A diver at a depth 12 m inside water (μ = 4/3) sees the sky in a cone of semi-vertical angle
a) $\sin^{-1}\frac{4}{3}$ b) $\tan^{-1}\frac{4}{3}$ c) $\sin^{-1}\frac{3}{4}$ d) $90°$

265. A man has height of 6 m. He observes image of 2 m height erect, then mirror used is
a) concave b) convex c) plane d) None of these

266. The intermediate image formed by the objective of a compound microscope is
a) real, inverted and magnified b) real, erect and magnified c) virtual, erect and magnified
d) virtual, inverted and magnified

267. In the formation of a rainbow, the light from the sun on water droplets undergoes
a) dispersion only. b) only TIR. c) dispersion and TIR. d) scattering.

268. Consider an extended object immersed in water contained in a plane trough. When seen from close to the edge of the trough the object looks distorted. Which of the following is not correct
a)
the apparent depth of the points close to the edge are nearer the surface of the water compared to the points away from the edge.
b)
the angle subtended by the image of the object at the eye is smaller than the actual angle subtended by the object in air

c)
some of the points of the object far away from the edge may not be visible because of total internal reflection.
d) water in a trough acts as a lens and magnifies the object.

269. A spot is placed on the bottom of a slab made of a transparent material of refractive index 1.5. The spot is viewed vertically from the top when it seems to be raised by 2 cm. Then, the height of the slab is
a) 10 cm b) 8 cm c) 6 cm d) 4 cm

270. Air bubble in water behaves as
a) sometimes concave, sometimes convex lens b) concave lens c) convex lens
d) always refracting surface

271. Mark the correct one.
a) Our eyes can distinguish between real and virtual image
b) Virtual image can also be taken on screen
c) If the incident rays are converging at a point, then the object is real d) None of the above

272. When a ray of light enters from one medium to another, then which of the following does not change?
a) Frequency b) Wavelength c) Speed d) Amplitude

273. Two lenses of power 15D and -3 D are placed in contact. The focal length of the combinations is
a) 10 cm b) 15 cm c) 12 cm d) 18 cm e) 8.33 cm

274. A focal length of a lens is 10 cm. What is power of a lens in dioptre?
a) 0.1 D b) 10 D c) 15 D d) 1 D

275. A spot is placed on the bottom of a slab made of a transparent material of refractive index 1.5. The spot is viewed vertically from the top when it seems to be raised by 2 cm. Then, the height of the slab is
a) 10 cm b) 8 cm c) 6 cm d) 4 cm

276. A ray of light, travelling in a medium of refractive index μ , is incident at an angle i on a composite transparent plate consisting of three plates of refractive indices μ_1, μ_2 and μ_3 The ray emerges from the composite plate into a medium of refractive index μ_4 , at angle x. Then
a) sin x = sin i b) $sinx = \frac{\mu}{\mu_4}$ c) $sinx = \frac{\mu_4}{\mu} sin\ i$ d) $sinx = \frac{\mu_1}{\mu_2}\frac{\mu_3}{\mu_2}\frac{\mu}{\mu_4} sin\ i$

277. In order to increase the angular magnification of a simple microscope, one should increase
a) the objectsize b) the aperture of the lens c) the focal length of the lens
d) the power of the lens

278. For a normal eye, the cornea of eye provides a converging power of 40 D and the least converging power of the eye lens behind the cornea is 20 D. Using this information, the distance between the retina and the cornea-eye lens can be estimated to be
a) 5 cm b) 2.5 cm c) 1.67 cm d) 1.5 cm

279. A point object is placed at a distance of 30 cm from a convex mirror of focal length 30 cm. The image will form at
a) infinity b) pole c) focus d) 15 cm behind the mirror

280. An object is placed at a distance of 10 cm from a co-axial combination of two lenses A and B in contact. The combination forms a real image three times the size of the object. If lens B is concave with a focal length of 30 cm. The nature and focal length of lens A is
a) convex, 12 cm b) concave, 12 cm c) convex, 6 cm d) convex, 18 cm

281. A ray of light strikes a transparent rectangular slab of refractive index $\sqrt{2}$ at an angle of incidence of 45°. The angle between the reflected and refracted ray is
a) 75° b) 90° c) 105° d) 120°

282. Image formed on the retina is
a) real and inverted b) virtual and erect c) real and erect d) virtual and inverted

283. The amount of scattering is inversely proportional to the fourth power of the wavelength. This is known as
a) Rayleigh scattering b) Maxwell scattering c) Oersted scattering
d) Reynold scattering

284. The refractive index of the material of an equilateral prism is $\sqrt{3}$ What is the angle of minimum deviation?
a) 45° b) 60° c) 37° d) 30°

285. An object approaches a convergent of lens from the left of the lens with a uniform speed 5m/s and stops at the focus. The image
a) moves away from the lens with a uniform speed 5 m/s
b) moves away from the lens with a uniform acceleration
c) moves away from the lens with a non-uniform acceleration
d) moves towards the lens with a non-uniform acceleration

286. A small coin is resting on the bottom of a beaker filled with a liquid . A ray of light from the coin travels up to the surface of the liquid and moves along its surface as shown in figure. How fast is the light travelling in the liquid?
a) $1.8 \times 10^8 ms^{-1}$ b) $2.4 \times 10^8 ms^{-1}$ c) $3.0 \times 10^8 ms^{-1}$ d) $1.2 \times 10^4 ms^{-1}$

287. A short linear object of length L lies on the axis of a spherical mirror of focal length f at a distance u form the mirror. Its image has an axial length L' equal to

a) $L\left[\frac{f}{u-f}\right]^{1/2}$ b) $L\left[\frac{u+f}{f}\right]^{1/2}$ c) $L\left[\frac{u-f}{f}\right]^{2}$ d) $L\left[\frac{f}{u-f}\right]^{2}$

288. Which of the following quantity remains unchanged after refraction?
a) Speed of light b) Intensity of light c) Wavelength of light d) Frequency of light

289. Two mirrors are kept at 60° to each other and a body is placed at the middle. The total number of images formed are
a) six b) four c) five d) three

290. If a convex lens of focal length 80 cm and a concave lens of focal length 50 cm are combined together, what will be their resulting power?
a) + 6.5 D b) - 6.5 D c) + 7.5 D d) - 0.75 D

291. A ray of light strikes an air-glass interface at an angle of incidence (i = 60°) and gets refracted at an angle of refraction r. On increasing the angle of incidence (i > 60°), the angle of refraction r

a) decreases b) remains same c) is equal to 60° d) increases

292. An object 2 cm high is placed at a distance of 16 cm from a concave mirror, which produces a real image 3 cm high. What is the focal length of the mirror?
a) - 9.6 cm b) - 3.6 cm c) - 6.3 cm d) - 8.3 cm

293. Two lenses are kept in contact with powers +2 D and -4 D. The focal length of this combination will be
a) +50 cm b) -50 cm c) -25 cm d) + 25 cm

294. Light from a point source in air falls on a spherical glass surface (n = 1.5 and radius of curvature = 20 cm). The distance of the light source from the glass surface is 100 cm. Image distance from the glass surface is
a) 20 cm b) 50 cm c) 100 cm d) 75 cm

295. A thin prism P_1 of angle 4^o and refractive index 1.54^o is combained with another thin prism P_2 of refractive index 1.72 to produce dispersion without deviation.The angle of P_2 is
a) 4^o b) 5.33^o c) 2.6^o d) 3^o

296. If a convex lens of focal length 80 cm and a concave lens of focal length 50 cm are combined together, what will be their resulting power?
a) + 6.5 D b) - 6.5 D c) + 7.5 D d) - 0.75 D

297. What can be the largest distance of an image of a real object from a convex mirror of radius of curvature is 20 cm?
a) 10 cm b) 20 cm c) Infinity d) zero

298. The focal lengths of the lenses of an astronomical telescope are 50 em and 5 cm. The length of the telescope when the image is formed at the least distance of distinct vision is
a) 45 cm b) 55 cm c) 275/6 cm d) 325/6 cm

299. The radii of curvature of the two surfaces of a lens are 20 cm and 30 cm and the refractive index of the, material of the lens is 1.5. If the lens is concave-convex, then the focal length of the lens is
a) 24 cm b) 10 cm c) 15 cm d) 120 cm

300. Which of the following is true for rays coming from infinity?

a) Two images are formed
b) Continuous image is formed between focalpoints of upper and lower lens
c) One image is formed d) None of the above

301. A converging lens is used to form an image on a screen. When the upper half of the lens is-covered by an opaque screen, then
a) half the image will disappear b) complete image will disappear
c) intensity of image will increase d) intensity of image will decrease

302. To measure the roughness of the surface of a material, which of the following microscope is preferred for better result output?
a) Compound microscope b) Electron microscope c) Atomic force microscope
d) None of the above

303. A vessel consists of two plane mirrors at right angles as shown in figure. The vessel is filled with water. The total deviation in incident ray is
a) 0° b) 60° c) 90° d) 180°

304. A hollow prism is filled with water and placed in air,It will deviate the incident rays
a) towards the base b) away from base c) parallel to base
d) towards or away from base depending on the location

305. A person wants a real image of his own, 3 times enlarged. Where should he stand in front of a concave mirror of radius of curvature of 30 cm?
a) 90 cm b) 10 cm c) 20 cm d) 30 cm

306. A glass prism ABC (refractive index 1.5), immersed in water (refractive index 4/3). A ray of light is incident normally on face AB. If it is totally reflected at face AC, then
a) $sin\theta \geq \frac{8}{9}$ b) $sin\theta \geq \frac{2}{3}$ c) $sin\theta \geq \frac{\sqrt{3}}{2}$ d) $\frac{2}{3}$

307. An object is placed at 21 cm in front of a concave mirror of radius of a curvature 10 cm, A glass slab of thickness 3 cm and μ = 1.5 is then placed close to the mirror in the space between the object and the mirror. The position of final image formed is
a) -3.94 cm b) 4.3 cm c) -4.93 d) 3.94 cm

308. A person can see clearly objects only when they lie bet ween 50 cm and 400 cm from his eyes. In order to increase the maximum distance of distinct vision to infinity, the type and power of the correcting lens, the person has to use, will be
a) convex, + 2.25 D b) concave, - 0.25D c) concave, - 0.2 D d) convex, + 0.15 D

309. An object is located 4 m from the first of two thin converging lenses of focal lengths 2 m and 1 m, respectively. The lenses are separated by 3 m. The final image formed by the second lens is located from the source at a distance of
a) 8 m b) 5.5 m c) 6 m d) 6.5 m

310. The resolving power of telescope whose lens has a diameter of 1.22 m for a wavelength of 5000 A is
a) 2 x 10^5 b) 2 x 10^6 c) 2 x 10^2 d) 2 x 10^4

311. A glass-slab is immersed in water. What will be the critical angle for a light ray at glass-water interface? Where ${}_an_g = 1.50$, ${}_an_w = 1.33$and $\sin^{-1}$ (0.887)=62.5
a) 48.8° b) 72.8° c) 62.5° d) 64.5°

312. An object is seen through a simple microscope of focal length 12 cm. What will be the angular magnification produced, if the image is formed at the near point of the eye which is 25 cm away from it?
a) 6.08 b) 3.08 c) 9.03 d) 5.09

313. A passenger in an aeroplane
a) should see a rainbow
b) may see a primary and a secondary rainbow as concentric circles
c) may see a primary and a secondary rainbow as concentric arcs
d) should never see a secondary rainbow

314. Two convex and concave lens are in contact and having focal length 12 cm and 18 cm, respectively. Focal length of joint lens will be

a) 50 cm b) 45 cm c) 36 cm d) 18 cm

315. A ray of light is successively deflected from two plane mirrors inclined to each other at a certain angle. If the total deviation in the path of the rays reflected from the two mirrors be 300^0 , then what is the number of images formed ?

a) 30 b) 15 c) 11 d) 5

316. You are given four sources of light each one providing a light of a single color-red, blue, green and yellow. Suppose the angle of refraction for a beam of yellow light corresponding to a particular angle of incidence at the interface of two media is 90°. Which of the following statements is correct, if the source of yellow light is replaced with that of other lights without changing the angle of incidence?

a) The beam of red light would undergo total internal reflection

b)

The beam of red light would bend towards normal' while it gets refracted through the second medium

c) The beam of blue light would undergo total internal reflection

d)

The beam of green light would bend away from the normal as it gets refracted through the second medium

317. Which of the following is not due to total internal reflection?

a) Difference between apparent and real depth of a pond b) Mirage on hot summer days

c) Brilliance of diamond d) Working of optical fibre

318. When an object is placed 40 cm from a diverging lens, its virtual image is formed 20 cm from the lens.The focal length and power of lens are

a) F = - 20 cm, P = - 5 D b) F = - 40 cm, P = - 5 D c) F =- 40 cm,P =-2.5 D

d) F =-20 cm,P =-2.5 D

319. A person can see clearly objects only when they lie bet ween 50 cm and 400 cm from his eyes. In order to increase the maximum distance of distinct vision to infinity, the type and power of the correcting lens, the person has to use, will be

a) convex, + 2.25 D b) concave, - 0.25D c) concave, - 0.2 D d) convex, + 0.15 D

320. The critical angle of a prism is 30°. The velocity of light in the medium is

a) 1.5 x 10^8 m/s b) 3 x 10^8 m/s c) 4.5 x 10^8 m/s d) None of these

321. An object is placed at 10 cm from a lens and real image is formed with magnification of 0.5. Then the lens is

a) concave with focal length of 10/3 cm b) convex with focal length of 10/3 cm

c) concave with focal length of 10 cm d) convex with focal length of 10 cm

322. A thin prism of angle 7^0 and refractive index 1.5 is combined with another prism of angle θ and refractive index 1.7. The emergent ray goes undeviated. What is the value of θ ?

a) 3^0 b) 5^0 c) 9^0 d) 1^0

323. The phenomena involved in the reflection of radiowaves by ionosphere is similar to

a) reflection of light by a plane mirror

b) total internal reflection of light in air during a mirage

c) dispersion of light by water molecules during the formation of a rainbow
d) scattering of light by the particles of air

324. A thin equiconvex lens of refractive index 3/2 and radius of curvature 30 em is put in water (refractive index = 4/3), its focal length is
a) 0.15 m b) 0.30 m c) 0.45 m d) 1.20 m

325. The astronomical telescope consists of objective and eyepiece. The focal length of the objective is
a) equal to the of the eyepiece. b) shorter than that of eyepiece
c) greater than that of eyepiece d) five times shorter than that of eyepiece

326. An object is moving towards a stationary plane mirror with a speed of 2 m/s. Velocity of the image w.r.t. the object is
a) 2 m/s towards right b) 4 rn/s towards right c) 2 rn/s towards left d) 4 rn/s towards left

327. A double convex lens of refractive index μ_1 is immersed in a liquid of refractive index μ_2. The lens will act as transparent plane sheet when
a) $\mu_1 = \mu_2$ b) $\mu_1 > \mu_2$ c) $\mu_1 < \mu_2$ d) $\mu_1 = \frac{1}{\mu_2}$

328. A plot of angle of deviation D versus angle of incidence for a triangular prism is shown below. The angle of incidence for which the light ray travels parallel to the base is

a) 30° b) 60° c) 48° d) 36°

329. A simple telescope ,consisting of an objective of focal length 60 cm and a single eye lens of focal length 5cm is focusedon a distant object in such a way that parallel rays emerge from the eye lens.if the object subtends an angle of 2^0 at the objective,the angular width of the image is
a) 10^0 b) 24^0 c) 50^0 d) $(1/6)^0$

330. The magnifying power of the astronomical telescope for normal adjustment is 50. The focal length of the eyepiece is 2 cm. The required length of the telescope for normal adjustment is
a) 102 cm b) 100 cm c) 98 cm d) 25 cm

331. A mark at the bottom of a liquid appears to rise by 0.1 m. The depth of the liquid is 1 ill. The refractive index of the liquid is
a) 1.33 b) 9/10 c) 10/9 d) 1.5

332. If $\mu_v = 1.5230$ and $\mu_R = 1.5145$ then dispersive power of a crown glass is
a) 0.0164 b) 0.00701 c) 0.0132 d) 0.0320

333. F_1 and F_2 are focal lengths of objective and eyepiece respectively, of the telescope. The angular magnification of the given telescope is equal to
a) $\frac{F_1}{F_2}$ b) $\frac{F_2}{F_1}$ c) $\frac{F_1F_2}{F_1+F_2}$ d) $\frac{F_1+F_2}{F_1F_2}$

334. Rainbow is caused due to
a) Refraction b) reflection c) dispersion d) All of these

335. Which of the following is correct for the image formed by a plane mirror?

a) Always real b) Always virtual c) Virtual and laterally inverted
d) Real and laterally inverted

336. The refractive index of the material of a prism is $\sqrt{2}$ and its refracting angle is 30^0. One of the refracting surfaces of the prism is made a mirror inwards. A beam of monochromatic light entering the prism from the other face will retrace its path after reflection from the mirrored surface, if its angle of incidence on the prism is
a) 45^0 b) 60^0 c) 0^0 d) 30^0

337. Two lenses are in contact having focal length 25 cm and -40 crn. Find power of this combination.
a) -6.67 D b) -2.5 D c) +1.5 D d) +4 D

338. When a lens of refractive index n_1 is placed in a liquid of refractive index n_2 then the lens looks to be disappeared only, if
a) $n_1=n_2/2$ b) $n_1=3n_2/2$ c) $n_1=n_2$ d) $n_1=5n_2/2$

339. A ray of light, travelling in a medium of refractive index μ , is incident at an angle i on a composite transparent plate consisting of three plates of refractive indices μ_1, μ_2 and μ_3 The ray emerges from the composite plate into a medium of refractive index μ_4 , at angle x. Then
a) sin x = sin i b) $sinx = \frac{\mu}{\mu_4}$ c) $sinx = \frac{\mu_4}{\mu} sin\, i$ d) $sinx = \frac{\mu_1}{\mu_2}\frac{\mu_3}{\mu_2}\frac{\mu}{\mu_4} sin\, i$

340. A plano-convex lens has a maximum thickness of 6 cm. When placed on a horizontal table with the curved surface in contact with the table surface, then the apparent depth of the bottom most point of the lens is found to be 4 cm. If the lens is inverted such that the plane face of the lens is in contact with the surface of the table, then the apparent depth of the centre of the plane face is found to be $\frac{17}{3}$ cm. The radius of curvature of the lens is
a) 68 cm b) 75 cm c) 128 cm d) 34 cm

341. An object has an image thrice of its original size when kept at 8 em and 16 cm from a convex lens. Focal length of the lens is
a) less than 8 cm b) 8 cm c) 16 cm d) between 8 and 16 cm

342. Advantage of reflecting telescopes are
a) no chromatic aberration b) parabolic reflecting surfaces are used
c) weighs of mirror are much less than a lens of equivalent optical quality
d) All of the above

343. Two lenses are in contact having powers of 5D and -3D. The focal length of this combination will be
a) 50 cm b) 75 cm c) 25 cm d) +20 cm

344. The intermediate image formed by the objective of a compound microscope is
a) real, inverted and magnified b) real, erect and magnified c) virtual, erect and magnified
d) virtual, inverted and magnified

345. The refracting angle of a prism is A and refractive index of the material of the prism is cot (A/2). The angle of minimum deviation is
a) 180°- 3A b) 180°- 2A c) 90°- A d) 180°+ 2A

346. A ray of light is incident at an angle of 60° on one face of a prism of angle 30°. The ray emerging out of the prism makes an angle of 30° with the incident ray. The emergent ray is
a) normal to the face through which it emerges
b) inclined at 30° to the face through which it emerges
c) inclined at 60° to the face through which it emerges d) None of the above

347. A convex mirror of focal length f forms an image which is 1/n times the object. The distance of the object from the mirror is
a) (n-1)f b) $\left[\frac{n-1}{n}\right]f$ c) $\left[\frac{n+1}{n}\right]f$ d) (n+1)f

348. A convex lens of refractive index 3/2 has a power of 2.5 D in air. If it is placed in a liquid of refractive index 2 then the new power of the lens is
a) - 1.25 D b) - 1.5 D c) 1.25 D d) 1.5 D

349. If light travels a distance x in t_1 sec in air and 10 x distance in t_2 see in a medium, the critical angle of the medium will be
a) $tan^{-1}\left(\frac{t_1}{t_2}\right)$ b) $sin^{-1}\left(\frac{t_1}{t_2}\right)$ c) $sin^{-1}\left(\frac{10t_1}{t_2}\right)$ d) $tan^{-1}\left(\frac{10t_1}{t_2}\right)$

350. Phenomena associated with scattering is/are
a) blue colour of the sky b) appearence of reddish sun during sunset and sunrise
c) both (a) and (b) d) None of the above

351. An object is placed at a distance of 0.5 m in front of a plane mirror. The distance between object and image will be
a) 0.25 m b) 0.5 m c) 1.0 m d) 2.0 m

352. The radii of curvature of the two surfaces of a lens are 20 cm and 30 cm and the refractive index of the, material of the lens is 1.5. If the lens is concave-convex, then the focal length of the lens is
a) 24 cm b) 10 cm c) 15 cm d) 120 cm

353. When light of wavelength λ is incident on an equilateral prism kept in, its minimum deviation position, it is found that the angle of deviation equals the angle of the prism itself The refractive index of the material of the prism for the wavelength λ is, then
a) $\sqrt{3}$ b) $\frac{\sqrt{3}}{2}$ c) 2 d) $\sqrt{2}$

354. A magnifying glass of focal length 5 cm is used to view an object by a person whose smallest distance of distinct vision is 25cm. If he holds the glass close to eye, then the magnification is
a) 5 b) 6 c) 2.5 d) 3

355. If the image formed by a convex mirror of focal length 30 cm is a quarter of the size of the object, then the distance of the object from the mirror will be
a) 30 cm b) 60 cm c) 90 cm d) 120 cm

356. If in a plano-convex lens, radius of curvature of convex surface is 10 cm and the focal length of the lens is 30 cm. The refractive index of the material of the lens will be
a) 1.5 b) 1.66 c) 1.33 d) 3

357. Dispersive power depends upon

a) the angle of prism b) material of prism c) deviation produced by prism
d) height of the prism

358. A glass slab has a critical angle of 30° when placed in air. What will be the critical angle when it is placed in liquid of refractive index 6/5?
a) 45° b) 37° c) 53° d) 60°

359. A convex lens has mean focal length 20 cm.The dispersive power of the material of the lens is 0.02.The longitudinal chromatic aberration for an object at infity,is
a) 0.20 b) 0.40 c) 0.80 d) 10^3

360. Angle of minimum deviation for a prism of refractive index 1.5 is equal to the angle of prism of given prism. Then, the angle of prism is
a) 80° b) 41°24' c) 60° d) 82°48'

361. The radius of curvature of the convex face of a plano-convex lens is 12 cm and the refractive index of the material of the lens is 1.5. Then, the focal length of the lens is
a) 6 cm b) 12 cm c) 18 cm d) 24 cm

362. An astronomical telescope in normal adjustment receives light from a distance source S, the tube length is now decreased slightly, then
a) no image will be formed b) a virtual image of S will be formed at a finite distance
c) a large, real image of S will be formed behind the eye piece, far away from i
d) a small, real image of S will be formed behind the eye-piece closes to it

363. A convex lens of refractive index 3/2 has a power of 2.5 D in air. If it is placed in a liquid of refractive index 2 then the new power of the lens is
a) - 1.25 D b) - 1.5 D c) 1.25 D d) 1.5 D

364. The focal length of a biconvex lens of radii of each surface 50 cm and refractive index 1.5, is
a) 40.4 cm b) 75 cm c) 50 cm d) 80 cm

365. Calculate the focal length of a reading glass of a person, if the distance of distinct vision is 75 crn.
a) 75.2 cm b) 25.6 cm c) 100.4 cm d) 37.5 cm

366. The radius of curvature of the convex face of a plano-convex lens is 12 cm and the refractive index of the material of the lens is 1.5. Then, the focal length of the lens is
a) 6 cm b) 12 cm c) 18 cm d) 24 cm

367. The focal lengths of a converging lens are f_v and f_r for violet and red lights, respectively. Which of the following is correct?
a) $f_v < f_r$ b) $f_v = f_r$ c) $f_v > f_r$ d) It depends on the average refractive index

368. An equilateral prism is in condition of minimum deviation. If incidence angle is 4/5 times of prism angle, then minimum deviation angle is
a) 72° b) 60° c) 48° d) 36°

369. The optical density of turpentine is higher than that of water while its mass density is lower. Figure shows a layer of turpentine floating over water in a container. For which one of the four rays incident on turpentine in figure the path shown is correct?

a) 1 b) 2 c) 3 d) 4

370. In total internal reflection,

a) light ray travelling through a denser medium is completely reflected back to denser medium

b) light ray travelling through a denser medium is completely refracted to rare medium

c) light ray is partially reflected back to denser medium and partially refracted to rare medium

d) light ray is absorbed completely by denser medium

371. A biconvex lens has a focal length f. It is cut into two parts along a line perpendicular to principal axis. The focal length of each part will be

a) f/2 b) f c) (3/2)f d) 2f

372. Two thin lenses are in contact and that combination has 15 cm focal length. If one lens has focal length 30 cm, then what is the second lens focal length?

a) 15 cm b) 25 cm c) 100 cm d) 30 cm

373. A magician during a show makes a glass lens with n = 1.47 disappear in a trough of liquid. Refractive index of the liquid is

a) 1.47 b) 1.33 c) $\frac{4}{3}$ d) $\frac{12}{5}$

374. If the value of critical angle is 30° for total internal reflection from any medium to vacuum, then speed of light in that medium

a) 3 x 10^8 m/s b) 1.5 x 10^8 m/s c) 6 x 10^8 m/s d) 4.5 x 10^8 m/s

375. A ray of light travelling in a transparent medium of refractive index μ on a surface separating the medium from air at an angle of incidence of 45^0 For which of the following value of μ the ray can undergo total internal reflection?

a) μ =1.33 b) μ =1.40 c) μ =1.50 d) μ =1.25

376. Magnifying power of a Galilean telescope is given by

a) $\frac{f_0}{f_e}\left(1-\frac{f_e}{D}\right)$ b) $\frac{f_0}{f_e}\left(1+\frac{f_e}{D}\right)$ c) $\frac{f_0}{f_e}\left(1+\frac{2f_e}{D}\right)$ d) $\frac{f_0}{f_e}\left(1-\frac{2f_e}{D}\right)$

377. Which of the following statement is correct for hypermetropia?

a) Near objects are not clearly visible b) Distant objects are not clearly visible

c) Concave lens is used for remedy of hypermetropia d) None of the above

378. A ray is incident at an angle of incidence i on one surface of a prism of small angle A and emerges normally from opposite surface. If the refractive index of the material of prism is μ , the angle of incidence i is nearly equal to

a) $\frac{A}{\mu}$ b) $\frac{A}{2\mu}$ c) μA d) $\frac{\mu A}{2}$

379. Magnifying power of a Galilean telescope is given by

a) $\frac{f_0}{f_e}\left(1-\frac{f_e}{D}\right)$ b) $\frac{f_0}{f_e}\left(1+\frac{f_e}{D}\right)$ c) $\frac{f_0}{f_e}\left(1+\frac{2f_e}{D}\right)$ d) $\frac{f_0}{f_e}\left(1-\frac{2f_e}{D}\right)$

380. A ray of light passing through a prism of refraction angle 60° has to deviate by at least 30°. Then, refractive index of prism should be
a) $\leq \sqrt{2}$ b) $\geq \sqrt{2}$ c) $\geq \sqrt{3}$ d) $\geq \sqrt{3}$

381. The radio $\frac{real\ depth}{apparent\ depth}$ is equal to
a) refractive index of denser medium with respect to air
b) refractive index of denser medium with respect to rare medium
c) refractive index of rare medium with respect to air
d) refractive index of rare medium with respect to dense medium

382. The r efracting angle of a prism is A and refractive index of the material of the prism is cot(A/2). The angle of minimum deviation is
a) 180°-3A b) 180°-2A c) 90°-A d) 180°+2A

383. Two lenses are in contact having powers of 5D and -3D. The focal length of this combination will be
a) 50 cm b) 75 cm c) 25 cm d) +20 cm

384. The magnification produced by an astronomical telescope for normal adjustment is 10 and the length of the telescope is 1.1 m. The magnification, when the image is formed at least distance of distinct vision is
a) 6 b) 14 c) 16 d) 18

385. The focal lengths of the lenses of an astronomical telescope are 50 em and 5 cm. The length of the telescope when the image is formed at the least distance of distinct vision is
a) 45 cm b) 55 cm c) 275/6 cm d) 325/6 cm

386. A ray of light passes from a medium A having refractive index 1.6 to the medium B having refractive index 1.5. The value ,of critical angle of medium
a) $sin^{-1}\sqrt{\frac{16}{15}}$ b) $sin^{-1}\left(\frac{16}{15}\right)$ c) $sin^{-1}\left(\frac{1}{2}\right)$ d) $sin^{-1}\left(\frac{15}{16}\right)$

387. To get three images of single object, one should have two plane mirrors at an angle of
a) 60° b) 90° c) 120° d) 30°

388. A point object is placed at a distance of 30 cm from a convex mirror of focal length 30 cm. The image will form at
a) infinity b) pole c) focus d) 15 cm behind the mirror

389. A thin prism P_1 with angle 6° and made from glass of refractive index 1.54 is combined with another thin prism P_2 of refractive index 1.72 to produce dispersion without deviation. The angle of prism P_2 will be
a) 5°24' b) 4°30' c) 6° d) 8°

390. A lens has focal length 10 cm. An object is placed 15 cm in front of it. Where should a convex mirror be placed, so that image is formed at the object itself,when focal length of convex mirror is 12 cm?
a) 6 cm from lens b) 8 cm from lens c) 5 cm from lens d) 4 cm from lens

391. Why sky appears blue?
a) Due to scattering b) Due to reflection c) Due to refraction
d) Due to total internal reflection

392. A convex mirror has focal length 20 cm. If an object is placed 20 cm away from the pole of mirror, then what is the distance between image formed and pole?
a) 40 cm b) 10 cm c) 20 cm d) At infinity

393. Which of the following is true for rays coming from infinity?
a) Two images are formed
b) Continuous image is formed between focalpoints of upper and lower lens
c) One image is formed d) None of the above

394. If the focal length of objective and eye lens are 1.2 cm and 3 cm respectively and the object is put 1.25 cm away from the objective lens and the final image is formed at infinity. The magnifying power of the microscope is
a) 150 b) 200 c) 250 d) 400

395. The diameter of the moon is $3.5 \times 10^3 km$ and its distance from the earth is $3.8 \times 10^5 km$ .seen by a telescope having focal lengths of the objective and the eye piece as 40mm and 1.0 cm respectively, the angular diameter of the image of the moon will be approximately.
a) 2° b) 10° c) 20° d) None of these

396. When sun light is scattered by minute particles of atmosphere, then the intensity of light scattered away is proportional to
a) (wavelength ot light)^4 b) (frequency of light)^4 c) (wavelength of light)^2
d) (frequency of light)^2

397. The optical density of turpentine is higher than that of water while its mass density is lower. Figure shows a layer of turpentine floating over water in a container. For which one of the four rays incident on turpentine in figure the path shown is correct?
a) 1 b) 2 c) 3 d) 4

398. The focal length of the objective of a terrestrial telescope is 80 ern and it is adjusted for parallel rays, then its power is 20. If the focal length of erecting lens is 20 cm, then full length of the telescope will be
a) 164 cm b) 124 cm c) 100 cm d) 84 cm

399. If in denser medium, incidence angle is equal to critical angle, then refraction angle will be
a) 0° b) 45° c) 90° d) 180°

400. If the critical angle for total internal reflection from a medium to vaccum is 30^0, the velocity of light in the medium is

a) $3 \times 10^{8} ms^{-1}$ b) $1.5 \times 10^{8} ms^{-1}$ c) $6 \times 10^{8} ms^{-1}$ d) $\sqrt{3} \times 10^{8} ms^{-1}$

401. A thin prism P_1 of angle 4° and refractive index 1.54° is combained with another thin prism P_2 of refractive index 1.72 to produce dispersion without deviation.The angle of P_2 is
a) 4° b) 5.33° c) 2.6° d) 3°

402. A microscope is focussed on a mark on a piece of paper and then, a slab of glass of thickness 3 cm and refractive index 1.5 is placed over the mark. How should the microscope be moved to get the mark in focus again?
a) 1 cm upward b) 4.5 cm downward c) 1 cm downward d) 2 cm upward

403. Two lamps of powers $P_1$and P_2 are placed on either side of apaper having an oil spot. The lamps are at 1m and 2 m respectively, On either side of the paper and the oil spot is invisible. What is the value of P_1/P_2?
a) 0.25 b) 0.40 c) 0.50 d) 0.60

404. A small angled prism of refractive index 1.4 is combined with another small angled prism of refractive index 1.6 to produce dispersion without deviation. If the angle of first prism is 6°, then the angle of the second prism is
a) 8° b) 6° c) 4° d) 2°

405. An object is 8 cm high. It is desired to form a real image 4 cm high at 60 cm from the mirror. The type of mirror needed with the focal length is
a) convex mirror with focal length f = 40 cm b) convex mirror with focal length f = 20 cm
c) concave mirror with focal length f = - 40 cm
d) concave mirror with focal length f = - 20 cm

406. Two identical thin plano-convex glass lenses each having radius of curvature of 20cm are placed with their convex surfaces in contact at the centre.The intervening space is filled with oil of refractive index 1.7.The intervening space is filled with oil refractive index 1.7.The focal length of the combination is
a) -20 cm b) -25 cm c) -50 cm d) 50 cm

407. If focal length of objective lens is increased then magnifying power of
a) microscope will increase but that of telescope decrease
b) microscope and telescope both will increase.
c) microscope and telescope both will decrease
d) microscope will decrease but that of telescope will Increase.

408. The length of an astronomical telescope for normal vision (relaxed eye) will be
a) $f_o - f_e$ b) $\frac{f_o}{f_e}$ c) $f_o \times f_e$ d) $f_o + f_e$

409. A vessel of depth 2 d cm is half filled with a liquid of refractive index $\mu_1$and the upper half with a liquid of refractive index μ_2The apparent depth of the vessel seen perpendicu.

a) $d\left[\frac{\mu_1\mu_2}{\mu_1+\mu_2}\right]$ b) $d\left[\frac{1}{\mu_1}+\frac{1}{\mu_2}\right]$ c) $2d\left[\frac{1}{\mu_1}+\frac{1}{\mu_2}\right]$ d) $2d\left[\frac{1}{\mu_1\mu_2}\right]$

410. Four lenses of focal lengths ± 15 cm and ± 150 cm are available for making a telescope. To produce the largest magnification, the focal length of the eyepiece should be
a) + 15 cm b) + 150 cm c) - 150 cm d) 15 cm

411. If focal length of objective lens is increased then magnifying power of
a) microscope will increase but that of telescope decrease
b) microscope and telescope both will increase.
c) microscope and telescope both will decrease
d) microscope will decrease but that of telescope will Increase.

412. The velocity of image when object and mirror both are moving towards each other with velocities 4 ms^{-1} and 5 ms^{-1} respectively, is
a) -14 ms^{-1} b) 15ms^{-1} c) -9 ms^{-1} d) 14 ms^{-1}

413. To get three images of single object, one should have two plane mirrors at an angle of
a) 60° b) 90° c) 120° d) 30°

414. For the refraction shown below the correct relation is,

a) $\frac{n_2}{v}-\frac{n_1}{u}=\frac{n_2-n_1}{R}$ b) $\frac{n_1}{v}-\frac{n_2}{u}=\frac{n_2-n_1}{R}$ c) $\frac{n_1}{v}-\frac{n_2}{u}=\frac{n_1-n_2}{R}$ d) $\frac{n_2}{v}-\frac{n_1}{u}=\frac{n_1-n_2}{R}$

415. A boy of height 1 m stands in front of a convex mirror. His distance from the mirror is equal to its focal length. The height of his image is
a) 0.25 m b) 0.33 m c) 0.5 m d) 0.67 m

416. Two thin lenses of focal lengths f_1 and f_2 are placed in contact with each other. Then, the equivalent focal length of the combination will be
a) $f_1 + f_2$ b) $\frac{1}{f_1+f_2}$ c) $\frac{f_1f_2}{f_1+f_2}$ d) $\frac{f_1+f_2}{f_1f_2}$

417. Two mirrors are kept at 60° to each other and a body is placed at the middle. The total number of images formed are
a) six b) four c) five d) three

418. An object is placed at 21 cm in front of a concave mirror of radius of a curvature 10 cm, A glass slab of thickness 3 cm and μ = 1.5 is then placed close to the mirror in the space between the object and the mirror. The position of final image formed is
a) -3.94 cm b) 4.3 cm c) -4.93 d) 3.94 cm

419. A beam of light composed of red and green rays is incident obliquely at a point on the face of a rectangular glass slab. When coming out on the opposite parallel face, then the red and green rays emerge from
a) two points propagating in two different non-parallel directions
b) two points propagating in two different parallel directions
c) one point propagating in two different directions
d) one point propagating in the same direction

420. If in denser medium, incidence angle is equal to critical angle, then refraction angle will be
a) 0° b) 45° c) 90° d) 180°

421. A ray of light strikes a transparent rectangular slab of refractive index $\sqrt{2}$ at an angle of incidence of 45°. The angle between the reflected and refracted ray is

a) 75° b) 90° c) 105° d) 120°

422. A prism has refractive angle 60°. When a light ray is incident on 50°, then minimum deviation is obtained. What is the value of minimum deviation?

a) 40° b) 45° c) 50° d) 60°

423. Relation between focal length (f) and radius of curvature (R) of a spherical mirror is

a) R = f/2 b) f = 3R c) f = R/2 d) f = R/4

424. A beam of light is incident on a glass slab in a direction as shown in the figure. The reflected light is analysed by a polaroid prism. On rotating the polaroid,

a) the intensity remains unchanged b) the intensity is reduced to zero and remains at zero

c) the intensity gradually reduced to zero and then again increases

d) the intensity increase continuously

e) the intensity increases initially and remains constant afterwards

425. The near point and far point of a person are 40 cm and 250 cm, respectively. Determine the power of the lens he/she should use while reading a book kept at distance 25 cm from the eye.

a) 2.5D b) 5D c) 1.5D d) 3.5D

426. A plano-convex lens (f = 20 cm) is silvered at plane surface. Now, focal length will be

a) 20 cm b) 40 cm c) 30 cm d) 10 cm

427. In a compound microscope, the focal length of the objective is 2.5 cm and of eye lens is 5 cm. If an object is placed at 3.75 cm before the objective and the image is formed at the least distance of distinct vision, then the distance between two lenses will be

a) 11.67 cm b) 12 cm c) 12.75 cm d) 13 cm

428. You are given four sources of light each one providing a light of a single color-red, blue, green and yellow. Suppose the angle of refraction for a beam of yellow light corresponding to a particular angle of incidence at the interface of two media is 90°. Which of the following statements is correct, if the source of yellow light is replaced with that of other lights without changing the angle of incidence?

a) The beam of red light would undergo total internal reflection

b)

The beam of red light would bend towards normal' while it gets refracted through the second medium

c) The beam of blue light would undergo total internal reflection

d)

The beam of green light would bend away from the normal as it gets refracted through the second medium

429. A simple telescope, consisting of an objective of focal length 60 cm and a single eye lens of focal length 5cm is focused on a distant object in such a way that parallel rays emerge from the eye lens.if the object subtends an angle of 2^0 at the objective, the angular width of the image is

a) 10^0 b) 24^0 c) 50^0 d) $(1/6)^0$

430. The focal length of objective lens is increased then magnifying power of

a) Microscope will increase but that of telescope decreases

b) Microscope and telescope both will increase

c) Microscope and telescope both will decrease

d) Microscope will decrease but that of telescope will increase

431. For the myopia defect in eye, it can be removed by

a) convex lens b) concave lens c) cylindrical lens d) toric lens

432. Two beams of red and violet colours made to pass separately through a prism (A = 60°). In the minimum deviation position, the angle of refraction inside the prism will be

a) greater for red colour b) equal but not 30° for both the colours

c) greater for violet colour d) 30° for both the colours

433. Limitation of reflecting telescope is

a) objective mirror focusses light inside the telescope tube

b) objective mirror focusses light outside the telescope tube

c) objective mirror has large focal length d) tube length is large

434. A thin glass prism (μ = 1.5) is immersed in water (μ = 1.3). if the angle of deviation in air for a particular ray be D, then in water will be

a) 0.2 D b) 0.3 D c) 0.5 D d) 0.6 D

435. A person suffering from the defect astigmatism

a) cannot see any object

b) cannot see objects in two perpendicular directions simultaneously

c) cannot see near by Objects d) cannot see distant objects

436. The radio $\frac{real\ depth}{apparent\ depth}$ is equal to

a) refractive index of denser medium with respect to air

b) refractive index of denser medium with respect to rare medium

c) refractive index of rare medium with respect to air

d) refractive index of rare medium with respect to dense medium

437. The minimum magnifying power of telescope is M. If the focal length of its eye lens is halved, the magnifying power will become

a) m/2 b) 2m c) 3m d) 4m

438. A 4 cm thick layer of water covers a 6 cm thick glass slab. Acoin placed at the bottom of the slab and is being observed from the air side along the normal to the surface. Find the apprent position of the coin from

a) 7.0 cm b) 8.0 cm c) 10 cm d) 5 cm

439. A thin lens of glass (μ = 1.5)of focal length ± 10 cm is immersed in water (μ = 1.33). The new focal length is

a) 20 cm b) 40 cm c) 48 cm d) 12 cm

440. A lens has focal length 10 cm. An object is placed 15 cm in front of it. Where should a convex mirror be placed, so that image is formed at the object itself,when focal length of convex mirror is 12 cm?

a) 6 cm from lens b) 8 cm from lens c) 5 cm from lens d) 4 cm from lens

441. When an object is placed 40 cm from a diverging lens, its virtual image is formed 20 cm from the lens.The focal length and power of lens are

a) F = - 20 cm, P = - 5 D b) F = - 40 cm, P = - 5 D c) F =- 40 cm,P =-2.5 D

d) F =-20 cm,P =-2.5 D

442. If c is the velocity of light in free space, then the time taken by light to travel a distance x in a medium refractive index μ is

a) $\frac{x}{c}$ b) $\frac{\mu x}{c}$ c) $\frac{x}{\mu c}$ d) $\frac{c}{\mu x}$

443. An equilateral prism is in condition of minimum deviation. If incidence angle is 4/5 times of prism angle, then minimum deviation angle is

a) 72° b) 60° c) 48° d) 36°

444. Two thin lenses are in contact and that combination has 15 cm focal length. If one lens has focal length 30 cm, then what is the second lens focal length?

a) 15 cm b) 25 cm c) 100 cm d) 30 cm

445. The focal length of a biconvex lens of radii of each surface 50 cm and refractive index 1.5, is

a) 40.4 cm b) 75 cm c) 50 cm d) 80 cm

446. An object of 5 cm height is placed 1 m apart from a concave spherical mirror which has a radius of curvature of 20 cm. The size of the image is

a) 0.11 cm b) 0.5 cm c) 0.55 cm d) 0.60 cm

447. An object is placed at a distance of 10 cm from a co-axial combination of two lenses A and B in contact. The combination forms a real image three times the size of the object. If lens B is concave with a focal length of 30 cm. The nature and focal length of lens A is

a) convex, 12 cm b) concave, 12 cm c) convex, 6 cm d) convex, 18 cm

448. Which of the following is correct for the image formed by a plane mirror?

a) Always real b) Always virtual c) Virtual and laterally inverted

d) Real and laterally inverted

449. The critical angle of a prism is 30°. The velocity of light in the medium is

a) 1.5×10^8 m/s b) 3×10^8 m/s c) 4.5×10^8 m/s d) None of these

450. A plano-convex lens is made of glass of refractive index 1.5. The radius of curvature of its convex surface is R. Its focal length is

a) R/2 b) R c) 2R d) 1.5R

Ravi Maths Tuition Centre

Time : 1 Mins **MAGNETISM 1** **Marks : 668**

1. Domain formation is the necessary feature of
   a) diamagnetism. b) Paramagnetism. c) ferromagnetism d) all of these.
2. The magnetic susceptibility of an ideal diamagnetic substance is
   a) +1 b) 0 c) -1 d) ∞
3. Nickel shows the ferromagnetic property at room temperature. If the temperature is increased beyond Curie temperature, then it will show ___________.
   a) antiferromagnetism b) no magnetic property c) diamagnetism d) paramagnetism
4. A bar magnet of magnetic moment M is placed in a magnetic field of induction B. The torque exerted on it is ________.
   a) M.B b) -M.B c) M x B d) -M x B
5. The variation of magnetic susceptibility (x) with temperature for a diamagnetic substance is best represented by figure
   a) b) c)
   d)
6. Diamagnetic material in a magnetic field moves ________.
   a) perpendicular to the field b) from stronger to the weaker parts of the field
   c) from weaker to the stronger parts of the field d) in none of the above directions
7. Curie temperature is the temperature above which __________.
   a) ferromagnetic material becomes paramagnetic material
   b) paramagnetic material becomes diamagnetic material
   c) paramagnetic material becomes ferromagnetic material
   d) ferromagnetic material becomes diamagnetic material.
8. A magnet can be completely demagnetised by
   a) breaking the magnet into small pieces b) heating it slightly
   c) dropping it into ice cold water d) a reverse field of appropriate strength
9. If M is magnetic moment and B is magnetic field intensity, then the torque is given by

a) $\overline{\mathbf{M}} \cdot \overline{\mathbf{B}}$ b) $\frac{|\overline{\mathbf{M}}|}{|\overline{\mathbf{B}}|}$ c) $\overline{\mathbf{M}} \times \overline{\mathbf{B}}$ d) MB

10. Gauss's law for magnetism is
 a) the net magnetic flux through any closed surface is B. $\triangle$S
 b) the net magnetic flux through any closed surface is E. $\triangle$S
 c) the net magnetic flux through any closed surface is zero d) Both (a) and (c)

11. Curie temperature is the temperature above which
 a) a ferromagnetic material becomes paramagnetic.
 b) a ferromagnetic material becomes diamagnetic
 c) a paramagnetic material becomes diamagnetic
 d) a paramagnetic material becomes ferromagnetic

12. Three needles N_1,N_2 and N_3 are made of a ferromagnetic, a paramagnetic and a diamagnetic substance respectively. A magnet, when brought close to them, will
 a) attract N_1 strongly, but repel N_2 and N_3 weakly. b) attract all three of them.
 c) attract N_1 and N_2 strongly but repel N_3
 d) attract N_1 strongly, N_2 weakly and repel N_3 weakly

13. A bar magnet having a magnetic moment of 2 x 10^4 JT^{-1} is free to rotate in a horizontal plane. A horizontal magnetic field B = 6 x 10^{-4} T exists in the space. The work done in taking the magnet slowly from a direction parallel to the field to a direction 60° from the field is __________.
 a) 12J b) 6J c) 2J d) 0.6J

14. A magnetic needle is kept in a non-uniform magnetic field. It experiences
 a) a torque but not a force b) neither a force nor a torque c) a force and a torque
 d) a force but not a torque

15. Two magnets have the same length and the same pole strength. But one of the magnets has a small hole at its centre. Then,
 a) both have equal magnetic moment b) one with hole has small magnetic moment
 c) one with hole has large magnetic moment
 d) one with hole loses magnetism through the hole

16. At a certain place, horizontal component is $1/\sqrt{3}$ times the vertical component. The angle of dip at this place is
 a) zero b) $\pi/3$ c) $\pi/6$ d) None of these

17. A large magnet is broken into two pieces so that their lengths are in the ratio 2 : 1. The pole strengths of the two pieces will have ratio.
 a) 2: 1 b) 1: 2 c) 4: 1 d) 1: 1

18. At a point on the right bisector of a magnetic dipole, the magnetic
 a) potential varies as $\frac{1}{r^2}$ b) potential is zero at aU points on the right bisector.
 c) field varies as r^3 d) field is perpendicular to the axis of dipole

19. A magnetic needle suspended parallel to a magnetic field requires $\sqrt{3}$ J of work to turn it through 60°. The torque needed to maintain the needle in this position will be
 a) $2\sqrt{3}$ J b) 3 J c) $\sqrt{3}$ J d) $\frac{3}{2}$ J

20. At a certain place on earth, $B_H = \frac{1}{\sqrt{3}} B_V$ angle of dip at this place is

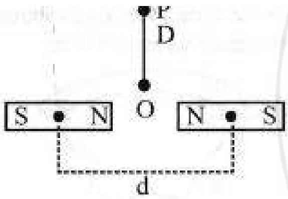
a) 60° b) 30° c) 45° d) 90°

21. A bar magnet is oscillating in the earth's magnetic field with a period T. What happens to its period of motion, if its mass is quadrupled?
    a) Motion remains simple harmonic with new period = T/2
    b) Motion remains simple harmonic with new period = 2T
    c) Motion remains simple harmonic and the period = 4T
    d) Motion remains simple harmonic and the period stays nearly constant

22. A bar magnet of length 3 cm has points A and B along axis at a distance of 24 cm and 48 cm on the opposite ends. Ratio of magnetic fields at these points will be
    a) 8 b) 3 c) 4 d) 1/2 $\sqrt{2}$

23. Ferromagnetism show their properties due to
    a) filled inner subshells b) vacant inner subshells c) partially filled inner subshells
    d) all the subshells equally filled

24. Two identical bar magnets are fixed with their centres at a distance d apart. A stationary charge Q is placed at P in between the gap of the two magnets at a distance D from the centre O as shown in the figure



The force on the charge Q is
    a) directed perpendicular to the plane of paper b) zero c) directed along OP
    d) directed along PO

25. In a permanent magnet at room temperature,
    a) magnetic moment of each molecule is zero
    b) the individual molecules have non-zero magnetic moment which are all perfectly aligned
    c) domains are partially aligned d) domains are all perfectly aligned

26. Essential difference between electrostatic shielding by a conducting shell and magnetostatic shielding is due to
    a) electrostatic field lines cannot end on charges and conductors do not have free charges.
    b) lines of B can also end but conductors cannot end them.
    c) lines of B cannot end on any material and perfect shielding is not possible.
    d)
    shells of high permeability materials cannot be used to divert lines of B from the interior region.

27. To make electromagnet, substance should be of
    a) high permeability and high susceptibility b) low permeability and high susceptibility
    c) high permeability and low susceptibility d) low permeability and low susceptibility

28. The magnetic field of Earth can be modelled by that of a point dipole placed at the centre of the Earth. The dipole axis makes an angle of 11.3° with the axis of Earth. At Mumbai, declination is nearly zero. Then,
a) the declination varies between 11.3° W to 11.3° E b) the least declination is 0°.
c) the plane defined by dipole axis and Earth axis passes through Greenwich
d) declination averaged over Earth must be always negative.

29. The material suitable for making electromagnets should have
a) high retentivity and high coercivity b) low retentivity and low coercivity
c) high retentivity and low coercivity d) low retentivity and high coercivity

30. The magnetic moment of a diamagnetic atom is ________.
a) equal to zero b) much greater than one c) 1 d) between zero and one

31. The relative permeability of a substance is 0.9999. The nature of substance will be
a) diamagnetic b) paramagnetic c) magnetic moment d) intensity of magnetic field

32. A 800 turn coil of effective area 0.05 m^2 is kept perpendicular to a magnetic field 5 x 10^{-5} T. When the plane of the coil is rotated by 90^o around any of its coplanar axis in 0.1 s, the emf induced in the coil will be: ________ .
a) 0.2 V b) 2 x 10^{-3} V c) 0.02 V d) 2 V

33. The earth's magnetic field at the equator is approximately 0.4 G, the earth's dipole moment is
a) 1 x 10^{23} Am ^{2} b) 1.05 x 10^{23} Am ^{2} c) 8 x 10^{22} Am ^{2} d) 4 x 10^2 Am ^{2}

34. Electromagnets are made of soft iron because soft iron has ________.
a) low retentivify ancl high coercive force b) high retentivity and high coercive force
c) low retentivity and low coercive force d) high retentivity and low coercive force

35. An electron of charge e moves in a circular orbit of radius r around orbital motion of the electron is
a) π ver ^{2} b) $\frac{\pi vr^2}{e}$ c) $\frac{\pi ve}{r}$ d) $\frac{\pi er^2}{v}$

36. If the magnetising field on a ferromagnetic material is increased, its permeability
a) is decreased b) is increased c) is unaffected d) may be increased or decreased

37. The universal property among all substances is
a) diamagnetism. b) paramagnetism. c) ferromagnetism. d) all of these

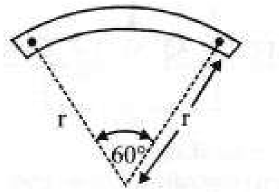
38. A bar magnet of magnetic moment M is placed at right angles to a magnetic induction B. If a force Fis experienced by each pole of the magnet, the length of the magnet will be _______.
a) F/MB b) MB/F c) BF/M d) MF/B

39. There are four lightweight rod samples A, B, C, D separately suspended by threads. A bar magnet is slowly brought near each sample and the following observations are noted
(i) A is feebly repelled
(lI) B is feebly attracted
(iii)C is strongly attracted
(lv) D remains unaffected
Which one of the following is true?
a) B is of a paramagnetic material b) C is of a diamagnetic material
c) D is of a ferromagnetic material d) A is of a non-magnetic material

40. The best material for the ore of a transformer is

a) stainless steel b) mild steel c) hard steel d) soft iron

41. A bar magnet of length 'ℓ', and magnetic dipole moment 'M' is bent in the form of an arc as shown in figure. The new magnetic dipole moment will be _______.



a) $\frac{3}{\pi}M$ b) $\frac{2}{\pi}M$ c) $\frac{M}{2}$ d) M

42. The intensity of magnetic field at a point X on the axis of a small magnet is equal to the field intensity at another point Y on equatorial axis. The ratio of distance of X and Y from the centre of the magnet will be
a) $(2)^{-3}$ b) $(2)^{-1/3}$ c) 2^{3} d) $2^{1/3}$

43. The relative permeability of a substance X is slightly less than unity and that of substance Y is slightly more than unity, then
a) X is paramagnetic and Y is ferromagnetic b) X is diamagnetic and Y is ferromagnetic
c) X and Y both are paramagnetic d) X is diamagnetic and Y is paramagnetic

44. A compass needle which is allowed to move in a horizontal plane is taken to a geomagnetic pole, It: __________.
a) will become rigid showing no movement b) will stay in any position
c) will stay in north-south direction only d) will stay in east-west direction only

45. The magnetic lines of force inside a bar magnet
a) are from north-pole to south-pole of the magnet b) do not exist.
c) depend upon the area of cross-section of the bar magnet.
d) are from south-pole to north-pole of the magnet

46. A 25 cm long solenoid has radius 2 ern and 500 total number of turns. It carries a current of 15 A. If it is equivalent to a magnet of the same size and magnetisation $\overline{\mathbf{M}}$, then $|\overline{\mathbf{M}}|$ is
a) $3\pi\mathbf{Am}^{-1}$ b) $\mathbf{30000}\pi\mathbf{Am}^{-1}$ c) 300 Am^{-1} d) 30000 Am^{-1}

47. The value of angle of dip is zero at the magnetic equator because on it
a) V and Hare equal b) the values of V and Hare zero c) the value of V is zero
d) the value ofH is zero

48. A short bar magnet of magnetic moment 0.4JT^{-1} is placed in a uniform magnetic field of 0.16 T. The magnet is in stable equilibrium when the potential energy is ___________.
a) -0.64J b) Zero c) -0.0.82J d) -0.064J

49. If a diamagnetic substance is brought near the north or the south pole of a bar magnet. it is: ______.
a) repelled by the north pole and attracted by the south pole
b) attracted by the north pole and repelled by the south pole c) attracted by both the poles
d) repelled by both the poles

50. At a place angle of dip is 30°. If horizontal component of earth's magnetic field is H, then the total intensity of magnetic field will be
a) H / 2 b) 2H / $\sqrt{3}$ c) H $\sqrt{3/2}$ d) 2 H

51. The primary origines) of magnetism lies in

a) Pauli exclusion principle. b) polar nature of molecules c) intrinsic spin of electron.
d) None of these

52. Two magnets of magnetic moments M and 2M are placed in a vibration magnetometer, with the identical poles in the same direction. The time period of vibration is T_l. If the magnets are placed with opposite poles together and vibrate with time period T_2, then _________.
a) T_2 is infinite b) $T_2 = T_l$ c) $T_2 > T_1$ d) $T_2 < T_1$

53. Angle of dip is 90° at
a) poles. b) equator. c) both at equator and poles. d) tropic of cancer.

54. A paramagnetic sample shows a net magnetisation of S Am^{-1} when placed in an external magnetic field of 0.6 T at a temperature of 4 K. When the same sample is placed in an external magnetic field of 0.2 T at a temperature of 16K, the magnetisation will be
a) $\frac{32}{3}\mathrm{Am}^{-1}$ b) $\frac{2}{3}\mathrm{Am}^{-1}$ c) 6 Am^{-1} d) 2.4 Am^{-1}

55. Work done in rotating a bar magnet from 0 to angle 120° is
a) $\frac{1}{2}$ MB b) $\frac{3}{2}$ MB c) MB d) $\frac{2}{3}$ MB

56. S is the surface of a lump of magnetic material.
a) Lines of B are not necessarily continuous across S.
b) Some lines of B must be discontinuous across S.
c) Lines of H are necessarily continuous across S.
d) Lines of H cannot all be continuous across S.

57. If a ferromagnetic material is inserted in a current carrying solenoid, the magnetic field of solenoid
a) largely increases b) slightly increases. c) largely decreases d) slightly decreases

58. Current I is flowing in a coil of area A and number of turns N, then magnetic moment of the coil, M ______.
a) NiA b) $\frac{Ni}{A}$ c) $\frac{Ni}{\sqrt{A}}$ d) N^2Ai

59. Let the magnetic field on earth be modelled by that of a point magnetic dipole at the centre of earth. The angle of dip at a point on the geographical equator
a) is always zero. b) can be zero at specific points. c) cannot be positive or negative
d) is not bounded.

60. Above Curie temperature __________.
a) a paramagnetic substance becomes diamagnetic
b) a diamagnetic substance becomes paramagnetic
c) a paramagnetic substance becomes ferromagnetic
d) a ferromagnetic substance becomes paramagnetic

61. A diamagnetic substance is brought near a strong magnet, then it is ______.
a) attracted by a magnet b) repelled by a magnet
c) repelled by North pole and attracted by South pole
d) attracted by North pole and attracted by South pole

62. In which type of material the magnetic susceptibility does not depend on temperature
a) Diamagnetic b) Paramagnetic c) Ferromagnetic d) Ferrite

63. Cutting a bar magnet in half is like cutting a solenoid, such that we get two smaller solenoids with

a) weaker magnetic properties b) strong magnetic properties
c) constant magnetic properties d) Both (a) and (b)

64. A short bar magnet placed with its axis at 30° with an external field of 800 G experiences a torque of 0.016 Nm. The magnetic moment of the magnet is
a) 4 Am^2 b) 0.5 Am^2 c) 2 Am^2 d) 0.40 Am^2

65. A long solenoid has 1000 turns per metre and carries a current of 1 A. It has a soft iron core of μ_r = 1000. The core is heated beyond the Curie temperature, T_c.
a) The H field in the solenoid is (nearly) unchanged but the B field decreases drastically
b) The Hand B fields in the solenoid are nearly unchanged.
c) The magnetisation in the core reverses direction.
d) The magnetisation in the core does not diminishes

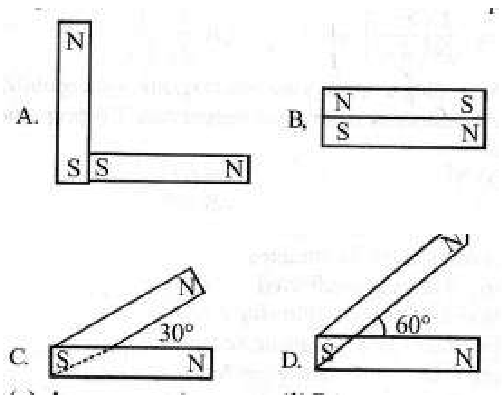
66. A toroid of n turns, mean radius R and cross-sectional radius a carries current I.It is placed on a horizontal table taken as x-y plane. Its magnetic moment m.
a) is non-zero and points in the z-direction by symmetry.
b) points along the axis of the tortoid (m = mΦ).
c) is zero, otherwise there would be a field falling as $\frac{1}{r^3}$ at large distances outside the toroid.
d) is pointing radially outwards,

67. Hysteresis loss is minimised by using
a) alloy of steel b) shell type of core c) thick wire which has low resistance d) metal

68. If the magnetic dipole moment of an atom of diamagnetic material, paramagnetic material and ferromagnetic material are denoted by m_d, m_p and m_f respectively, then ______.
a) $\mu_d = 0$ and $\mu_p \neq 0$ b) $\mu_d \neq 0$ and $\mu_p = 0$ c) $\mu_p = 0$ and $\mu_f \neq 0$ d) $\mu_d \neq 0$ and $\mu_f \neq 0$

69. For protecting a sensitive equipment from the external magnetic field, it should be _______.
a) placed inside an aluminum can b) placed inside an iron
c) require less kinetic energy to reach the equator than the poles
d) Surrounded with fine copper sheet

70. Following figures show the arrangement of bar magnets in different configurations. Each magnet has magnet dipole moment m. Which configuration has highest net magnetic dipole moment?



a) A b) B c) C d) D

71. An iron rod of susceptibility 599 is subjected to a magnetising field of 1200 Am^{-1}. The permeability of the material of the rod is: ________.
a) 2.4 p x 10^{-7} T mA^{-1} b) 2.4 p x 10^{-4} T mA^{-1} c) 8 x 10^{-5} T mA^{-1} d) 2.4 p x 10^{-5} T mA^{-1}

72. Lines of force, due to earth's horizontal magnetic field, are

a) elliptical b) curved lines c) concentric circles d) parallel and straight

73. Consider the two idealized systems: (i) a parallel plate capacitor with large plates and small separation and (ii) a long solenoid of length L >> R, radius of cross-section. In (i) E is ideally treated as a constant between plates and zero outside. In (ii) magnetic field is constant inside the solenoid and zero outside. These idealised assumptions, however, contradict fundamental laws as below.

a) case (i) contradicts Gauss's law for electrostatic fields.

b) case (ii) contradicts Gauss's law for magnetic fields. c) case (i) agrees with $\int E.dl = 0$.

d) case (ii) contradicts $\int \boldsymbol{H}.dl = I_{en}$

74. A coil in the shape of an equilateral triangle of side l is suspended between the pole pieces of a permanent magnet such that $\vec{B}$ is in the plane of the coil. If due to a current i in the triangle a torque t acts on it, the side l of the triangle is _______.

a) $\frac{2}{\sqrt{3}}\left(\frac{\tau}{B \cdot i}\right)^{\frac{1}{2}}$ b) $2\left(\frac{\tau}{\sqrt{3}B \cdot i}\right)^{\frac{1}{2}}$ c) $\frac{2}{\sqrt{3}}\left(\frac{\tau}{B \cdot i}\right)$ d) $\frac{1}{\sqrt{3}}\frac{\tau}{B \cdot i}$

75. Due to the earth's magnetic field, charged cosmic ray particle _______.

a) can never reach the poles b) can never reach the equator

c) require less kinetic energy to reach the equator than the poles

d) require greater kinetic energy to reach the equator than the poles

76. A vibration magnetometer placed in magnetic meridian has a small bar magnet. The magnet executes oscillations with a time period of 2 sec in earth's horizontal magnetic field of 24 microtesla. When a horizontal field of 18 microtesla is produced opposite to the earth's field by placing a current carrying wire, the new time period of magnet will be _______.

a) 1s b) 2s c) 3s d) 4s

77. A diamagnetic material in a magnetic field moves

a) perpendicular to the field b) from weaker to stronger parts

c) from stronger to weaker parts. d) in random direction.

78. A magnet of dipole moment M is aligned in equilibrium position in a magnetic field of intensity B. The work done to rotate it through an angle θ with the magnetic field is

a) MB sin θ b) MB cos θ c) MB (1 - cos θ) d) MB(l - sin θ)

79. A magnetic needle suspended parallel to a magnetic field requires $\sqrt{3}$J of work to turn it through 60°. The torque needed to maintain the needle in this position will be: _______.

a) $2\sqrt{3}$ J b) 3J c) $\sqrt{3}$ J d) $\frac{3}{2}J$

80. If a diamagnetic substance is brought near the North or the South-pole of a bar magnet, then it is

a) attracted by the both poles b) repelled by both the poles

c) repelled by the North-pole and attracted by the South-pole

d) attracted by the North-pole and repelled by the South-pole

81. A bar magnet is hung by a thin cotton thread in a uniform horizontal magnetic field and is in equilibrium state. The energy required to rotate it by 60° is W. Now the torque required to keep the magnet in this new position is _______.

a) $\frac{W}{\sqrt{3}}$ b) $\sqrt{3}W$ c) $\frac{\sqrt{3}W}{2}$ d) $\frac{2W}{\sqrt{3}}$

82. According to Curie's law, the magnetic susceptibility of a substance at an absolute temperature T is proportional to _________.
a) T^2 b) 1/T c) T d) $1/T^2$

83. At a point A on the earth's surface the angle of dip, d = +25°. At a point B on the earth's surface the angle of dip, d = -25°. We can interpret that ______.
a) A is located in the southern hemisphere and B is located in the northern hemisphere.
b) A is located in the northern hemisphere and B is located in the southern hemisphere.
c) A and B are both located in the southern hemisphere.
d) A and B are both located in the northern hemisphere

84. The work done in turning a magnet of magnetic moment M by an angle of 90^0 from the meridian, is n times the corresponding work done to turn it through an angle of 60^0. The value of n is given by ___________ .
a) 2 b) 1 c) 0.5 d) 0.25

85. Curie law XT = constant, relating magnetic susceptibility (X) and absolute temperature (T) of magnetic substance is obeyed by
a) all magnetic substances. b) paramagnetic substances. c) diamagnetic substances.
d) ferromagnetic substances.

86. A current of 5 A is flowing through a circular coil of diameter 14 cm having 100 turns. The magnetic dipole moment associated with this coil is :
a) $0.077Am^2$ b) $0.77Am^2$ c) $7.7Am^2$ d) $77Am^2$

87. The maximum current that can be measured by a galvanometer of resistance 40 Ω is 10 mA. It is converted into voltmeter that can read upto 50 V. The resistance to be connected in the series with the galvanometer is
a) 2010 Ω b) 4050 Ω c) 5040 Ω d) 4960 Ω

88. A galvanometer of resistance 25 Ω shows full scale deflection for current of 10 mA. To convert it into 100 V range voltmeter, the required series resistance is
a) 9975 Ω b) 10025 Ω c) 10000 Ω d) 975 Ω

89. Proton, Deuteron and alpha particle of the same kinetic energy are moving in circular trajectories in a constant magnetic field. The radii of proton, deuteron and alpha particle are respectively r_p, r_d and r_α. Which one of the following relations is correct?
a) $r_\alpha = r_p = r_d$ b) $r_\alpha = r_p < r_d$ c) $r_\alpha > r_d > r_p$ d) $r_\alpha = r_d > r_p$

90. The wire which connects the battery of a car to its starter motor carries current of 300 A during starting. Force per unit length between wires (wires are 0.7 m long and 0.015 m distant apart) is
a) 1.2 Nm^{-1} repulsive b) 1.2 Nm^{-1} attractive c) 2.4 Nm^{-1} repulsive
d) 2.4 Nm^{-1} attractive

91. Consider a wire carrying a steady current, I placed in a uniform magnetic field B perpendicular to its length. Consider the charges inside the wire. It is known that magnetic forces do not work. This implies that,
a)
motion of charges inside the conductor is unaffected by B, since they do not absorb energy.
b) Some charges inside the wire move to the surface as a result of B.

c) if the wire moves under the influence of B, no work is done by the force.
d)
If the wire moves under the influence of B, no work is done by the electric force on the ions, assumed fixed within the wire.

92. If the beams of electrons and protons move parallel to each other in the same direction, then they
a) attract each other b) repel each other. c) no relation. d) neither attract nor repel

93. A magnetic needle lying parallel to a magnetic field requires W units of work to turn it through 60°. The torque required to keep the needle in this position will be
a) 2 W b) W c) $\frac{W}{\sqrt{2}}$ d) $\frac{W}{\sqrt{3}}$ e) $\sqrt{3}W$

94. The magnetic force acting on a charged particle of charge $-2\mu C$ in a magnetic field of 2 T acting in y-direction, when the particle velocity is $\left(2\hat{i}+3\hat{j}\right)\times 10^6 ms^{-1}$ is
a) 8 N in z-direction b) 8 N in -z-direction c) 4 N in z-direction d) 8 N in y-direction

95. The area of a circular ring is 1 cm^2 and current of 10 A is passing through it. If a magnetic field of intensity 0.1 T is applied perpendicular to the plane of the ring. The torque due to magnetic field on the ring will be
a) zero b) 10^{-4} N-m c) 10^{-2} N-m d) 1 N-m

96. An electron is moving in a cyclotron at a speed of 3.2 x 10^7 ms" in a magnetic field of 5 x 10^{-4} T perpendicular to it. What is the frequency of this electron? (q = 1.6 x 10^{-19} C,m_e = 9.1 x 10^{-31} kg)
a) 1.4 x 10^5 Hz b) 1.4 x 10^7 Hz c) 1.4 x 10^6 Hz d) 1.4 x 10^9 Hz

97. A particle of mass m and charge q is accelerated through a potential difference V to a velocity $\vec{v}$ towards south. The particle enters a region with both a magnetic field $\vec{B}$ (pointing eastwards) and electric field $\vec{E}$ (pointing downwards). The particle travels with a constant velocity through this region. The potential difference V through this region should be equal to
a) E/B b) E/qB c) 2 mE/qB d) $mE^2/2qB^2$

98. The gyro-magnetic ratio of an electron in an H-atom, according to Bohr model, is
a) independent of which orbit it is in. b) neutral c) positive
d) increases with the quantum number n.

99. An electron is projected along the axis of a circular conductor carrying the same current. Electron will experlence
a) no force experienced. b) a force along the axis. c) a force perpendicular to the axis
d) a force at an angle of 4° with axis

100. When a proton is released from rest in a room, it starts with an initial acceleration a_0 towards west. When it is projected towards north with a speed v_0 it moves with an initial acceleration 3 a_0 towards west. The electric and magnetic fields in the room are
a) $\frac{ma_0}{e} east, \frac{3ma_0}{ev_0} down$ b) $\frac{ma_0}{e} west, \frac{2ma_0}{ev_0} up$ c) $\frac{ma_0}{e} west, \frac{2ma_0}{ev_0} down$ d) $\frac{ma_0}{e} east, \frac{3ma_0}{ev_0} up$

101. A short bar magnet of magnetic moment $0.4JT^{-1}$ is placed in a uniform magnetic field of 0.16 T. The magnet is in stable equilibrium when the potential energy is
a) -0.064 J b) zero c) -0.082 J d) 0.064 J

102. There is a thin conducting wire carrying current. What is the value of magnetic field induction at any point on the conductor itself ?

a) 1 b) Zero c) - 1 d) Either (a) or (b

103. If the velocity of charged particle is doubled and value of magnetic field is reduced to half, then the radius of path of charged particle will be

a) 8 times b) 3 times c) 4 times d) 2 times

104. Ampere's circuital law can be derived from

a) Ohm's law b) Biot-Savart's law c) Kirchhoff's law d) Gauss's law

105. An electron of charge (e) is moving parallel to uniform magnetic field B with constant velocity v. The force acting on electron is

a) Bev b) Be / v c) B / ev d) Zero

106. For a cylindrical conductor of radius a, which of the following graphs shows a correct relationship of B versus r?

a)  b)  c)  d) 

107. A positive charge enters in a magnetic field and travels parallel to but opposite the field. If experiences

a) an upward force. b) a downward force. c) an accelerated force d) no force.

108. Vector form of Biot-Savart's law is

a) $d\mathbf{B} = \frac{\mu_0}{4\pi}\frac{1\times dl}{r^2}$ b) $d\mathbf{B} = \frac{Id\mathbf{l}\times\mathbf{r}}{r^3}$ c) $d\mathbf{B} = \frac{\mu_0}{4\pi}\frac{Id\mathbf{l}\times\mathbf{r}}{r^3}$ d) $d\mathbf{B} = \frac{\mu_0}{4\pi}\frac{Id\mathbf{l}\times\mathbf{r}}{r^2}$

109. A charged particle goes undeflected in a region containing electric and magnetic field. It is possible that

a) $\vec{E} \parallel \vec{B}$ but $\vec{v}$ is not parallel to $\vec{E}$ b) $\vec{v} \parallel \vec{B}$ but $\vec{E}$ is not parallel to $\vec{B}$ c) $\vec{E} \parallel \vec{B}, \vec{v} \parallel \vec{E}$

d) $\vec{E}$ is not parallel to $\vec{B}$ and $\vec{v}$

110. For a toroid, magnetic field strength in the region enclosed by wire turns is given by

a) B = μ_0 n I, where n = number of turns.

b) B = μ_0 I / n, where n = number of turns per metre c) $B = \frac{\mu_0 I}{2r}$,where r = mean radius

d) $B = \frac{\mu_0 NI}{2\pi r}, \begin{cases} \text{where, } N = \text{ number of turn} \\ \text{and } r = \text{ radius of toroid.} \end{cases}$

111. A horizontal wire 0.1 m long carries a current of 5 A. Find the magnitude and direction of the magnetic field, which can support the weight of the wire. Given the mass of the wire is $3 \times 10^{-3} kg/m \quad and \quad g = 10 ms^{-2}$.

a) $6 \times 10^{-3} T$, acting vertically upwards

b) $6 \times 10^{-3} T$, acting horizontally perpendicular to wire

c) $6 \times 10^{-2} T$, acting vertically downwards

d) $6 \times 10^{-2} T$, acting horizontally perpendicular to wire

112. A current loop placed in a non-uniform magnetic field experiences

a) a force of repulsion. b) a force of attraction. c) a torque but not force.

d) a force and a torque

113. An electron is travelling along the X-direction. It encounters the magnetic field in the Y-direction. Its subsequent motion will be
a) straight line along X-direction b) a circle in the X-Z plane c) a circle in the YZ plane
d) a circle in the XY plane

114. Two particles X and Y having equal charges after being accelerated through the same potential difference, enter a region of uniform magnetic field and describe circular paths of radii $R_1\ and\ R_2$ respectively. The ratio of the mass of X to that Y is
a) $\frac{R_1}{R_2}$ b) $\frac{R_2}{R_1}$ c) $\left(\frac{R_1}{R_2}\right)^{1/2}$ d) $\left(\frac{R_1}{R_2}\right)^{2}$

115. Three long, straight parallel wires, carrying current are arranged as shown in the figure. The force experienced by a 25 cm length of wire C is

a) 10^{-3} N b) 2.5×10^{-3} N c) zero d) 1.5×10^{3} N

116. The strength of magnetic field at the centre of circular coil is

a) $\frac{\mu_0 I}{R}\left(1-\frac{1}{\pi}\right)$ b) $\frac{\mu_0 \boldsymbol{I}}{\pi \boldsymbol{R}}$ c) $\frac{\mu_0 I}{2R}\left(1-\frac{1}{\pi}\right)$ d) $\frac{\mu_0 I}{2R}\left(1+\frac{1}{\pi}\right)$

117. An electron moving in a circular orbit of radius r makes n rotations per second. The magnetic field produced at the centre has magnitude
a) zero b) $\frac{\mu_0 n^2 e}{r}$ c) $\frac{\mu_0 ne}{2r}$ d) $\frac{\mu_0 ne}{2\pi r}$

118. A proton and an α-particle moving with same velocity enter into a uniform magnetic field, acting normal to the plane of their motion. The ratio of radii of the circular paths described by the proton and α-particle is
a) 1 : 2 b) 1 : 4 c) 1 : 16 d) 4 : 1

119. A long solenoid has 20 turns cm^{-1}. The current necessary to produce a magnetic field of 20 mT inside the solenoid is approximately
a) I A b) 2 A c) 4 A d) 8 A

120. A current carrying closed loop of an irregular shape lying in more than one plane when placed in uniform magnetic field, the force acting on it
a) will be more in the plane where its larger position is covered. b) is zero. c) is infinite.
d) mayor may not be zero.

121. A coil of wire has an area of 600 sq. cm and has 500 turns. If it carries 1.5 A current, its magnetic dipole moment is
a) 5 Am^2 b) 15 Am^2 c) 30 Am^2 d) 45 Am^2

122. Two similar coils of radius R, are lying concentrically with their planes at right angles to each other. The currents flowing in them are I and 2 I respectively. The resultant magnetic field at the centre will be :

a) $\frac{\sqrt{5}\mu_0 I}{2R}$ b) $\frac{3\mu_0 I}{2R}$ c) $\frac{\mu_0 I}{2R}$ d) $\frac{\mu_0 I}{R}$

123. A galvanometer has a sensitivity of 60 division/ampere. When a shunt is used its sensitivity becomes 10 division/ampere. What is the value of shunt used if the resistance of the galvanometer is 20Ω ?
a) 2Ω b) 3Ω c) 4Ω d) 6Ω

124. A current carrying circular loop of radius R is placed in the x-y plane with centre at the origin. Half of the loop with x>0 is now bent so that it now lies in the y-z plane.
a) The magnitude of magnetic moment now diminishes
b) The magnetic moment does not change
c) The magnitude of $\vec{B}$ at (0,0,z), z>>R increases.
d) The magnitude $\vec{B}$ at (0,0,z), z>>R is unchanged.

125. The value of force F acting on charge q moving with velocity perpendicular to the magnetic field B will be
a) F = qvB b) $F = \frac{qv}{B}$ c) $F = \frac{qB}{v}$ d) $F = \frac{Bv}{q}$

126. A long straight wire of radius a carries a steady current i. The current is uniformly distributed across its cross-section. The ratio of the magnetic field at a/2 and 2 a is
a) 1/2 b) 1/4 c) 4 d) 1

127. A positive charge is moving towards an observer. The direction of magnetic induction lines is
a) clockwise b) anticlockwise c) right d) left

128. An element $\triangle$l = $\triangle$x $\hat{i}$ is placed at the origin and carries a current I = 10A.

If $\triangle$x = 1cm, magnetic field at point P is
a) $4\times10^{8}\hat{\mathbf{k}}\mathrm{T}$ b) $4\times10^{-8}\hat{\mathbf{i}}\mathrm{T}$ c) $4\times10^{-8}\hat{\mathbf{j}}\mathrm{T}$ d) $-4\times10^{-8}\hat{\mathbf{j}}\mathrm{T}$

129. A long solenoid has n turns per metre and current I A is flowing through it. The magnetic field induction at the ends of the solenoid is
a) zero b) $\mu_o nI/2$ c) $\mu_o nI$ d) $2\mu_o NI$

130. The magnetic field of earth can be modeled by that of a point dipole placed at the center of the earth. The dipole axis makes an angle of 11.3° with the axis of the earth. At Mumbai, declination is nearly zero. Then,
a) the declination varies between 11.3°W to 11.3° b) the least declination is 0°
c) the plane defined by dipole axis and earth axis passes through Greenwich.
d) declination averaged over the earth must be always negative.

131. An electron of mass M_e, initially at rest, moves through a certain distance in a uniform electric field in time t_1. A proton of mass M_p also initially at rest, takes time t_2 to move through an equal distance in this uniform electric field. Neglecting the effect of gravity, the ratio t_2/t_1 is nearly equal to
a) 1 b) $\sqrt{\frac{M_p}{M_e}}$ c) $\sqrt{\frac{M_e}{M_p}}$ d) 1836

132. The current sensitivity of a moving coil galvanometer increases by 35%, when its resistance is increased by a factor 3. The voltage sensitivity of galvanometer changes by a factor
a) 35% b) 45% c) 55% d) none of the above

133. A rectangular loop carrying a current i is situated near a long straight wire such that the wire is parallel to the one of the sides of the loop and is in the plane of the loop. If a steady current I is established in wire as shown in figure, the loop will

a) rotate about an axis parallel to the wire. b) move away from the wire or towards right
c) move towards the wire d) remain stationary.

134. The coil of a galvanometer consists of 100 turns and effective area of 1 cm^2. The restoring couple is 10^{-8} Nm rad $^{-1}$. The magnetic, field between poles is of 5 T. Current sensitivity of this galvanometer is
a) 5x 10^4 rad /μ amp b) 5 x10^6 per amp c) 2 x 10^{-7} per amp d) 5 rad/ μ amp

135. A conducting circular loop of radius r carries a constant current i. It is placed in a uniform magnetic field B, such that B is perpendicular to the plane of the loop. The magnetic force acting on the loop is
a) irB b) 2πriB c) zero d) πrib

136. Two parallel wires are placed 1m apart and 1A and 3 A currents are flowing in the wires in opposite direction. The force acting per unit length of both the wires will be
a) 6 x10^{-7} N / m attractive b) 6 x10^{-5} N /m attractive c) 6 x10^{-7} N / m repulsive
d) 6 x10^{-5} N / m repulsive

137. A magnetic needle suspended parallel to a magnetic field requires $\sqrt{3}J$ of work to turn it through 60°. The torque needed to maintain the needle in this position will be :
a) $2\sqrt{3}J$ b) $3J$ c) $\sqrt{3}J$ d) $\frac{3}{2}J$

138. Two identical current carrying coaxial loops, carry current I in an opposite sense. A simple amperian loop passes through both of them once. Calling the loop as C,
a) $\oint_C \boldsymbol{B} \cdot \boldsymbol{dl} = \pm 2\mu_0 I$ b) the value of $\oint_C \boldsymbol{B}. dl$ is independent of sense of C.
c) there may be a point on C where, B and dl are parallel. d) B vanishes everywhere on C.

139. A galvanometer having a coil resistance of 100Ω gives a full scale deflection, when a current of 1 mA is passed through it. The value of the resistance, which can convert this galvanometer into ammeter giving a full scale deflection for a current of 10 A is
a) 0.01Ω b) 2Ω c) 0.1Ω d) 3Ω

140. A helium nucleus moves in a circle of 0.8 m radius in one second. The magnetic field produced at the centre of circle will be
a) $\mu_0 \times 10^{-19}$ b) $\mu_0 \times 10^{+19}$ c) $2\mu_0 \times 10^{-19}$ d) $\frac{2\times10^{-19}}{\mu_0}$

141. Current carrying wire produces
a) Only electric field b) Only magnetic field c) Both electric and magnetic field
d) None of the above

142. Two charged particles traverse identical helical paths in a completely opposite sense in a uniform magnetic field $\vec{B} = B_0\hat{k}$.
a) They have equal z-components of momenta b) They must have equal charges
c) They necessarily represent a particle anti-particle pair.
d) The charge to mass ratio satisfy $\left(\frac{e}{m}\right)_1 + \left(\frac{e}{m}\right)_2 = 0$

143. A paramagnetic sample shows a net magnetization of when placed $8Am^{-1}$ in an external magnetic field 0.6 T at a temperature of 4K. When the same sample is placed in an external magnetic field of 0.2 T at a temperature of 16 K, the magnetization will be
a) $\frac{32}{3}Am^{-1}$ b) $\frac{2}{3}Am^{-1}$ c) $6 \quad Am^{-1}$ d) $2.4 \quad Am^{-1}$

144. A proton and an alpha particle both enter a region of uniform magnetic field B, moving at right angles to the field B. If the radius of circular orbits for both the particles is equal and the kinetic energy acquired by proton is 1 MeV, the energy acquired by the alpha particles will be :
a) 1 MeV b) 4 MeV c) 0.5 MeV d) 1.5 MeV

145. Which of the following represent a correct figure to display of magnetic field lines due to a solenoid?

a)  b)  c)  d) 

146. A magnetic field can be produced
a) only by moving charge b) only by changing electric field c) Both (a) and (b)
d) None of the above

147. Biot-Savart law indicates that the moving electrons produce a magnetic field $\vec{B}$such that
a) $\vec{B}\perp\vec{v}$ b) $\vec{B} \parallel \vec{v}$ c) it obeys inverse cube law
d) it is along the line joining the electron and point of observation.

148. The magnetic field at a perpendicular distance of 2 cm from an infinite straight current carrying conductor is 2×10^{-6} T. The current in the wire is
a) 0.1 A b) 0.2 A c) 0.4 A d) 0.8 A

149. The current i is flowing in a coil of area A with the number of turns N, then the magnetic moment of the coil M will be
a) NiA b) Ni / A c) $Ni/\sqrt{A}$ d) N^2 Ai

150. A circular current loop of magnetic moment M is in arbitrary orientation in an external magnetic field.$\vec{B}$ The work does to rotate the loop by 30° about an axis perpendicular to its plane is
a) MB b) $\sqrt{3}\frac{MB}{2}$ c) $\frac{MB}{2}$ d) zero

151. In an ammeter 0.5% of main current passes through galvanometer. If resistance of galvanometer is G, the resistance of ammeter will be
a) G/200 b) G/199 c) 199 G d) 200G.

152. A straight wire of mass 200 g and length 1.5 m carries a current of 2 A. It is suspended in mid air by uniform horizontal magnetic field B. The magnitude of B (in Tesla) is : (Take $g = 9.8m/s^2$)
a) 2 b) 1.5 c) 0.55 d) 0.65

153. A charged particle with charge q enters a region of constant, uniform and mutually orthogonal fields $\vec{E} \quad and \quad \vec{B}$ with a velocity $\vec{v}$ perpendicular to both $\vec{E} \quad and \quad \vec{B}$, and comes out without any change in magnitude or direction of $\vec{v}$. Then

a) $\vec{v} = \vec{B} \times \vec{E}/E^2$ b) $\vec{v} = \vec{E} \times \vec{B}/B^2$ c) $\vec{v} = \vec{B} \times \vec{E}/B^2$ d) $\vec{v} = \vec{E} \times \vec{B}/E^2$

154. In a uniform magnetic field, an electron (or charge particle) enters perpendicular to the field. The path of electron will be

a) ellipse b) circular c) parabolic d) linear

155. A toroid of n turns, mean radius R and cross-sectional radius carries a current I. It is placed on a horizontal table taken as x-y plane. Its magnetic moment $\vec{M}$

a) is non-zero and points in the z-direction by symmetry

b) points along the axis of the toroid $(\vec{M} = M\hat{\phi})$

c) is zero, otherwise, there would be a field falling as $\frac{1}{r^3}$ at large distances outside the toroid

d) is pointing radially outwards.

156. Two circular coils 1 and 2 are made from the same wire but the radius of the Ist coil twice that of the 2nd coil. What potential difference ratio should be applied across them so that the magnetic field at their centres is the same?

a) 2 b) 3 c) 4 d) 6

157. A polygon shaped wire is inscribed in a circle of radius R. The magnetic induction at the centre of polygon, when current flows through the wire is

a) $\frac{\mu_0 nI}{2\pi R}\tan\left(\frac{2\pi}{n}\right)$ b) $\frac{\mu_0 nI}{2\pi R}\tan\left(\frac{4\pi}{n}\right)$ c) $\frac{\mu_0 nI}{2\pi R}\tan\left(\frac{\pi}{n}\right)$ d) $\frac{\mu_0 nI}{2\pi R}\tan\left(\frac{\pi}{n^2}\right)$

158. A circular coil carrying current behaves as a

a) bar magnet b) horse shoe magnet c) magnetic shell d) solenoid

159. In a circular coil of radius r, the magnetic field at the centre is proportional to

a) r^2 b) r c) $\frac{1}{r}$ d) $\frac{1}{r2}$

160. A thin ring of radius R metre has charge q coulomb uniformly spread on it. The ring rotates about its axis with a constant frequency of f revolutions/s. The value of magnetic field induction in Wb/m^2 at the centre of the ring is

a) $\frac{\mu_o qf}{2\pi R}$ b) $\frac{\mu_o q}{2\pi fR}$ c) $\frac{\mu_o q}{2fR}$ d) $\frac{\mu_o qf}{2R}$

161. Consider the two idealized systems: (i) a parallel plate capacitor with large and small separation and (ii) a long solenoid of length L>>R, radius of the cross-section. In (i) $\vec{E}$ is ideally treated as a constant between plates and zero outside. In (ii) magnetic field is constant inside the solenoid and zero outside. These idealized assumptions, however, contradict fundamental law as below:

a) case (i) contradicts Gauss's law for electrostatic fields.

b) case (ii) contradicts Gauss's law for magnetic fields.

c) case (i) agrees with $\oint \vec{E}.\vec{dl} = 0$ d) case (ii) contradicts $\oint \vec{H}.\vec{dl} = l_{en}$

162. An electron is projected with uniform velocity along the axis of a current carrying long solenoid. Which of the following is true?

a) The electron will be accelerated along the axis

b) The electron path will be circular about the axis.

c) The electron will experience a force at 45° to the axis and hence execute a helical path.

d) The electron will continue to move with uniform velocity along the axis of the solenoid.

163. An electric charge + q moves with velocity $\vec{v} = 3\hat{i} + 4\hat{j} + \hat{k}$, in an electromagnetic field give $\vec{E} = 3\hat{i} + \hat{j} + 2\hat{k}, \quad \vec{B} = \hat{i} + \hat{j} - 3\hat{k}$. They y-component of the force experienced by + q is

a) 2 q b) 11 q c) 5 q d) 3 q

164. An electron is travelling horizontally towards East. Amagnetic field in vertically downward direction exerts a force on the electron along

a) East b) West c) North d) South

165. In a permanent magnet at room temperature

a) the magnetic moment of each molecule is zero

b) the individual molecules have a non-zero magnetic moment which is all perfectly aligned

c) domains are partially aligned d) domains are all perfectly aligned.

166. If a charged particle moves through a magnetic field perpendicular to it

a) both momentum and energy of particle change.

b) momentum as well as energy are constant.

c) energy is constant but momentum changes.

d) momentum is constant but energy changes

167. A conducting wire of length l is turned in the form of a circular coil and a current I is passed through it. For the torque, due to magnetic field produced at its centre, to be maximum, the number of turns in the coil will be

a) one b) two c) three d) more than three.

168. A magnet with moment M is given. If it is bent into a semicircular form, its new magnetic moment will be :

a) M/π b) $M/2$ c) M d) $2M/\pi$

169. A circular coil of radius 4 cm and of 20 turns carries a current of 3 amperes. It is placed in a magnetic field of intensity 0.5 weber/m^2. The magnetic dipole moment of the coil is

a) 0.15 ampere-m^2 b) 0.3 ampere-m^2 c) 0.45 ampere-m^2 d) 0.6 ampere-m^2

170. A circular coil of n turns and radius r carries a current I. The magnetic field at the centre is

a) $\frac{\mu_o nI}{r}$ b) $\frac{\mu_o nI}{2r}$ c) $\frac{2\mu_o nI}{r}$ d) $\frac{\mu_o nI}{4r}$

171. Two particles each of mass m and charge q are attached to the two ends of a light rigid rod of length 2 R. The rod is rotated at constant angular speed about a perpendicular axis passing through its centre. The ratio of the magnitudes of the magnetic moment of the system and its angular momentum about the centre of the rod is

a) q/2 m b) q/m c) 2 q/m d) $q/\pi\, m.$

172. A circular loop of area A, carrying current I, is placed in a magnetic field B perpendicular to the plane of the loop. The torque on the loop due to magnetic field is

a) BIA b) 2 BIA c) $\frac{1}{2}BIA$ d) Zero

173. For the voltmeter circuit given,

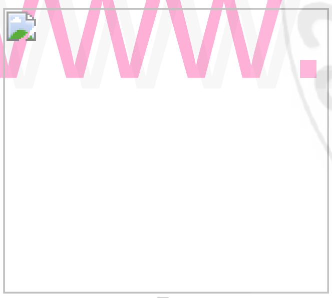
a) $\frac{I_g}{I} = \frac{G}{S}$ b) $\frac{I}{I_g} = \frac{R_L+G}{S}$ c) $(I - I_g)R_L = I_g(G+S)$ d) $IR_L = I_gG$

174. If a copper wire carries a direct current, the magnetic field associated with the current will be
a) only outside the wire b) only inside the wire c) both inside and outside the wire
d) neither inside nor outside the wire

175. A cubical region of space is filled with some uniform electric and magnetic fields. An electron enters the cube across one of its faces with velocity v and a positron enters via opposite face with velocity -v. At this instant
a) the electric forces on both the particles cause identical accelerations.
b) the magnetic forces on both the particles cause equal accelerations.
c) Only electron gains or looses energy
d) the motion of the centre of mass (CM) is determined by E alone

176. The work done in turning a magnet of magnetic moment M by an angle of 90° from the magnetic meridian is n times the corresponding work done to turn it through an angle of 60°, where n is
a) 1/2 b) 2 c) 1/4 d) 1.

177. What is the net force on the rectangular coil?



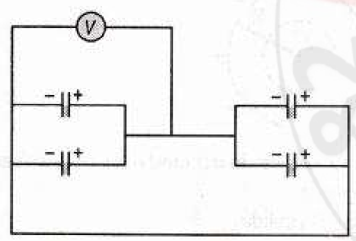
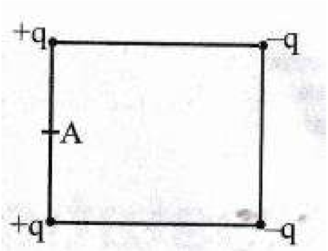
a) 25 x 10^{-7} N towards wire. b) 25 x 10^{-7} N away from wire c) 35 x 10^{-7} N towards wire
d) 35 x 10^{-7} N away from wire.

178. A galvanometer of resistance 25Ω is connected to a battery of 2 volt along with a resistance in series. When the value of this resistance is 3000Ω, a full scale deflection of 30 units is obtained in the galvanometer. In order to reduce this deflection 10 20 units, the resistance in series will be
a) 4514Ω b) 5413Ω c) 2000Ω d) 6000Ω.

179. In a cyclotron a charged particle
a) undergoes acceleration all the time
b) speeds up between the dees because of the magnetic field. c) speeds up in a dee
d) slows down within a dee and speeds up between dees.

Ravi Maths Tuition Centre

Time : 1 Mins **ELECTRIC CHARGES FIELDS CAPACITANCE 1** **Marks : 583**

1. The electric potential at a point 6, y, r) is given by Z = $x^2y - xz^3 + 4$. The electric field $\vec{E}$ at that point is ______.
   a) $\vec{E} = \hat{i}2xy + \hat{j}\left(x^2 + y^2\right) + \hat{k}\left(3xz - y^2\right)$ b) $\vec{E} = \hat{i}z^3 + \hat{j}xyz + \hat{k}z^2$ c) $\vec{E} = \hat{i}\left(2xy - z^3\right) + \hat{j}xy^2 + \hat{k}3z^2x$
   d) $\vec{E} = \hat{i}\left(2xy + z^3\right) + \hat{j}x^2 + \hat{k}3xz^2$
2. Two parallel metal plates, having charges +Q and -Q face each other at a certain distance between them. If the plates are now dipped in kerosene oil tank, the electric field between the plates will
   a) remains same b) becomes zero c) increases d) decreases
3. The four capacitors, each of 25 mF are connected as shown in figure. The DC voltmeter reads 200 V. The charge on each plate of capacitor is ______.
   
   a) $\pm 2 \times 10^{-3}$C b) $\pm 5 \times 10^{-3}$C c) $\pm 2 \times 10^{-2}$C d) $\pm 5 \times 10^{-2}$C
4. Four electric charges +q,+q, -q and -q are placed at the corners of a square of side 2L (see figure). The electric potential at point A, midway between the two charges +q and +q, is __________.
   

   a) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}(1+\sqrt{5})$ b) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1+\frac{1}{\sqrt{5}}\right)$ c) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1-\frac{1}{\sqrt{5}}\right)$ d) Zero
5. A parallel plate condenser with oil (dielectric constant 2) between the plates has capacitance C. If oil is removed, the capacitance of capacitor becomes _______.
   a) $\sqrt{2}C$ b) 2C c) $\frac{C}{\sqrt{2}}$ d) $\frac{C}{2}$

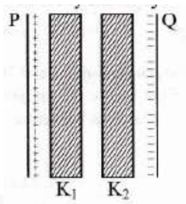
6. The formation of a dipole is due to two equal and dissimilar point charges placed at a __________.
   a) short distance b) long distance c) above each other d) None of these

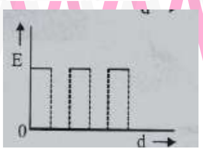
7. A hollow insulated conducting sphere is given a positive charge of l0 mC. What will be the electric field at the centre of the sphere if its radius is 2 m?
   a) zero b) 5 mCm^{-2} c) 20 mCm^{-2} d) 8 mCm^{-2}

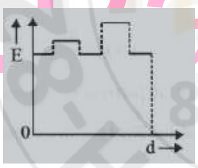
8. A series combination ofrr, capacitors, each of value C_1 is charged by a source of potential difference 4V. When another parallel combination of n_2 capacitors, each of value C_2, is charged by a source of potential difference V, it has the same (total) energy stored in it, as the first combination has. The value of C_2, in terms of C_1, is then _______.
   a) $\frac{2C_1}{n_1 n_2}$ b) $16\frac{n_2}{n_1}C_1$ c) $2\frac{n_2}{n_1}C_1$ d) $\frac{16C_1}{n_1 n_2}$

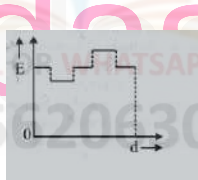
9. The energy required to charge a parallel plate condenser of plate separation d and plate area of cross-section A such that the uniform electric field betwen the plates is E, is _______.
   a) $\frac{1}{2}\varepsilon_0 E^2/Ad$ b) $e_0 E^2/\text{Ad}$ c) $e_0 E^2\text{Ad}$ d) $\frac{1}{2}\varepsilon_0 E^2 Ad$

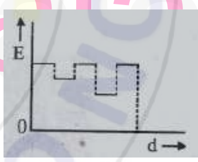
10. Two thin dielectric slabs of dielectric constants K_1 and K_2(K_1 < K_2) are inserted between plates of a parallel plate capacitor, as shown in the figure. The variation of electric field 'E' between the plates with distance 'd' as measured from plate P is correctly shown by:



a) 

b) 

c) 

d) 

11. The capacitance of a parallel plate capacitor with air as medium is 6 mf. With the introduction of a dielectric medium, the capacitance becomes 30 mF. The permittivity of the medium is
   $$\left(\Sigma_0 = 8.85 \times 10^{-12} \text{C}^2\,\text{N}^{-1}\,\text{m}^{-2}\right)$$
   a) $5.00\text{C}^2\text{N}^{-1}\text{m}^{-2}$ b) $0.44 \times 10^{-13}\text{C}^2\text{N}^{-1}\text{m}^{-2}$ c) $1.77 \times 10^{-12}\text{C}^2\text{N}^{-1}\text{m}^{-2}$
   d) $0.44 \times 10^{-10}\text{C}^2\text{N}^{-1}\text{m}^{-2}$

12. A pendulum bob of mass 30.7 x 10^{-6} kg and carrying a charge 2 x 10^{-8} C is at rest in a horizontal uniform electric field of 20000 V/m. The tension in the thread of the pendulum is (g = 9.8 m/s^2)
   a) 3 x 10^4N b) 4 x 10^{-4}N c) 5 x 10^{-4} N d) 6 x 10^{-4}N

13. A parallel plate air capacitor of capacitance C is connected to a cell of emf Zand then disconnected from it.A dielectric slab of dielectric constant K, which can just fill the air gap of the capacitor, is now inserted in it. Which of the following is incorrect.
   a) The energy stored in the capacitor decreases K times.
   b) The chance in energy stored is $\frac{1}{2}CV^2\left(\frac{1}{K}-1\right)$

c) The charge on the capacitor is not conserved.

d) The potential difference between the plates decreases K times.

14. A conducting sphere of radius R is given a charge Q. The electric potential and the electric field at the centre of the sphere respectively are _______.

a) Zero and $\frac{Q}{4\pi\varepsilon_0 R^2}$ b) $\frac{Q}{4\pi\varepsilon_0 R}$ and Zero c) $\frac{Q}{4\pi\varepsilon_0 R}$ and $\frac{Q}{4\pi\varepsilon_0 R^2}$ d) Both are zero

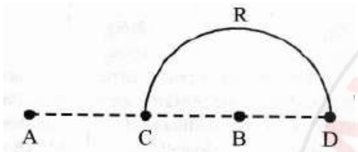
15. A parallel plate capacitor has a uniform electric field E in the space between the plates. If the distance between the plates is d and area of each plate is A, the energy stored in the capacitor is __________.

a) $\frac{1}{2}\varepsilon_0 E^2$ b) $E^2 Ad/\varepsilon_0$ c) $\frac{1}{2}\varepsilon_0 E^2 Ad$ d) ε_0 EAd

16. A bullet of mass 2 g is having a charge of 2mC. Through what potential difference must it be accelerated, starting from rest, to acquire a speed of 10 m/s?

a) 50 V b) 5 KV c) 50 KV d) 5V

17. Charges +q and -q are placed at points A and, B respectively which are a distance 2L apart, C is the midpoint between A and B. The work done in moving a charge +Q along the semicircle CRD is _____.



a) $\frac{qQ}{2\pi\varepsilon_0 L}$ b) $\frac{qQ}{6\pi\varepsilon_0 L}$ c) $-\frac{qQ}{6\pi\varepsilon_0 L}$ d) $\frac{qQ}{4\pi\varepsilon_0 L}$

18. In a region, the potential is represented by V(x, y, z') = 6x - 8xy - 8y + 6yz, where V is in volts and x, y, z are in metres. The electric force experienced by a charge of 2 coulomb situated at point (1, 1, 1) is ________.

a) $6\sqrt{5}$N b) 30 N c) 24 N d) $4\sqrt{35}$N

19. Two concentric spheres of radii R and r have similar charges with equal surface charge densities (s). What is the electric potential at their common centre?

a) $\frac{\sigma}{\varepsilon_0}$ b) $\frac{\sigma}{\varepsilon_0}(R-r)$ c) $\frac{\sigma}{\varepsilon_0}(R+r)$ d) None of these

20. A parallel plate condenser has a uniform electric field E(V/ m) in the space between the plates. If the distance between the plates is d(m) and area of each plate is A(m^2) the energy joules) stored in the condenser is _______.

a) $E^2 Ad/\varepsilon_0$ b) $\frac{1}{2}\varepsilon_0 E^2$ c) ε_0EAd d) $\frac{1}{2}\varepsilon_0 E^2 Ad$

21. Three capacitors each of capacity 7mF are to be connected in such a way that the effective capacitance is 6mF. This can be done by __________.

a) connecting two in parallel and one in series b) connecting all of them in series

c) connecting all of them in parallel d) connecting two in series and one in parallel

22. An electric dipole has the magnitude of its charge as q and its dipole moment is p. It is placed in uniform electric field E. If its dipole moment is along the direction of the field, the force on it and its potential energy are respectively.

a) zero and min. b) q.E and max. c) 2q.E and min. d) q.E and p.E

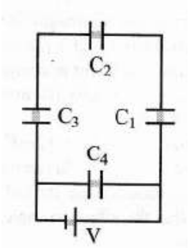
23. There is an electric field E in x-direction. If the work done on moving a charge of 0.2C through a distance of 2m along a line making an angle 60° with x-axis is 4J, then what is the value of E?
a) 3 N/C b) 4 N/C c) 5 N/C d) 20 N/C

24. The electric field strength in air at NTP is 3 x 106 V/m. The maximum charge that can be given to a spherical conductor of radius 3 m is ___________.
a) 3×10^{4}C b) 3×10^{-3}C c) 3×10^{-2}C d) 3×10^{-1}C

25. A hollow metal sphere of radius 10 cm is charged such that the potential on its surface is 80 V. The potential at the centre of the sphere is _______.
a) zero b) 80 V c) 800 V d) 8 V

26. The capacity of a parallel plate condenser is 10 mF, when the distance between its plates is 8 cm. If the distance between the plates is reduced to 4 cm then the capacity of this parallel plate condenser will be _______.
a) 5 mF b) 10 mF c) 20 mF d) 40 mF

27. A network of four capacitors of capacity equal to C_1 = C, C_2 = 2C, C_3 = 3C and C_4 = 4C are connected to battery as shown in the figure. The ratio of the charges on C_2 and C_4 is ______.



a) $\frac{4}{7}$ b) $\frac{3}{22}$ c) $\frac{7}{4}$ d) $\frac{22}{3}$

28. When air is replaced by a dielectric medium of constant K, the maximum force of attraction between two charges, separated by a distance.
a) decreases K times b) increases K times c) remains unchanged d) becomes $\frac{1}{K^2}$ times

29. In bringing an electron towards another electron, the electrostatic potential energy of the system.
a) decreases b) increases c) remains same d) becomes zero

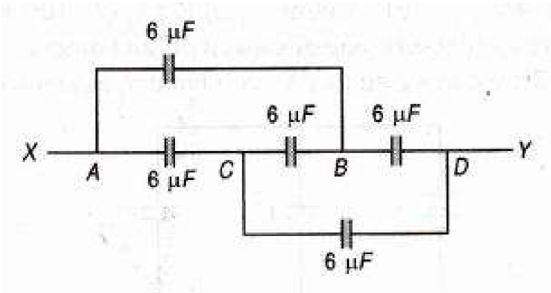
30. Four point charges -Q. -q, 2q and 2Q are placed, one at each corner of the square. The relation between e and q for which the potential at the centre of the square is zero is _______.
a) Q = -q b) $Q = -\frac{1}{q}$ c) Q = q d) $Q = \frac{1}{q}$

31. An electric dipole, consisting of two opposite charges of 2×10^{-6} C each separated by a distance 3 cm is placed in an electric field of 2×10^{5} N/C. Torque on the dipole is _______.
a) 12×10^{-1}N-m b) 12×10^{-2}Nm c) 12×10^{-3}N-m d) 12×10^{-4}Nm

32. The electric potential at a point in free space due to a charge Q coulomb is $Q \times 10^{11}$ volts. The electric field at that point is ______.
a) $4\pi\varepsilon_0 Q \times 10^{22}$ volt /m b) $12\pi\varepsilon_0 Q \times 10^{20}$ volt /m c) $4\pi\varepsilon_0 Q \times 10^{20}$ volt /m d) $12\pi\varepsilon_0 Q \times 10^{22}$ volt /m

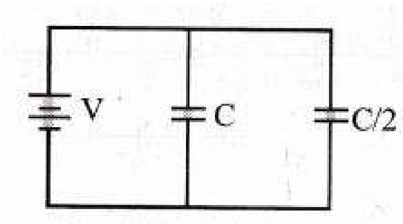
33. If the potential of a capacitor having capacity 6 mF is increased from 10 V to 20 V then increase in its energy will be ___________.
a) 4×10^{-4}J b) 4×10^{-14}J c) 9×10^{-4}J d) 12×10^{-6} J

34. The effective capacitance between points X and Y of figure shown is ______.



a) 6 mF b) 12 mF c) 18 mF d) 24 mF

35. Two condensers, one of capacity C and other of capacity C/2 are connected to a V-volt battery as shown.



The work done in charging fully both the condensers is _______.

a) $\frac{1}{4}CV^2$ b) $\frac{3}{4}CV^2$ c) $\frac{1}{2}CV^2$ d) $2CV^2$

36. Intensity of an electric field (E) depends on distance r due to a dipole, is related as _____.

a) $E \propto \frac{1}{r}$ b) $E \propto \frac{1}{r^2}$ c) $E \propto \frac{1}{r^3}$ d) $E \propto \frac{1}{r^4}$

37. A hollow metal sphere of radius R is uniformly charged. The electric field due to the sphere at a distance r from the centre ______.

a) Zero as r increases for r < R, decreases as r increases for r>R

b) Zero as r increases for r < R, increases as r increases for r> R

c) Decreases as r increases for r < R and for r > R

d) Increases as r increases for r < R and for r > R

38. A parallel plate capacitor of capacitance 20 mF is being charged by a voltage source whose potential is changing at the rate of 3 V/s. The conduction current through the connecting wires, and the displacement current through the plates of the capacitor, would be, respectively.

a) 60 mA, 60 mA b) 60 mA, zero c) Zero, zero d) Zero,60 mA

39. A capacitor C_1 is charged to a potential difference V. The charging battery is then removed and the capacitor is connected to an uncharged capacitor C_2. The potential difference across the combination is _____________.

a) $\frac{VC_1}{(C_1+C_2)}$ b) $V\left(1+\frac{C_2}{C_1}\right)$ c) $V\left(1+\frac{C_1}{C_2}\right)$ d) $\frac{VC_2}{(C_1+C_2)}$

40. A 4mF capacitor is charged to 400 V and then its plates are joined through a resistance of 1 kW. The heat produced in the resistance is _______.

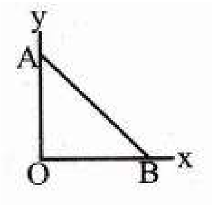
a) 0.16 J b) 1.28 J c) 0.6a J d) 0.32 J

41. In, a parallel plate capacitor, the distance between the plates is d and potential difference across the plates is V. Energy stored per unit volume between the plates of capacitor is ________.

a) $\frac{Q^2}{2V^2}$ b) $\frac{1}{2}\varepsilon_0\frac{V^2}{d^2}$ c) $\frac{1}{2}\frac{V^2}{\varepsilon_0 d^2}$ d) $\frac{1}{2}\varepsilon_0\frac{V^2}{d}$

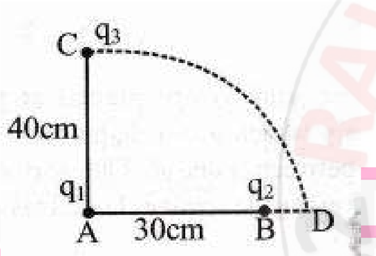
42. Point charges + 4 q, - q and + 4 q are kept on the x-axis at points x = 0, x = a and x = 2a, respectively. Then, __________.
a) only q is in stable equilibrium b) None of the charges in equilibrium
c) all the charges are in unstable equilibrium d) all the charges are in stable equilibrium

43. As per the diagram, a point charge +q is placed at the origin O, Work done in taking another point charge - Q from the point A [coordinates (0, a)] to another point B [coordinates (a, 0)] along the straight pathAB is:



a) $\left(\frac{qQ}{4\pi\varepsilon_0}\frac{1}{a^2}\right)\cdot\frac{a}{\sqrt{2}}$ b) $\left(\frac{qQ}{4\pi\varepsilon_0}\frac{1}{a^2}\right)\cdot\sqrt{2}a$ c) zero d) $\left(\frac{-qQ}{4\pi\varepsilon_0}\frac{1}{a^2}\right)\sqrt{2}a$

44. Two charges q_1 and q_2 are placed 30cm apart, as shown in the figure. A third charge q_3 is moved along the arc of a circle of radius 40 cm from C to D. The change in the potential energy of the system is $\frac{q_3}{4\pi\varepsilon_0}k$, where K is ______.



a) $8q_1$ b) $6q_1$ c) $8q_2$ d) $6q_2$

45. Three concentric spherical shells have radii a, b and c (a < b < c) and have surface charge densities s, -s and s respectively. If V_A, V_B and V_C denotes the potentials of the three Shells, then for c = a+b,we have _______.
a) $V_C = V_B \neq V_A$ b) $V_C \neq V_B \neq V_A$ c) $V_C = V_B = V_A$ d) $V_C = V_A \neq V_B$

46. Energy stored in a capacitor is _________.
a) $\frac{1}{2}QV$ b) QV c) $\frac{1}{QV}$ d) $\frac{2}{QV}$

47. A parallel plate air capacitor is charged to a potential difference of V volts. After disconnecting the charging battery the distance between the plates of the capacitor is increased using an insulating handle. As a result the potential difference between the plates.
a) does not change b) becomes zero c) increases d) decreases

48. In a certain region of space with volume 0.2 m^3, the electric potential is found to be 5 V throughout. The magnitude of electric field in this region is _______.
a) 5 N/C b) Zero c) 0.5 N/C d) 1 N/C

49. Three capacitors each of capacitance C and of breakdown voltage V are joined in series. The capacitance and breakdown voltage of the combination will be ______.
a) $3C, \frac{V}{3}$ b) $\frac{C}{3}, 3V$ c) 3C, 3V d) $\frac{C}{3}, \frac{V}{3}$

50. A charge 4 is placed at the centre of the line joining two exactly equal positive charges Q. The system of three charges will be in equilibrium if q is equal to ________.
a) $-\frac{Q}{4}$ b) +Q c) -Q d) $\frac{Q}{2}$

51. A solid spherical conductor is given a charge. The electrostatic potential of the conductor is ______.
a) constant throughout the conductor b) largest at the centre c) largest on the surface
d) largest somewhere between the centre and the surface

52. Each corner of a cube of side / has a negative charge, -q. The electrostatic potential energy of a charge q at the centre of the cube is _______.
a) $-\frac{4q^2}{\sqrt{2}\pi\varepsilon_0 l}$ b) $\frac{\sqrt{3}q^2}{4\pi\varepsilon_0 l}$ c) $\frac{4q^2}{\sqrt{2}\pi\varepsilon_0 l}$ d) $-\frac{4q^2}{\sqrt{3}\pi\varepsilon_0 l}$

53. A condenser of capacity C is charged to a potential difference of V_1. The plates of the condenser are then connected to an ideal inductor of inductance L. The current through the inductor when the potential difference across the condenser reduces to V_2 is

a) $\left(\frac{C\left(V_1^2-V_2^2\right)}{L}\right)^{1/2}$ b) $\left(\frac{C\left(V_1-V_2\right)^2}{L}\right)^{1/2}$ c) $\frac{C\left(V_1^2-V_2^2\right)}{L}$ d) $\frac{C\left(V_1-V_2\right)}{L}$

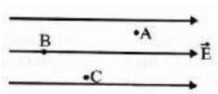
54. A particle of mass m and charge q is placed at rest in a uniform electric field E and then released. The kinetic energy attained by the particle after moving a distance y is _______.
a) qEy^2 b) qE^2y c) qEy d) q^2Ey

55. A point charge + q is placed at mid-point of a cube of side L. The electric flux emerging from the cube is _________.
a) $\frac{q}{\varepsilon_0}$ b) $\frac{6qL^2}{\varepsilon_0}$ c) $\frac{q}{6qL^2}$ d) zero

56. A point Q lies on the perpendicular bisector of an electric dipole of dipole moment p. If the distance of Q from the dipole is r, (much larger than the size of the dipole) then electric field at Q is proportional to _______.
a) p^{-1} and r^2 b) p and r^{-2} c) p^2 and r^{-3} d) p and r^{-3}

57. The potential energy of particle in a force field is $U=\frac{A}{r^2}-\frac{B}{r}$ where A and B are positive constants and r is the distance of particle from the centre of the field. For stable equilibrium, the distance of the particle is _________.
a) B/2A b) 2A/B c) A/B d) B/A

58. A, B and C are three points in a uniform electric field. The electric potential is



a) maximum at B b) maximum at C c) same at all the three points A, B and C
d) maximum at A

59. Two spherical conductors I and B of radii 1 mm and 2 mm are separated by a distance of 5 cm and are uniformly charged. If the spheres are connected by a conducting wire then in equilibrium condition, the ratio of the magnitude of the electric fields at the surfaces of spheres

A and B is ________.

a) 4:1 b) 1:2 c) 2:1 d) 1:4

60. When an electric dipole p is placed in a uniform electric field E,then at what angle between p and E the value of torque will be maximum?

a) 90° b) 0° c) 180° d) 45°

61. Number of electrons present in a negative charge of 8 C is ____________

a) 5 x10^{19} b) 2.5 x 10^{19} c) 12.8 x 10^{19} d) 1.6 x 10^{19}

62. Which of the following statement is correct? $\int E \cdot ds = 0$ over a surface, then

a) the electric field inside the surface and on it is zero.

b) the electric field inside the surface is necessarily uniform.

c)

the number of flux lines entering the surface must be equal to the number of flux lines leaving it.

d) all charges must not necessarily be outside the surface.

63. There are two charges +1 μC and +5 μC. The ratio of the forces acting on them will be

a) 1 : 5 b) 1 : 1 c) 5 : 1 d) 1 : 25

64. The electric potential V at any point (x, y, z) all in metres in space is given by $V = 4x^2$ volt. The electric field at the point (1,0,2) in volt/metre is:

a) 8 along positive X-axis b) 16 along negative X-axis c) 16 along positive X-axis

d) 8 along negative X-axis

65. An object of mass 1kg contains 4 x 10^{20} atoms. If one electron is removed from every atom of the solid, the charge gained by the solid of 1g is _______

a) 2.8 C b) 6.4 x 10^{-2} C c) 3.6 x 10^{-3} C d) 9.2 x 10^{-4} C

66. A cylinder of radius R and length L is placed in a uniform electric field E parallel to the cylinder axis. The total flux for the surface of the cylinder is given by

a) $2\pi R^2 E$ b) πr^2 c) $\frac{\pi R^2 - \pi R}{E}$ d) Zero

67. The mean free path of electrons in a metal is 4×10^{-8} m. The electric field which can give on an average 2 eV energy to an electron in the metal will be in units of V/m.

a) 5×10^{-11} b) 8×10^{-11} c) 5×10^{7} d) 8×10^{7}

68. An electric charge q is placed at the centre of a cube of side a. The electric flux on one of its faces will be

a) $\frac{q}{6\varepsilon_0}$ b) $\frac{q}{\varepsilon_0 a^2}$ c) $\frac{q}{4\pi\varepsilon_0 a^2}$ d) $\frac{q}{\varepsilon_0}$

69. A charge Q is divided into two parts of q and Q - q. If the coulomb repulsion between them when they are separated is to be maximum, the ratio of Q/q should be

a) 2 : 1 b) 1/2 c) 4 : 1 d) 1/4

70. Four equal charges q are placed at the four corners A, B, C, D of a square of length a. The magnitude of the force on the charge at B will be

a) $\frac{3q^2}{4\pi\varepsilon_0 a^2}$ b) $\frac{4q^2}{4\pi\varepsilon_0 a^2}$ c) $\frac{(1+2\sqrt{2})q^2}{2\times 4\pi\varepsilon_0 a^2}$ d) $\frac{\left(\frac{2+1}{\sqrt{2}}\right)q^2}{4\pi\varepsilon_0 a^2}$

71. The intensity of electric field at the surface of conducting hollow sphere is 10 NC^{-1} and its radius is 10 cm. The value of electric field at the centre of sphere is

a) zero b) 10 NC^{-1} c) 1 NC^{-1} d) 100 NC^{-1}

72. Two similar spheres having +Q and -Q charges are kept at a certain distance. F force acts between the two. If at the middle of two spheres, another similar sphere having +Q charge is kept, then it experiences a force in magnitude and direction as

a) zero having no direction. b) SF towards +Q charge. c) SF towards -Q charge.
d) 4F towards +Q charge

73. An electric dipole of moment $'p'$ is placed in an electric field of intensity ' E '. The dipole acquires a position such that the axis of the dipole makes an angle q with the direction of the field. Assuming that the potential energy of the dipole to be zero when $= 90°$, the torque and the potential energy of the dipole will respectively be:

a) $pE\sin q, -pE\cos q$ b) $pE\sin q, -2pE\cos q$ c) $pE\sin q, 2pE\cos q$ d) $pE\cos q, -pE\cos q$

74. A charge q is located at the centre of a cube. The electric flux through any face is ________________ .

a) $\frac{q}{6(4\pi\varepsilon_0)}$ b) $\frac{2\pi q}{6(4\pi\varepsilon_0)}$ c) $\frac{4\pi q}{6(4\pi\varepsilon_0)}$ d) $\frac{\pi q}{6(4\pi\varepsilon_0)}$

75. Total electric flux coming out of a unit positive charge put in air is

a) E_o b) ε_0^{-1} c) $(4\ pE_0)^{-1}$ d) $4\pi\ E_0$

76. Which of the following statement is correct? The electric field at a point is

a) always continuous b) continuous if there is a charge at that point.
c) discontinuous only if there is a negative charge at that point.
d) discontinuous if there is a charge at that point

77.

In given figures, OP = OQ = 15 cm, OA = OB = 2.5 mm Magnitudes of electric field at P and Q are respectively

a) $2.6 \times 10^5\ NC^{-1}$, $2.6 \times 10^5\ NC^{-1}$ b) $1.3 \times 10^5\ NC^{-1}$, $1.3 \times 10^5\ NC^{-1}$
c) $2.6 \times 10^5\ NC^{-1}$, $1.3 \times 10^5\ NC^{-1}$ d) $1.3 \times 10^5\ NC^{-1}$, $2.6 \times 10^5\ NC^{-1}$

78. In general, metallic ropes are suspended from the carriers to the ground which take inflammable material. The reason is

a) their speed is controlled b) to keep the gravity of the carrier nearer to the earth
c) to keep the body of the carrier in contact with the earth
d) nothing should be placed under the carrier

79. An electron is moving round the nucleus of a hydrogen atom in a circular orbit of radius r. The coulomb force $\vec{F}$ between the two is (where $K = \frac{1}{4K\varepsilon_0}$)

a) $K\frac{e^2}{r^3}\vec{r}$ b) $K\frac{e^2}{r^2}\hat{r}$ c) $-K\frac{e^2}{r^3}\hat{r}$ d) $-K\frac{e^2}{r^3}\vec{r}$

80. Two parallel infinite line charges with linear charge densities $+\lambda \mathrm{C/m}$ and $-\lambda \mathrm{C/m}$ are placed at a distance of 2R in free space. What is the electric field mid-way between the two line charges?

a) $\frac{2\lambda}{\pi\varepsilon_0 \mathrm{R}}\mathrm{N/C}$ b) $\frac{\lambda}{\pi\varepsilon_0 \mathrm{R}}\mathrm{N/C}$ c) $\frac{\lambda}{2\pi\varepsilon_0 \mathrm{R}}\mathrm{N/C}$ d) Zero

81. Two equal and opposite charges each of 2C are placed at a distance of 0.04 m. Dipole moment of the system will be
a) 6×10^{-8} C-m b) 8×10^{-2} C-m c) 1.5×10^{2} C-m d) 8×10^{-6} C-m

82. ABC is an equilateral triangle. Three charges +q are placed at each comer. The electric intensity at O will be

a) $1.q/4\pi\varepsilon_0.r^2$ b) $1.q/4\pi\varepsilon_0 r$ c) Zero d) $1.3q/4\pi\varepsilon_0 r^2$

83. The electric field at a distance $\frac{3R}{2}$ from the centre of a charged conducting spherical shell of radius R is E. The electric field at a distance $\frac{R}{2}$ from the centre of the sphere is:

a) $\frac{E}{2}$ b) zero c) E d) $\frac{E}{2}$

84. Gauss's law will be invalid if
a) there is magnetic monopoles b) the inverse square law is not exactly true.
c) the velocity of light is not a universal constant. d) none of these

85. Two charges of equal magnitudes kept at a distance r exert a force F on each other. If the charges are halved and distance between them is doubled, then the new force acting on each charge is

a) $\frac{F}{8}$ b) $\frac{F}{4}$ c) 4 F d) $\frac{F}{16}$

86. Gauss' law is true only if force due to charges varies as
a) r^{-1} b) r^{-2} c) r^{-3} d) r^{-4}

87. A short electric dipole has a dipole moment of 16×10^{9} cm. The electric potential due to the dipole at a point at a distance of 0.6 m from the centre of the dipole, situated on a line making an angle of $60°$ with the dipole axis is:

$\left(\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \mathrm{Nm}^2/\mathrm{C}^2\right)$

a) zero b) 50 V c) 200 V d) 400 V

88. In the following configuration of charges, force on charge q_2 by q_1 is given by (here, $r = r_{21} = (r_2 - r_1)$

a) $\mathbf{F}_{21} = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}\cdot\hat{\mathbf{r}}_{21}$ b) $\mathbf{F}_{21} = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}\left(-\hat{\mathbf{r}}_{21}\right)$ c) $\mathbf{F}_{21} = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^3}\cdot\hat{\mathbf{r}}_{21}$ d) $\mathbf{F}_{21} = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^3}\cdot\left(-\hat{\mathbf{r}}_{21}\right)$

89. A positive charge Q is uniformly distributed along a circular ring of radius R. A small test charge q is placed at the centre of the ring.

Which of the following statement is not correct?

a)

If q > 0 and is displaced away from the centre in the plane of the ring, it will be pushed back towards the centre.

b)

If q < 0 and is displaced away from the centre in the plane of the ring, it will never return to the centre and will continue moving till it hits the ring.

c) If q < 0, it will perform SHM for small displacement along the axis.

d)

q at the centre of the ring is in an unstable equilibrium within the plane of the ring for q > 0.

90. An electric dipole is kept in a non-uniform electric field. It experiences

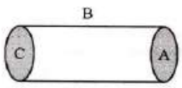
a) a force and a torque b) a force but not a torque c) a torque but not a force.

d) neither a force nor a torque

91. What is the flux through a cube of side ' a ' if a point charge of q is at one of its corner:

a) $\frac{2q}{\varepsilon_0}$ b) $\frac{q}{8\varepsilon_0}$ c) $\frac{q}{\varepsilon_0}$ d) $\frac{q}{2\varepsilon_0}6a^2$

92. A hollow cylinder has a charge q coulomb within it. If, f is the electric flux in units of voltmeter, associated with the curved surface B, the flux linked with the plane surface A in units of voltmeter will be:



a) $\frac{q}{\varepsilon_0} - \phi$ b) $\frac{1}{2}\left(\frac{q}{\varepsilon_0} - \phi\right)$ c) $\frac{q}{2\varepsilon_0}$ d) $\frac{\phi}{3}$

93. In charging by induction

a) body to be charged must be an insulator

b) body to be charged must be a semiconductor

c) body to be charged must be a conductor

d) any type of body can be charged by induction

94. The number of electrons that must be removed from an electrically neutral silver dollar to give it a charge of + 2.4 C is

a) 2.5×10^{19} b) 1.5×10^{19} c) 1.5×10^{-19} d) 2.5×10^{-19}

95. In an electric field E, the torque acting on a dipole moment p is

a) p·E b) p x E c) zero d) E x p

96. Unit of electric field is

a) N/m b) C/N c) N/C d) J/N

97. Five charges q_1 q_2, q_3, q_4 and q_5 are fixed at their positions as shown in Figure, S is a Gaussian surface. The Gauss' law is given by $\int_s E \cdot dS = \frac{q}{\varepsilon_0}$ Which of the following statements is correct?

a)
E on the LHS of the above equation will have a contribution from q_1, q_5 and q_1 ,q_5 and q_3 while q on the RHS will have a contribution from q_2 and q_4 only.

b)
E on the LHS of the above equation will have a contribution from all charges while q on the RHS will have a contribution from q_2 and q_3 only

c)
E on the LHS of the above equation will have a contribution from all charges while q on the RHS will have a contribution from q_1, q_3, and q_5 only.

d) Both E on the LHS and q on the RHS will have contributions from q_2 and q_4 only

98. A charge Q mc is placed at the centre of a cube, the flux coming out from any surface will be:

a) $\frac{Q}{6\varepsilon_0} \times 10^{-6}$ b) $\frac{Q}{6\varepsilon_0} \times 10^{-3}$ c) $\frac{Q}{24\varepsilon_0}$ d) $\frac{Q}{8\varepsilon_0}$

99. Charge on a body is q1 and it is used to charge another body by induction. Charge on second body is found to be q2 after charging. Then

a) $\frac{q_1}{q_2} = 1$ b) $\frac{q_1}{q_2} < 1$ c) $\frac{q_1}{q_2} \le 1$ d) $\frac{q_1}{q_2} \ge 1$

100. Electric field at a point varies as r^o for

a) an electric dipole b) a point charge c) a plane infinite sheet of charge

d) a line charge of infinite length

101. If charges q, q and -q are placed at vertices of an equilateral triangle of side I. If F_1,F_2 and F_3 are the forces on the charges respectively, then

a) $\left|\mathbf{F}_1 + \mathbf{F}_2 + \mathbf{F}_3\right| = \sqrt{3}\frac{kq^2}{l^2}$ b) $\left|\mathbf{F}_1 + \mathbf{F}_2 + \mathbf{F}_3\right| = 0$ c) $\left|\mathbf{F}_1 + \mathbf{F}_2 + \mathbf{F}_3\right| = 3\sqrt{2}\frac{kq^2}{l^2}$

d) $\left|\mathbf{F}_1 + \mathbf{F}_2 + \mathbf{F}_3 \quad\right| = \sqrt{2}\frac{kq^2}{l^2}$

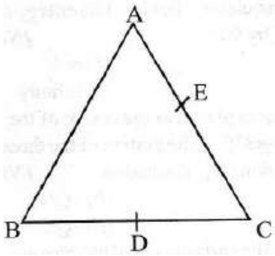
102. A point positive charge is brought near an isolated conducting sphere (figure). The electric field is best given by

a) b) c) d)

103. The magnitude of electric field intensity E is such that, an electron placed in it would experience an electrical force equal to its weight is given by

a) e^2g/m^2 b) mge c) mg/e d) e/mg

104. Three charges, each +q, are placed at the corners of an isosceles triangle ABC of sides BC and AC, 2a. D and E are the mid points of BC and CA. The work done in taking a charge Q from D to E is:



a) $\frac{3qQ}{8\pi\varepsilon_0 a}$ b) $\frac{qQ}{4\pi\varepsilon_0 a}$ c) zero d) $\frac{3qQ}{4\pi\varepsilon_0 a}$

105. In figure two positive charges q_2 and q_3 fixed along the y-axis, exert a net electric force in the + x- direction on a charge q_1 fixed along the x-axis. If a positive charge Q is added at (x, 0), the force on q_1

a) shall increase along the positive x-axis b) shall decrease along the positive x-axis

c) shall point along the negative x-axis

d) shall increase but the direction changes because of the intersection of Q with q_2 and q_3

106. For a given surface, the $\oint \mathbf{E} \cdot d\mathbf{S} = 0$ From this, we can conclude that

a) E is necessarily zero on the surface. b) E is perpendicular to the surface at every point

c) the total flux through the surfaceis zero d) the flux is only going out of the surface

107. What is the angle between the electric dipole moment and the electric field strength due to it on the equatorial line?

a) 0º b) 90º c) 180º d) None of these

108. Electric field of a system of charges does not depend on

a) position of charges forming the system

b) distance of point (at which fieldis being observed) from the charges forming system

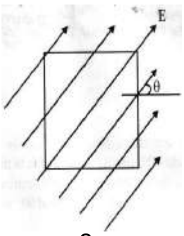
c) value of test charge used to find out the field

d) separation of charges forming the system

109. Force between two charges varies with distance between them as

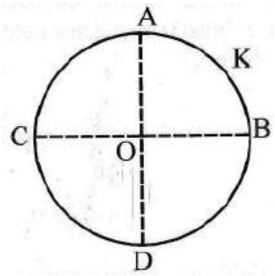
a) b) c) d)

110. A square surface of side L metre in the plane of the paper is placed in a uniform electric field $E(volt/\mathrm{m})$ acting along the same plane at an angle q with the horizontal side of the square as shown in figure. The electric flux linked to the surface, in units of volt. m, is:



a) EL^2 b) $EL^2 \cos\theta$ c) $EL^2 \sin\theta$ d) zero

111. A thin conducting ring of radius R is given a charge +Q. The electric field at the centre O of the ring due to the charge on the part AKB of the ring is E. The electric field at the centre due to the charge on the part ACDB of the ring is:



a) E along Ko b) E along OK c) E along KO d) 3 E along OK

112. A spherical conductor of radius 10 cm has a charge of $3.2 \times 10^{-7}C$ distributed uniformly. What is the magnitude of electric field at a point 15 cm from the centre of the sphere?

$$\left(\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \mathrm{Nm}^2/\mathrm{C}^2\right)$$

a) 1.28×10^7 N/C b) 1.28×10^4 N/C c) 1.28×10^5 N/C d) 1.28×10^6 N/C

113. Consider the charge configuration and spherical Gaussian surface as shown in the figure. When calculating the flux of the electric field over the spherical surface, the electric field will be due to

a) q_2 b) only the positive charges' c) all the charges d) + q_1 and - q_2

114. A charge q is placed at the centre of the line joining two equal charges Q and Q. The system of the three charges will be ill equilibrium, if q is equal to

a) -Q /2 b) -Q/ 4 c) +Q/ 4 d) +Q/ 2

115. Three point charges +q, -q and +q are placed at points (x=0, y=a, z=0),(x=0, y=0, z=0) and (x=a, y=0, z=0) respectively. The magnitude and direction of the electric dipole moment vector of this charge assembly are:

a) $\sqrt{2}qa$ along the line joining points (x=0, y=0, z=0) and (x=a, y=a, z=0)

b) qa along the line joining points (x=0, y=0, z=0 and (x=a, y=a, z=0)

c) $\sqrt{2}$qa along +ve x direction, d) $\sqrt{2}$qa along +ve y direction,

116. Unit of electric field intensity is

a) N/m b) C/N c) N/C d) J/N

117. Four charges are arranged at the comers of a square ABCD, as shown. The force on the charge kept at the centre O is

a) zero b) along the diagonal AC c) along the diagonal BD d) perpendicular to side AB

118. If a dipole of dipole moment $\vec{p}$ is placed in a uniform electric field $\vec{E}$, then torque acting on it is given by:

a) $\vec{\tau} = \vec{p} \cdot \vec{E}$ b) $\vec{\tau} = \vec{p} \times \vec{E}$ c) $\vec{\tau} = \vec{p} + \vec{E}$ d) $\vec{\tau} = \vec{p} - \vec{E}$

119. A hemisphere is uniformly charged. The electric field at a point on a diameter away from the centre is directed

a) perpendicular to the diameter b) parallel to the diameter

c) at an angle tilted towards the diameter d) at an angle tilted away from the diameter

120. A charge on a sphere of radius 2 cm is 2 μC while charge on sphere of radius 5 cm is 5μC. Find the ratio of an electric field on distance of 10 crn from centre of the sphere.

a) 1 : 1 b) 2 : 5 c) 5 : 2 d) 4 : 25

121. A force of 2.25 N acts on a chrage of 15 x 10^{-4} C. The intensity of electric field at that point is

a) 150 NC^{-1} b) 15 NC^{-1} c) 1500 NC^{-1} d) 1.5 NC^{-1}

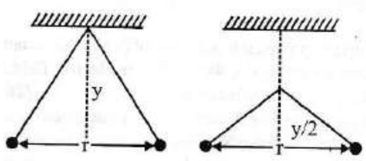
122. Radius of a hollow sphere is R and a charge q is placed at the centre of hollow sphere. If the radius of sphere becomes half and charge also becomes half, then the value of emergent total flux from the surface of sphere is

a) $4q/\varepsilon_0$ b) $2q/\varepsilon_0$ c) $q/2\varepsilon_0$ d) q/ε_0

123. Two identical metallic spheres having charges +4q and -2q are placed with their centres r distance apart. Force of attraction between the spheres is F. If the two spheres are brought in contact and then placed at the same distance r apart, the force between them

a) F b) F/2 c) F/4 d) F/8

124. Two pith balls carrying equal charges are suspended from a common point by strings of equal length. The equilibrium separation between them is r. Now the strings are rigidly clamped at half the height. The equilibrium separation between the balls now become



a) $\left(\frac{r}{\sqrt[3]{2}}\right)$ b) $\left(\frac{2r}{\sqrt{3}}\right)$ c) $\left(\frac{2r}{3}\right)$ d) $\left(\frac{r}{\sqrt{2}}\right)^2$

125. Which of the following graphs shows the variation of electric field E due to a hollow spherical conductor of radius R as a function of distance from the centre of the sphere?

a) b) c) d)

126. A point charge q is placed at a distance a/2 directly above the centre of a square of side a. The electric flux through the square is

a) q/ε_0 b) $q/\pi\varepsilon_0$ c) $q/4\varepsilon_0$ d) $q/6\varepsilon_0$

127. One metallic sphere A is given positive charge whereas another identical metallic sphere B of exactly same mass as of A is given equal amount of negative charge. Then

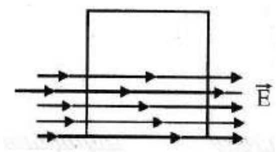
a) mass of A and mass of B still remain equal b) mass of A increases

c) mass of B decreases d) mass of B increases

128. An electric dipole of moment p is placed in the position of stable equilibrium in uniform electric field of intensity E. It is rotated through an angle 9 from the initial position. The potential energy of electric dipole in the final position is

a) $pE\cos\theta$ b) $pE\sin\theta$ c) $pE(1-\cos\theta)$ d) $-pE\cos\theta$

129. A square surface of side L metres is in the plane of the paper. A uniform electric field $\vec{E}(volt/\mathrm{m})$, also in the plane of the paper, is limited only to the lower half of the square surface (see figure). The electric flux in SI units associated with the surface is:



a) $\mathrm{EL}^2/2$ b) zero c) EL^2 d) $\mathrm{E}^2/\left(2\mathrm{e}_0\right)$

130. When a glass rod is rubbed with silk, it

a) gains electrons from silk. b) gives electrons to silk c) gains protons from silk

d) gives protons to silk.

131. A point charge + q is placed at a distance d from an isolated conducting plane. The field at a point P on the other side of the plane is

a) directed perpendicular to the plane and away from the plane.

b) directed perpendicular to the plane but towards the plane

c) directed radially away from the point charge d) directed radially towards the point charge

132. The surface densities on the surfaces of two charged spherical conductors of radii R_1 and R_2 are equal. The ratio of electric intensities on the surfaces are

a) R_1^2/R_2^2 b) R_2^2/R_1^2 c) R_1/R_2 d) 1:1

133. Two charges + 1 μ Cand +4μ C are situated at a distance in air. The ratio of the forces acting on them is

a) 1 : 4 b) 4 : 1 c) 1 : 1 d) 1 : 16

134. The electric flux in a charged spherical conductor is
a) zero inside and outside the sphere
b) maximum inside the sphere and zero outside the sphere
c)
zero inside the sphere and decreases outside the sphere with increase of square of distance.
d) maximum inside the sphere and decreases outside the sphere with increase of distance.

135. The unit of intensity of electric field is
a) N/m b) C/N c) N/C d) J/N

136. The electric field in a certain region is acting radially outward and is given by E=Ar. A charge contained in a sphere of radius ' a ' centred at the origin of the field, will be given by:
a) $A\varepsilon_0 a_1^2$ b) $4\pi\varepsilon_0 Aa^3$ c) $\varepsilon_0 Aa^3$ d) $4\pi\varepsilon_0 \mathrm{Aa}^2$

137. A charge ' q ' is placed at the centre of the line joining two equal charges ' Q '. The system of the three charges will be in equilibrium if ' q ' is equal to:
a) Q/2 b) -Q/4 c) Q/4 d) -Q/2

138. A charge Q is enclosed by a Gaussian spherical surface of radius R. If the radius is doubled, then the outward electric flux will ________________ .
a) increase four times b) be reduced to half c) remain the same d) be doubled

139. The electric flux through the surface

a) in Fig. (iv) is the largest b) in Fig. (iii) is the least
c) in Fig. (ii) is same as Fig. (iii) but is smaller than Fig. (iv) d) is the same for all the figures

140. In a system, 'n' electric dipole are placed in a closed surface. The value of emergent electric flux from enclosed surface is
a) $\frac{q}{\varepsilon_0}$ b) $\frac{2q}{\varepsilon_0}$ c) $-\frac{2q}{\varepsilon_0}$ d) zero

141. Two metallic spheres of radii 1 m and 3 cm are given charges of $-1\times10^{-2}\mathrm{C}$ and $5\times10^{-2}\mathrm{C}$, respectively. If these are connected by a conducting wire, the final charge on the bigger sphere is:
a) $2\times10^{-2}\mathrm{C}$ b) $3\times10^{-2}\mathrm{C}$ c) $4\times10^{-2}\mathrm{C}$ d) $1\times10^{-2}\mathrm{C}$

142. In the diagram shown below,

a) field strength at P is less than field strength at Q b) field strength at P and Q are equal
c) field is more strong at P and less strong at Q d) cannot be tell from the figure

143. An electric dipole of dipole moment p is aligned parallel to a uniform electric field E. The energy required to rotate the dipole by 90° is _______________ .
a) pE^2 b) p^2E c) pE d) Infinity

144. SI unit of electrical permittivity is
a) N-m ^{2}C^{-2} b) Am $^{-2}$ c) NC^{-1} d) C^{2}N^{-1}m^{-2}

145. The SI unit of electric flux is
a) $\frac{\text{volt}}{\text{metre}}$ b) $\frac{\text{newton}}{\text{coulomb}}$ c) $\frac{\text{newton} \times \text{metre}^2}{\text{coulomb}}$ d) $\text{volt} \times \text{metre}^2$

146. Two positive ions, each carrying a charge q, are separated by a distance d. If F is the force of repulsion between the ions, the number of electrons missing from each ion will be (e being the charge of an electron)
a) $\frac{4\pi\varepsilon_0 Fd^2}{e^2}$ b) $\sqrt{\frac{4\pi\varepsilon_0 Fe^2}{d^2}}$ c) $\sqrt{\frac{4\pi\varepsilon_0 Fd^2}{e^2}}$ d) $\sqrt{\frac{4\pi\varepsilon_0 Fd^2}{q^2}}$

147. Electric charges q,q,-2q are placed at the corners of an equilateral △ABC of side l. The magnitude of electric dipole moment of the system is
a) ql b) 2ql c) $\sqrt{3}$ ql d) 4ql

148. The electric intensity due to a dipole of length 10 cm and having a charge of 500 mC, at a point on the axis at a distance 20 cm from one of the charges in air, is _____________ .
a) 6.25×10^7 N/C b) 9.28×10^7 N/C c) 13.1×10^{11} N/C d) 20.5×10^7 N/C

149. For the dipole shown,

Dipole moment is given by
a) p= q x 2a$\hat{p}$ b) $\mathbf{p} = \frac{1}{2}q \times 2a\hat{\mathbf{p}}$ c) p=- q x 2a$\hat{p}$ d) p=4q x 2a$\hat{p}$

150. The electric field inside a spherical shell of uniform surface charge density is
a) zero. b) constant, less than zero.
c) directly proportional to the distance from the centre. d) none of the these

151. Figure shows electric field lines in which an electric dipole P is placed as shown. Which of the following statements is correct?

a) The dipole will not experience any force.
b) The dipole will experience a force towards right.
c) The dipole will experience a force towards left.
d) The dipole will experience a force upwards.

152. Two point charges A and B, having charges +Q and -Q respectively, are placed at certain distance apart and force acting between them is F. If 25 % charge of A is transferred to B, then force between the charges becomes:

a) $\frac{9\,F}{16}$ b) $\frac{16\,F}{9}$ c) $\frac{4\,F}{3}$ d) F

153. An electric dipole of moment $\vec{p}$ is lying along a uniform electric field $\vec{E}$. The work done in rotating the dipole by 90° is __________ .

a) $\frac{pE}{2}$ b) 2pE c) pE d) $\sqrt{2}pE$

154. The electric field intensity due to an infinite cylinder of radius R and having charge q per unit length at a distance r(r > R) from its axis is

a) directly proportional to r^2. b) directly proportional to r^3. c) inversely proportional to r.
d) inversely proportional to r^2.

Ravi Maths Tuition Centre

Time : 1 Mins | THERMAL PROPERTIES KINETIC THEORY 1 | Marks : 1079

1. The high thermal conductivity of metal is due to free electrons. The relevant electron property is
   a) its being charged b) its high average energy c) its high average thermal speed
   d) its low volume
2. A piece of paper wrapped tightly on a wooden rod is found to get charged quickly When held over a flame compared to a similar piece of wrapped on brass rod.This is because
   a) wood contains large no. of free electrons b) wood is good conductor of heat
   c) wood is a bad conductor of heat
   d) brass is a good conductor and wood is a bad conductor of heat
3. The value of coefficient of volume expansion of mercury is 1.8 x $10^{-4}K^{-1}$. The fractional change in the density of mercury for a rise of 50 ^{o}C in its temperature is___________x 10^{-3}.
   a) 7 b) 8 c) 6 d) 9

4. A glass of ice-cold water left on a table on a hot summer day eventually warms up whereas a cup of hot tea on the same table cools down because
   a) its surrounding media are different
   b)
   the direction of heat flow depends on the surrounding temperature with respect to the object
   c) heating or cooling does not depend on surrounding temperature d) Both (a) and (b)
5. The rates of cooling of two different liquids put in exactly similar calorimeters and kept in identical surroundings are the same if
   a) the masses of the liquids are equal
   b) equal masses of the liquids at the same temperature are taken
   c) different volumes of the liquids at the same temperature are taken
   d) equal volumes of the liquids at the same temperature are taken
6. For nitrogen C_p-C_v = x and for argon, C_p-C_v = y.The relation between x and y is given by
   a) x = y b) x = 7y c) y = 7x d) x = 1/2y
7. A black body is at 2000 K, it emits maximum energy at a wavelength 1μm . The temperature, it emits at wavelength of 2μm is
   a) 1000 K b) 2000 K c) 500 K d) 100 K

8. The common physical property which is to be used as the basis for constructing thermometer is
a) the variation of the volume of a liquid with temperature
b) the variation of the pressure of a gas with temperature
c) the variation of the resistance of a wire with temperature d) All of the above
9. According to Newton 's law of cooling, the rate of cooling of a body is proportional to $(\Delta\theta)^n$ where $\Delta\theta$ is difference of the temperaturebody and the surroundings. and n is equal to
a) 1 b) 2 c) 3 d) 4
10. Two rods A and B of identical dimensions are at temperature 40 °C. If A is heated upto 160 °C and B upto T °C then new lengths are the same. If the ratio of the coefficients of linear expansion of B and A is 2 : 5, then the value of T is____________ °C.
a) 234 b) 450 c) 340 d) 435
11. A piece of iron is heated in a flame. It first becomes dull red then becomes reddish yellow and finally turns to white hot. The correct explanation for the above observation is possible by using______
a) Wien's displacement law b) Kirchoff's law c) Newton's law of cooling
d) Stefan's law
12. A black body radiate energy at rate of X W/m^2 at a high temperature of TK. When temperature is reduced to $\left(\frac{T}{2}\right)K$, the radiant energy is
a) $\frac{X}{16}$ b) $\frac{X}{4}$ c) $\frac{X}{2}$ d) $2X$
13. The total radiant energy per unit area, normal to the direction of incidence, received at a distance R from the centre of a star of radius r, whose outer surface radiates as a black body at a temperature T K is given by____
(where s is Stefan's constant)
a) $\frac{\sigma r^2 T^4}{R^2}$ b) $\frac{\sigma r^2 T^4}{4\pi R^2}$ c) $\frac{\sigma r^4 T^4}{r^4}$ d) $\frac{4\pi\sigma r^2 T^4}{R^2}$
14. Two bars of having same length but unequal cross sections are heated to the same temperature.The change in length Will be
a) equal in both bar b) more in thicker bar c) more in thinner bar d) cannot say
15. A black body radiates heat energy at the rate of 3X10^6 W at 127°C. The temperature at which it would radiate heat energy at 243X10^6 W is
a) 1000 K b) 1200 K c) 1400 K d) 1600 K
16. A spherical black body with a radius of 12 cm radiates 450 watt power at 500 K. If the radius were halved and the temperature doubled, the power radiated in watt would be_____
a) 225 b) 450 c) 1000 d) 1800
17. Match the laws given in Column I, with their formula in column II and select the correct option in the choices given below.

	Column I		Column II
A.	Newton's law of cooling	1.	$\lambda_m . T = constant$
B.	Calorimetry	2.	$\frac{dQ}{dt} = K\Delta T$
C.	Wein's displacement law	3.	$m_1 s_1 (\theta_1 - \theta) = m_2 s_2 (\theta - \theta_2)$

a)

A	B	C
3	1	2

b)

A	B	C
1	2	3

c)

A	B	C
2	3	1

d)

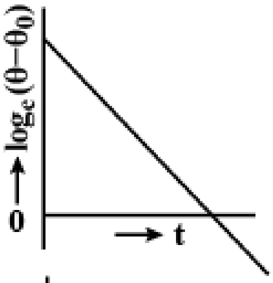
A	B	C
3	2	1

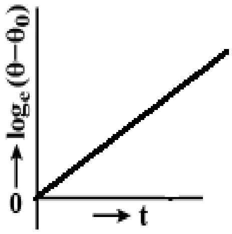
18. A new linear temperature scale designed for specific experiment records the ice point at 22 ^oT (^oT is the new unit of temperature) and the steam point 232 ^oT. The specific heat capacity of water in J kg^{-1} $^\circ T^{-1}$ will be if it is 4200 in J kg^{-1} $^oC^{-1}$.
a) 3000 b) 4000 c) 2000 d) 1000
19. Certain quantity of water cools from $70^\circ C$ to $60^\circ C$ in the first 5 minutes and to $54^\circ C$ in the next 5 minutes. The temperature of the surroundings is______
a) $45^\circ C$ b) $20^\circ C$ c) $42^\circ C$ d) $10^\circ C$
20. A slab of stone of area $0.36\ m^2$ and thickness $0.1\ m$ is exposed on the lower surface to steam at $100^\circ C$, A block of ice at $0^\circ C$ rests on the upper surface of the slab. In one hour $4.8\ kg$ of ice is melted. The thermal conductivity of slab is (Given latent heat of fusion of ice $= 3.36 \times 10^5 Jkg^{-1}$)_____
a) $1.24\ J/m/s/^\circ C$ b) $1.29\ J/m/s/^\circ C$ c) $2.05\ J/m/s/^\circ C$ d) $1.02\ J/m/s/^6C$
21. The radius of metal sphere at room temperature T is R and the coefficient of linear expansion of the metal is α . The sphere is heated a little by a temperature T so that, new temperature is $T + \Delta T$. The increase in volume of sphere is approximately
a) $2\pi R\alpha\Delta T$ b) $\pi R^2\alpha\Delta T$ c) $4\pi R^3\alpha\Delta T/3$ d) $4\pi R^3\alpha\Delta T$
22. Consider ă compound slab consisting of two different materials having equal thicknesses and thermal conductivities K and 2 K, respectively. The equivalent thermal conductivity of the slab is_____
a) $\frac{4}{3}K$ b) $\frac{2}{3}K$ c) $\sqrt{3}K$ d) 3 K
23. The temp of a piece of metal is increased from 27^{0}C to 84^0 C.The rate at which energy is radiated is increased to
a) four times b) two times c) six times d) eight times
24. If the temperature of a black body is doubled, the wavelength at which the spectral radiancy has its maximum is
a) doubled b) halved c) quadrupled d) unchanged
25. The specific heat of a gas in an isothermal proess is
a) infinite b) zero c) negative d) remains constant
26. A bar of iron is 10 cm at 20°C. At 19°C, it will be
a) 11 x 10^{-6} cm longer b) 11 x 10^{-5} cm shorter c) 11 x 10^{-6} cm shorter
d) 11 x 10^{-5} cm longer

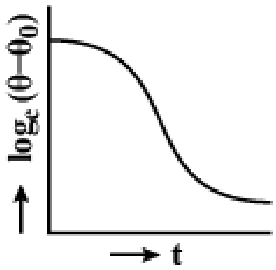
27. If λ_m denotes the wavelength at which the radiative emission from a black body af a temperature T K is maximum, then____

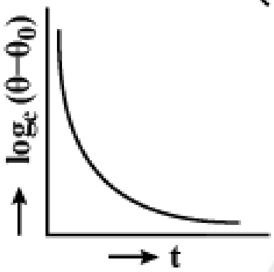
a) $\lambda_m \alpha T^{-1}$ b) $\lambda_m \alpha T^4$ c) λ_m is independent of T d) $\lambda_m \alpha T$

28. A liquid in a breaker has temperature $\theta(t)$ at time t and θ_0 is temperature of surroundings, then according to Newton's law of cooling the correct graph between $log_e\left(\theta - \theta_0\right)$ and t is

a) 

b) 

c) 

d) 

29. An iron plate has a circular hole of diameter 1 m. Find the change in diameter of the hole (in cm) when the plate is uniformly heated from 20 °C to 80 °C. (α = 12 x 10^{-6}/ °C)

a) 3 b) 0.07 c) 32 d) 4

30. When 100 g of a liquid A at 100 °C is added to 50 g of a liquid B at temperature 75 °C, the temperature of the mixture becomes 90 °C. The temperature of the mixture, if 100 g of liquid A at 100 °C is added to 50 g of liquid B at 50 °C will be__________ °C.

a) 49 b) 80 c) 50 d) 89

31. Suppose there is a hole in a copper plate. upon heating the plate, diameter of hole would

a) always increase b) always decrease c) remains the same d) none of the above

32. A black body is at $727\,^{\circ}\mathrm{C}$. It emits energy at a rate which is proportional to____

a) $(1000)^4$ b) $(1000)^2$ c) $(727)^4$ d) $(727)^2$

33. A beaker full of hot water is kept in a room and it cools from 80°C to 75°C in t_1 minutes, from 75°C to 70° C in t_2 minutes and from 70° C to 65° C in t_3 minutes. Then

a) $t_1 > t_2 > t_3$ b) $t_1 = t_2 = t_3$ c) $t_1 < t_2 = t_3$ d) $t_1 < t_2 < t_3$

34. The amount of heat that a body can absorb by radiation

a) depends on colour and temperature both of body

b) depends on colour of body only c) depends on temperature of body only

d) depend on density of body

35. When water boils or freezes, during these processes its temperature

a) increases b) decreases c) does not change

d) sometimes increase and sometimes deceases

36. Heat given to a system can be associated with

a) kinetic energy of random motion of molecules
b) kinetic energy of orderly motion of molecules
c) total kinetic energy of random and orderly motion of molecules
d)
kinetic energy of random motion in some cases and kinetic energy of orderly motion in other

37. Oil at 25 ^oC is poured very slowly into a calorimeter that is at temperature of 120 ^oC. The boiling point of the oil is 80 ^oC. It is found that the first 5 g of the oil completely evaporates. After pouring another 75 g of the oil the equilibrium temperatwe is found to be 40 ^oC. The ratio of the latent heat of the oil to its specific heat will be ___________ ^oC.
a) 170 b) 167 c) 134 d) 133

38. The rate of loss of heat depends on
a) the sum of temperature of the body and its surroundings
b) the difference in temperature of the body and its surroundings
c) the product of temperature of the body and its surroundings
d) the ratio of temperature of the body and its surroundings

39. The temperature of inversion of a thermocouple is $620\,^\circ C$ and the neutral temperature is $300\,^\circ C$. What is the temperature of cold junction?
a) 320°C b) 20°C c) −20°C d) 40°C

40. The of equal masses of three different liquids A, B and C are 12^0C, 19^0C and 28^0C respectively. The temperature B are mixed is 16^0C and when B and is 23^0C. The temperature when A mixed is
a) 18.2^0C b) 22^0C c) 20.2^0C d) 24.2^0C

41. Two rods of thermal conductivities K_1 and K_2, crosssections A_1 and A_2 and specific heats S_1 and S_2 are of equal lengths. The temperatures of two ends of each rod are T_1 and T_2. The rate of flow of heat at the steady state will be equal if___
a) $\frac{K_1}{A_1S_1} = \frac{K_2}{A_2S_2}$ b) $K_1A_1 = K_2A_2$ c) $K_1S_1 = K_2S_2$ d) $A_1S_1 = A_2S_2$

42. 'M' kg of water at 80 ^oC is divided into two parts so that one part of mass 'm' kg when converted into ice at 0 ^oC would release enough heat to vaporise the other part entirely, then $\frac{m}{M}$ is equal to ___________
(Take Specific heat of water= 1 cal g -1 $^oC^{-1}$,
Latent heat of fusion of ice = 80 cal g^{-1},
Latent heat of steam = 540 cal g^{-l})
a) 4.78 b) 5.78 c) 0.78 d) 1.78

43. Which of the following circular rods, (given radius r and length l) each made of the same material and whose ends are maintained at the same temperature difference will conduct most heat?
a) $r = 2r_0; l = 2l_0$ b) $r = 2r_0; l = l_0$ c) $r = r_0; l = 2l_0$ d) $r = r_0; l = l_0$

44. A cup of tea cools from 65.5° C to 62.5° C in one minute in a room of 22.5° CC. How long will the same cup of tea take to cool from 46.5° C to 40.5° C in the same room. (Choose the nearest value in min.)

a) 1 b) 2 c) 3 d) 4

45. A body cools at the rate of 2.8 ^oC/min, when its temperature is 70 ^oC. If the temperature of its surroundings is half the temperature of the body, then the rate of cooling of the body at 40 ^oC will be__________ ^oC / min.

a) 1 b) 0.1 c) 0.2 d) 0.4

46. It is hotter at the some distance over the top of a fire than it is on the side of it mainly because

a) heat is radiated upwards b) air conducts heat upwards

c) convection takes more heat upwards

d)

conduction, convection and radiation all contribute significantly in transferring heat up wards.

47. The temperature of sun is measured With

a) platinum thermometer b) gas thermometer c) Pyrometer

d) vapour pressure thermometer

48. If temperature scale is changed from C to F, numerical value of specific heat will

a) increase b) decrease c) remains same d) cannot say

49. Water of volume 2 litre in a container is heated with a coil of 1 kW at 27° C. The lid of the container is open and energy dissipates at the rate of 160 Js^{-1}. In how much time temperature will rise from 27° C to 77° C? [Given specific heat of water = 4.2 kJ/kg]

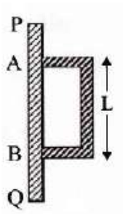
a) 8 min 20 s b) 6 in 2 s c) 7 min d) 14 min

50. The bottoms of utensils for cooking food are blackened to

a) absorb minimum heat from fire b) absorb maximum heat from fire

c) emit radiations d) reflect heat to surroundings

51. Temperature difference between two ends of a uniform rod PQ of length 2L is 150^oC. Another identical rod AB is bent and connected to PQ to form a rectangle as shown in figure. In steady state, temperature difference between ends A and B will be _____________^oC.



a) 60 b) 78 c) 67 d) 87

52. The radii of two copper spheres are in the ratio 1 : 4 and their temperatures are in the ratio 24 : I. What will be the ratio of heat content in them?

a) 0.38 b) 12 c) 14 d) 6

53. An electric heater, with power 10 W is used to heat a container filled with 0.5 kg of water. Ir is found that the temperature of water and the container rises by 3 K in 15 minutes. The container is then emptied, dried and filled with 2 kg of oil. The same heater now raises the temperature of container-oil system by 2 K in 20 minutes. Assuming that there is no heat loss in the process and the specific heat of water is 4200 $Jkg^{-1}K^{-1}$, the specific heat of oil in the same unit is equal to __________ x 10^3.
a) 3.55 b) 1.55 c) 2.55 d) 5.55

54. Hot water cools from 60° C to 50° C in first 10 min and 42° C in next 10 min. Then, the temperature of surrounding is
a) 10°C b) 15°C c) 20°C d) 30°C

55. Newton's law of cooling hold's good only, if the temperature difference between the body and the surrounding is
a) less than 40° C b) more than 50° C c) less than 100° C d) more than 100° C

56. Two metal rods 1 and 2 of same lengths have same temperature difference between their ends. Their thermal conductivities are K_1 and K_2 and cross sectional areas A_1 and A_2, respectively. If the rate of heat conduction in rod 1 is four times that in rod 2, then ______
a) $K_1A_1 = K_2A_2$ b) $K_1A_1 = 4K_2A_2$ c) $K_1A_1 - 2K_2A_2$ d) $4K_1A_1 = K_2A_2$

57. Coefficient of volumetric expansion α_V is not a constant. It depends on temperature. Variation of α_V with temperature for metals is
a) b) c) d)

58. Steam at $100\,^\circ C$ is passed into 20 g of water at $10\,^\circ C$. When water acquires a temperature of $80\,^\circ C$, the mass of water present will be:
[Take specific heat of water $= 1 cal g^{-1}\,^\circ C^{-1}$ and latent heat of steam $= 540 cal g^{-1}$]_____
a) 24 g b) 31.5 g c) 42.5 g d) 22.5 g

59. The two ends of a metal rod are maintained at temperatures $100\,^\circ C$ and $110\,^\circ C$. The rate of heat flow in the rod is found to be 4.0 J/s. If the ends are maintained at temperatures $200\,^\circ C$ and $210\,^\circ C$, the rate of heat flow will be____
a) 16.8 J/s b) 8.0 J/s c) 4.0 J/s d) 44.0 J/s

60. At atmospheric pressure, water boils at 100°C. If pressure is reduced, then
a) it still boils at same temperature b) it now boils at a lower temperature
c) it now boils at a higher temperature d) it does not boil at all

61. If a cylinder of radius R having thermal conductivity K_1 is surrounded by other cylindrical shell of radius 2R having thermal conductivity K_2 . Two ends are maintained at two different temperatures. In steady state, the effective thermal conductivity of system is (assume no heat loss)

a) $\frac{k_1+4k_2}{4}$ b) $\frac{k_1+3k_2}{4}$ c) $\frac{4k_1+k_2}{4}$ d) $\frac{3k_1+k_2}{4}$

62. The coefficient of thermal conductivity of copper is nine times that of steel. In the composite cylindrical bar shown in fig. What will be the temperature at the junction of copper and steel?

a) 84.3° C b) 67° C c) 33° C d) 25° C

63. Time taken to heat water upto a temperature of 40°C (from room temperature) is t1 and time taken to heat mustard oil (of same mass and at room temperature) upto a temperature of 40°C is t_2, then (given mustard oil has smaller heat capacity)

a) $t_1 = t_2$ b) $t_1 > t_2$ c) $t_2 > t_1$ d) t_1 and t_2 both are less than 10 min

64. Three rods of copper. brass and steel are welded together to term an inverted Y-shaped structure. End of copper rod is maintained at 100 °C whereas ends of brass and steel are kept at 0 °C. All the three rods have same length of 9 cm and cross section of 4.5 cm^2. Th. rods are thermally insulated from surroundings except at ends. Rate of heat flow through copper rod is________ calls.
(Take thermal conductivities of copper, brass and steel to be 0.9, 0.24 and 0.11 CGS units respectively.)

a) 12.6 b) 12 c) 13 d) 13.6

65. It is hotter at some distance ova the fire than front of it, because

a) heat is radiated upwards only b) convection of heat occurs downwards only

c) air conducts heat upwards d) convection of heat occures upwards only

66. A normal dict furnishes 2000 kcal to a 60 kg person in a day. If this energy was used to heat the person with no losses to the surroundings, how much the would the person temperature increases? The specific heat of the human body is 0.83 $calg^{-1}\,{}^{o}C^{-1}$

a) 8.2°C b) 4.01°C c) 6.0°C d) 5.03°C

67. A spherical body with radius 12 cm radiates 450 W power at 500 K. If the radius were halved and the temperature doubled what would be the power radiated?

a) 2000 W b) 1500 W c) 1800 W d) 2500 W

68. Certain quantity of water cools from 85 °C to 55 °C in the first I0 minutes and to 43 °C in the next I0 minutes. The temperature of the surroundings is ________ °C.

a) 35 b) 36 c) 65 d) 67

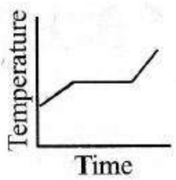
69. Which of the following has the highest specific heat

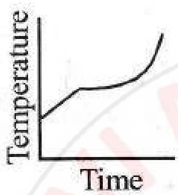
a) copper b) water c) hydrogen d) silver

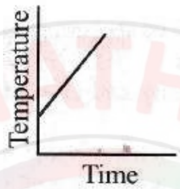
70. The molar specific heats of an ideal gas at constant pressure and volume are denoted by C_P and C_V respectively. If $Y = \frac{C_P}{C_V}$ and R is the universal gas constant, then C_V is equal to______

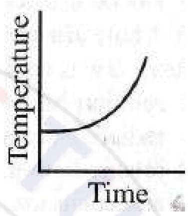
a) $\frac{R}{(y-1)}$ b) $\frac{(\gamma-1)}{R}$ c) gR d) $\frac{1+\gamma}{1-\gamma}$

71. TWO layers of cloth Of equal thickness provide warmer covering than a Single layer of cloth of double the thickness, because they
    a) behave like a therms   b) have lesser thickness
    c) allow heat of atmosphere to come to body   d) enclose between them a layer of air
72. On observing light from three different stars P, Q and R, it was found that intensity of violet colour is maximum in the spectrum of P, the intensity of green colour is maximum in the spectrum of R and the intensity of red colour is maximum in the spectrum of Q. If T_P, T_Q and T_R are the respective absolute temperature of P, Q and R, then it can be concluded from the above observations that ____________ .
    a) $T_P > T_R > T_Q$ b) $T_P < T_R < T_Q$ c) $T_P < T_Q < T_R$ d) $T_P > T_Q > T_R$
73. Liquid oxygen at 50 K is heated to 300 K at constant pressure of 1 atm. The rate of heating is constant. Which one of the following graphs represents the variation of temperature with time?

a) 

b) 

c) 

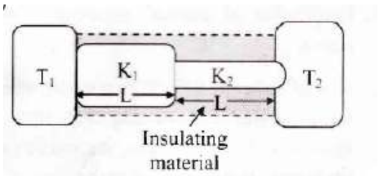
d) 

74. Two identical rods of copper and iron are coated with wax uniformly. When one end of each is kept at temperature of boiling water, the length upto which wax melts are 7 .2 cm and 3.6 cm respectively. If thermal conductivity of copper is 0.92, then what is the thermal conductivity of iron?
    a) 1   b) 0.23   c) 1.23   d) 3
75. At Absolute zero
    a) all substances exist in solid form   b) Molecular motion ceases
    c) Water becomes ice   d) zone of the above
76. A cylindrical rod having temperature T_1, and T_2 at its end. The rate of flow of heat is $Q_1 \text{cal/sec}$. If all the linear dimensions are doubled keeping temperature constant, then the rate of flow of heat Q_2 will be______
    a) 4 Q   b) 2 Q   c) Q_1 / 4   d) Q_1 / 2
77. Cooking is difficult on hills becuase
    a) atmospheric pressure is higher   b) atmospheric pressure is lower
    c) boiling point of water is reduced   d) Both (b) and (c)
78. Which one of the following would raise the temperature of 40 g of water at 20^o C most mixed with?
    a) 20 g of water at 40^o C   b) 30 g of water at 30^o C   c) 10 g of water at 60^o C
    d) 4 g of water at 100^o C
79. A lead bullet at 277 'C just melts when stopped by an obstacle. Assuming that 25o/o of heat is absorbed by the obstacle, the minimum velocity the bullet should possess at the time of striking is __________ m/s. (Take M.P. of lead = 327 ^{o}C, c_{lead} = 0.03 cal/g ^{o}C, latent heat of fusion of lead = 5.5 cal/g, 1 cal = 4.20 J)

a) 250 b) 280 c) 300 d) 320

80. In which of the following process, convection does not take place primarily?
a) sea and land breeze b) boiling of water
c) warming of glass of bulb due to filament d) heating air around a furnace

81. Two conducting cylinders are connected in series with each other. They are kept between two heat baths at temperatures T_1 = 200 K and T_2 = 400 K as shown in the figure. Radius of the smaller cylinder is half the radius of bigger one, whereas, both of them have same length L. Thermal conductivities of the materials of the larger and the smaller cylinders are K_1 and K_2 respectively. In steady state, if temperature at the junction of the two cylinders is 300 K. then $\left(\frac{K_1}{K_2}\right)$ will be ________.



a) 0.13 b) 0.25 c) 0.15 d) 0.45

82. An electric kettle takes 4 A current at 220 V. How much time will it take to boil 1 kg of water from temperature 20 °C? The temperature of boiling water is 100 °C ____
a) 6.3 min b) 8.4 min c) 12.6 min d) 4.2 min

83. 70 calories of heat are required to increase the temperature of 2 moles of an ideal gas from 30° C to 35° C at constant pressure. The amount of heat required to increase the temperature of the same gas through same temperature range (30° C to 35° C) at constant volume will be (R = 2 cal/mole/K).
a) 30 cals b) 50 cals c) 70 cals d) 90 cals

84. A black body has maximum wavelength I_m at temperature 2000 K. Its corresponding wavelength at temperature 3000 K will be____
a) $\frac{3}{2}\lambda_m$ b) $\frac{2}{3}\lambda_m$ c) $\frac{4}{9}\lambda_m$ d) $\frac{9}{4}\lambda_m$

85. A bimetallic strip is made of aluminium and steel $\left(\alpha_{Al} > \alpha_{steel}\right)$ on heating, the strip will
a) remain straight b) get twisted c) get twisted
d) bend with aluminium on concave side

86. If a liquid cools from 70°C to 55°C in 5 min and then to 45° C in 10 min, then temperature of surrounding is
a) 50°C b) 60°C c) 25°C d) 20°C

87. Ice at -20 °C is added to 40 g of water at 50 °C. When the temperature of the mixture reaches 0 °C, it is found that 25 g of ice is still unmelted. The amount of ice added to the water was _______________ g.
(Take, specific heat of water = 4.18 $Jg^{-1}\,{}^{o}C^{-1}$, specific heat of ice = 2.1 $Jg^{-1}\,{}^{o}C^{-1}$ and latent heat of fusion of water at 0 °C = $3341g^{-1}$)

a) 44.44 b) 44 c) 45.44 d) 45.44

88. Dimensional formula of specific heat capacity is
a) $[ML^2T^{-2}L^{-1}]$ b) $[MLT^{-2}K^{-1}]$ c) $[M^0L^2T^{-2}K^{-1}]$ d) $[ML^2T^{-2}K]$

89. If there are no heat losses, the heat released by the condensation of x gram of steam at 100°C into water at 100 °C can be used to convert y gram of ice at 0 °C into water at 100 ^{0}C. Then the ratio y : x is nearly
a) 1 : 1 b) 2 : 1 c) 3 : 1 d) 25 : 1

90. Three very large plates of same area are kept parallel equispaced and close to each other. They are considered as ideal black surfaces and have very high thermal conductivity. The first and third plates are maintained at temperatures 3T and 2T, respectively. The temperature of the middle (i.e., second) plate under steady state ,condition is n^4. The value of no will be __________
a) 48.5 b) 44.5 c) 47.5 d) 49.5

91. The two ends of a rod of length L and a uniform cross sectional area A are kept at two temperatures T_1 and T_2 $\left(T_1 > T_2\right)$. The rate of heat transfer, $\frac{dQ}{dt}$ through the rod in a steady state is given by_____
a) $\frac{dQ}{dt} = \frac{k\left(T_1 - T_2\right)}{LA}$ b) $\frac{dQ}{dt} = kLA\left(T_1 - T_2\right)$ c) $\frac{dQ}{dt} = \frac{kA\left(T_1 - T_2\right)}{L}$ d) $\frac{dQ}{dt} = \frac{kL\left(T_1 - T_2\right)}{A}$

92. A black body at $1227\,^\circ C$ emits radiations with maximum intensity at a wavelength of 5000 A°. If the temperature of the body is increased by $1000\,^\circ C$, the maximum intensity will be observed at____
a) 5000 A° b) 6000 A° c) 3000 A° d) 4000 A°

93. The thickness of ice on a lake is 10 cm and the temperature of air is -10°C. If rate of cooling of water inside lake is 20000 cal min^{-1} through each square metre surface, then K for ice is
a) 14 b) 10 c) 3 d) 4

94. Which of the following circular rods given radius r and length l, each made of the same material and whose ends are maintained at the same temperature will conduct most heat?
a) $r = r_0 : l = l_0$ b) $r = 2r_0; l = l_0$ c) $r = r'_\theta l = 2l_0$ d) $r = 2r_0; l - 2I_0$

95. Wein's displacement law for emission of radiation can be written as
a) λ_{max} is inversely proportional to square of absolute temperature (T^2)
b) λ_{max} is inversely proportional to absolute temperature (T)
c) λ_{max} is directly proportional to absolute temperature (T)
d) λ_{max} is inversely proportional to square of absolute temperature (T^2)

96. The specific heat of ice at 0^0C melting into water at 0^0C is
a) zero b) infinity c) more than zero d) less than zero

97. Two uniform solid spheres made from copper have radii 15 cm and 20 cm respectively. Both are kept at temperature 70 °C. If the temperature of the surrounding is 45 °C, then find the ratio of rates of cooling of both the spheres initially.
a) 1.33 b) 2.44 c) 5.78 d) 3.45
98. A beaker is completely filled With water at 4^0C. It will overflow
a) when heated, but not When cooled b) when cooled, but not heated
c) both with heated or cooled d) neither when heated nor when cooled
99. Wien's law is concerned with_____
a) relation between emissivity and absorptivity of a radiating surface
b) total radiation, emitted by a hot surface
c) an expression for spectral distribution of energy of a radiation from any source
d)
a relation between the temperature of a black body and the wavelength at which there is maximum radiant energy per unit wavelength
100. A 0.5 kg of mass is attached to a massless spring with k = 600 N/m. The system is completely immersed in a vessel containing 1 kg of water. The spring is made to oscillate with amplitude of 5 cm. When the oscillations are stopped completely, the change in the temperature of the water will be x 10^{-4} K. (Consider, specific heat of the mass = 900 J/kg-K, specific heat of water = 4200 J/kg-K, the heat received by the vessel and spring can be neglected.)
a) 2.61 b) 2 c) 1.61 d) 1
101. The increase in internal energy of a gas per unit mass per unit rise in temp is equal to
a) C_v b) C_p c) C_p-C_v d) C_p+C_v
102. 336 g of ice at 0^0C is mixed With 336 g of water at 80^0C.The final temp of the mixture is
a) 80^0C b) 40^0C c) 60^0C d) 0^0C
103. A clock with a steel pendulum keeps correct time at 25°C. What will be the error in second per day, if room temperature is 35°C? (coefficient of linear expansion, $\alpha_{steel} = 5 \times 10^{-5} C^{-1}$)
a) 43.2 s gained b) 43.2 s lost c) 21.6 s gained d) 21.6 s lost
104. At what temperature (in ° C), the fahrenheit and celsius scale gives same reading?
a) 40 b) -40 c) 8 d) -8
105. Which of the following qualities are best suited for a cooking utensil?
a) High specific heat and low thermal conductivity
b) High heat and high thermal conductivity
c) low specific heat and low thermal conductivity
d) Low specific heat and high thermal conductivity
106. A polished metal plate With a rough black spot on it has heated to about 1400K and quickly taken a dark room.The spot will appear
a) darker than plate b) brighter than plate c) equally bright d) equally dark

107. Assuming the sun to have a spherical outer surface of radius r, radiating like a black body at temperature $\rho\,^{\circ}\mathrm{C}$, the power received by a unit surface, (normal to the incident rays) at a distance R from the centre of the sun is____
(where s is the Stefan's constant.)
a) $\frac{r^2\sigma(t+273)^4}{4\pi R^2}$ b) $\frac{16\pi^2 r^2\sigma t^4}{R^2}$ c) $\frac{r^2\sigma(t+273)^4}{R^2}$ d) $\frac{4\pi r^2\sigma t^4}{R^2}$

108. The density of water at 20° C is 998 kg / m^3 and at 40° C is 992 kg / m^3. The coefficient of volume expansion of water is_____.
a) $10^{-4/\rho}\mathrm{C}$ b) $3\times10^{-4/0}\mathrm{C}$ c) $2\times10^{-4/\rho}\mathrm{C}$ d) $6\times10^{-4/9}\mathrm{C}$

109. At about 4°C, a certain amount of water has maximum
a) energy b) specific heat c) density d) Volume

110. Two identical rods AC and CB made of two different metals having thermal conductivities in the ratio 2 : 3 are kept in contact with each other at the end C as shown in Fig. A is at 100°C and B is at 25°C. Then the junction C is at

a) 55°C b) 60°C c) 75°C d) 50°C

111. On a hilly region, water boils at 95°C. The temperature expressed in fahrenheit is
a) 100°F b) 20.3 °F c) 150°F d) 203°F

112. The molar specific heat at constant pressure of an ideal gas is (7/2) R. The ratio of specific heat at constant pressure to that at constant volume is
a) 9/7 b) 7/5 c) 8/7 d) 5/7

113. A metal rod having a coefficient of linear expansion of 2.5 x 10^{-5} /°C has a length of 1 m at 20 °C. The temperature at which it is shortened by 1 mm is _______ °C.
a) -20 b) -10 c) 2 d) 1

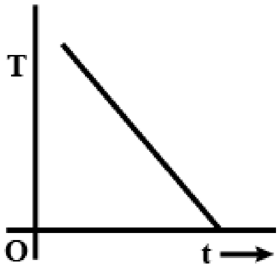
114. If temperature of a perfectly black body is increased two times, then the rate of perfectly black body increases to
a) two times b) four times c) eight times d) sixteen times

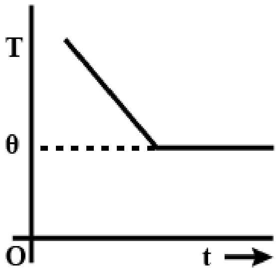
115. The scale on a steel meter rod is calibrated at 20°C. What will be the error in the reading of 50 ern at 27°C? Take, a = 1.2 x 10.5 °C^{-1}
a) 0.0021 CM b) 0.042CM c) 0.0042 d) 0.021 CM

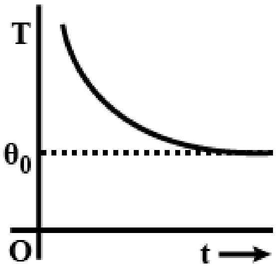
116. A star emits wavelength 289.8 nm of maximum intensity. Then, radiant intensity of state is ($\sigma = 5.67\times10^{-8}W/m^2/k^4$, Wein's constant, b=2898X10^{-6} mK)
a) 5.67X10^{16} W/m^2 b) 5.67X10^{14} W/m^2 c) 5.67X10^{10} W/m^2 d) 5.67X10^{8} W/m^2

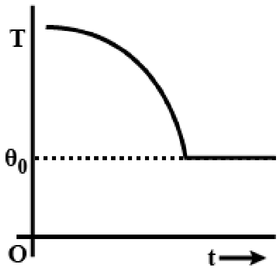
117. Two rods of same length and material transfer a given amount of heat in 12s, when they are joined end to end (ie. in series). But when they are joined in parallel, they will transfer same heat under same conditions in
a) 2rs b) 3s c) 48s d) 1.5s

118. If a piece of metal is heated to temperature θ and then allowed to cool in a room which is at temperature θ_0, the graph between the temperature T of the metal and time t will be closed to

a) 

b) 

c) 

d) 

119. A liquid boils when its vapour pressure is equal to
a) 6.0 cm of Hg column b) atmospheric pressure c) double of atmospheric pressure
d) 1000 Pa or more

120. Coefficient of cubical expansion for water is zero at___________ °C.
a) 4 b) 5 c) 6 d) 7

121. Water is used as a coolant because of its
a) lower density b) easy availability c) high specific heat d) low specific heat

122. If temperature of black body increases from 300 K to 900 K, then the rate of energy radiation increase by
a) 81 b) 3 c) 9 d) 2

123. Three copper bodies at temperature 30 °C. 20°C and 35 °C have masses 3m, m and 2m respectively. If the bodies are brought in thermal contact, then the final temperature attained by the bodies will be ___________ °C.
a) 10 b) 30 c) 40 d) 50

124. Heat is associated with
a) kinetic energy of random motion of molecules
b) kinetic energy of orderly motion of molecules
c) total kinetic energy of random and orderly motion of molecules
d)
kinetic energy of random motion in some cases and kinetic energy of orderly motion in other

125. A black body at $227\,^\circ\mathrm{C}$ radiates heat at the rate of 7 cals/cm^2 s. At a temperature of $727\,^\circ\mathrm{C}$, the rate of heat radiated in the same units will be __________ .
a) 50 b) 112 c) 80 d) 60

126. The volume of a metal sphere increases by 0.24% when its temperature is raised by 40^0C.the coefficient of linear expansion of the metal is
a) 2×10^{-5} b) 6×50^{-5} c) 18×10^{-5} d) 1.2×10^{-5}

127. Two spheres are made of same metal and have mass. One is solid and the other is hollow.When heated to the same temperature, increase in diameter will be
a) more for hollow sphere b) less for hollow sphere c) same for both d) cannot say

128. A cylindrical metallic rod in thermal contact with two reservoirs of heat at its two ends conducts an amount of heat Q in time t. The metallic rod is melted and the material is formed into a rod of half the radius of the original rod. What is the amount of heat conducted by the new rod, when placed in thermal contact with the two reservoirs in time t?
a) $\frac{Q}{4}$ b) $\frac{Q}{16}$ c) 2Q d) $\frac{Q}{2}$

129. The presence of gravitational field is required for the heat transfer by
a) stiffing of liquids b) conduction c) natural convection d) radiation

130. The rate of radiation of a black body at 0^0C is E watt.The rate of radiation of this body at 273^0C will be
a) 16E b) 8E c) 4E d) E

131. In a room containing air, heat can go from place to another by
a) conduction b) convection c) radiation d) all these

132. A thermometer graduated according to linear scale reads a value t when in contact with boiling water and $\frac{t}{4}$ when kept in contact with ice. When the thermometer is in contact with an object it reads $\frac{t}{3}$ What is the temperature of the object in ^{o}C?
a) 12 b) 12.12 c) 11.11 d) 11

133. The density of a substance at 0^0C is 10g/cc and at 100^0C, its density is 9.7 g/cc The coefficient of linear expansion of the substance is
a) $10^{-4}\ {}^0C^{-1}$ b) $10^{-2}\ {}^0C^{-1}$ c) $10^{-3}\ {}^0C^{-1}$ d) $10^{2}\ {}^0C^{-1}$

134. On a new scale of temperature (which is linear) and called the W scale, the freezing and boiling points of water are $39\,^\circ W$ and $239\,^\circ W$ respectively. What will be the temperature on the new scale, corresponding to a temperature of $39\,^\circ C$ on the Celsius scale $^+$?
a) $78\,^\circ W$ b) $117\,^\circ W$ c) $200\,^\circ W$ d) $139\,^\circ W$

135. A pendulum clock gains 5 s a day if the temperature is 15 ^{o}C and loses I0 s a day if the temperature is 30 ^{o}C. The relation between coefficient of linear expansion (α) of the metal of the pendulum shaft and time period (T) of the pendulum is $\alpha = \frac{x}{T}$ where x has the value

____

a) 1 b) 2 c) 3 d) 4

136. If specific heat of a substance is infinite, it means
a) heat is given out b) heat is taken in
c) no change in temperature takes place whether heat is taken in or given out
d) All of the above

137. If the cold junction of a thermo-couple is kept at $0\,^\circ\mathrm{C}$ and the hot junction is kept at $\mathrm{T}\,^\circ\mathrm{C}$ then the relation between neutral temperature $\left(T_n\right)$ and temperature of inversion $\left(T_i\right)$ is______

a) $T_n = 2T_i$ b) $T_n = T_i - T$ c) $T_n = T_i + T$ d) $T_n = T/2$

138. Equal volumes of two liquids are cooled under identical circumstances from 72 ^{o}C to 40 ^{o}C and time taken by them are 510 and 850 seconds respectively. If ratio of their specific heats is 3 : 4, then the density of first liquid is _______________ times density of second liquid. (Work done may be neglected.)

a) 0.8 b) 0.7 c) 0.5 d) 0.6

139. An aluminium sphere is dipped into water. Which of the following is true?

a) Buoyancy will be less in water at 0°C than that in water at 4°C

b) Buoyancy will be more in water at 0°C than that in water at 4°C

c) Buoyancy in water at 0°C will be same as that in water at 4°C

d) Buoyancy may be more or less in water at 4°C depending on the radius of the sphere

140. Due to change in main voltage the temperature of the electric bulb rises from 3000K to 4000K. What is the percentage rise in electric power consumed?

a) 216 b) 100 c) 150 d) 178

141. At NTP, water boils at 100° C. Deep down the mine, water will boil at a temperature

a) 100°C b) > 100°C c) < 100°C d) will not boil at all

142. Change of state from solid to vapour state without passing through the liquid state is called

a) regelation b) sublimation c) condensation d) sedimentation

143. One kilogram of water at 40 oC is heated in an electric kettle whose heating element has a mean (temperature averaged) resistance of 20 Ω. The rms voltage in the mains is 200 V. Ignoring heat loss from the kettle, time taken for water to evaporate fully in minutes is __________.

(Take specific heat of water = 4200 J/kg ^{o}C, latent heat of water = 2262 kJ/kg)

a) 26.85 b) 20 c) 20.95 d) 25.95

144. Radiation from which of the following sources, approximates black body radiation best?

a) A tungsten lamp b) Sodium flame c) Hot lamp black

d) A hole in a cavity, maintained at constant temperature

145. If the radius of a star is R and it acts as a black body, what would be the temperature of the star, in which the rate of energy production is Q?

(s stands for Stefan's constant)

a) $Q/4\mathrm{p}R^2\,\mathrm{s}$ b) $\left(Q/4\mathrm{p}R^2\,\mathrm{s}\right)^{-1/2}$ c) $\left(4\mathrm{p}R^2 Q'\mathrm{s}\right)^{1/4}$ d) $\left(Q/4\mathrm{p}R^2\,\mathrm{s}\right)^{1/4}$

146. Two rods X and Y having equal lengths. Then, cross-sectional area are A_x and A_y and thermal conductivities K_x and K_y . When the temperature at ends of each rod are are T_x and T_y respectively, the rate of flow of heat through X and Y will b, if equal

a) $\frac{A_x}{A_y}=\frac{K_y}{K_x}$ b) $\frac{A_x}{A_y}=\frac{K_y}{K_x}\times\frac{T_y}{T_x}$ c) $\frac{A_x}{A_y}=\sqrt{\frac{K_y}{K_x}}$ d) $\frac{A_x}{A_y}=\left(\frac{K_y}{K_x}\right)^2$

147. A uniform metallic rod rotates about its perpendicular bisector with constant angular speed. If it is heated uniformly to raise its temperature slightly

a) its speed of rotation increases b) its speed of rotation decreases

c) its speed of rotation remains same

d) its speed increases because its moment of inertia increases

148. Variation of the density of water with respect to temperature from 0°C to 10°C is correctly represented by

a) b) c) d)

149. Consider a compound slab consisting of two different materials having equal thickness and thermal conductivities K and 2K respectively. The equivalent thermal conductivity of the slab is

a) (2/3) K b) $\sqrt{2}K$ c) 3 K d) (4/3) K

150. As the temperature is increased, the period of a pendulum

a)
increases as its effective length increases even though its centre of mass still remains at the centre of the bob

b)
decreases as its effective length increases even though its centre of mass still remains at the centre of the bob

c)
increases as its effective length increases due to shifting to centre of mass below the centre of the bob

d)
decreases as its effective length remains same but the centre of mass shifts above the centre of the bob

151. A metal sphere 10.01 cm in diameter is placed on a brass ring of internal diameter I0 cm and at the same temperature of I0 °C. Determine the
temperature (in °C) up to which they should be heated together so that the metal sphere just passes through the ring.

(αmetal = 11.74 x 10-6/ °C and

αbrass = 18.002 x 10^{-6}/ °C)

a) 170 b) 120 c) 130 d) 150

152. Pressure of an ideal gas is i=ncreases by keeping temperature constant.What is effect on kinetic energy of molecules?

a) Increase b) Decrease c) No change d) Cannot be determined

153. If gas molecules undergo inelastic collision with the wall of the container:
a) the temperature of the gas will decrease b) the pressure of the gas will increase
c) neither the temperature nor the pressure will change
d) the temperature of the gas will increase

154. 1 mole of a gas with $\gamma = \frac{7}{5}$ is mi9xed with 1 mole of a gas with $\gamma = \frac{5}{3}$, then the value of γ for the resulting mixture is
a) $\frac{7}{5}$ b) $\frac{2}{5}$ c) $\frac{24}{16}$ d) $\frac{12}{7}$

155. A gas is heated through 1°C in a closed vessel. Its pressure is increased by 0.4%. The initial temperature of the gas is:
a) 250°C b) 100°C c) -75°C d) -23°C

156. The rms speed of the molecules of a gas in a vessel is 400 m s^{-1} . If half of the gas leaks out, at constant temperature, the rms speed of the remaining molecules will be:
a) 800 ms^{-1} b) $400\sqrt{2}ms^{-1}$ c) 400 ms^{-1} d) 200 ms^{-1}

157. 1L of hydrogen and 1L of oxygen are given at NTP.Which of them are correct?
a) Hydrogen has larger number of moles b) Oxygen has larger number of moles
c) Both have same number of moles d) None of the above

158. Math the laws given in column I with their formulae given in column II and select the correct option from the choice given below

Column I	Column II
A.Charle's law	1.pV=constant[at constant temperature]
B.Gay-Lussac's law	2.$\frac{V}{T}$=constant[At constant pressure]
C.Boyle's law	3.$\frac{p}{T}$=constant[At constant volume]

a)	b)	c)	d)
ABC	ABC	ABC	ABC
123	231	321	213

159. A closed vessel A having volume V contains N_2 at pressure P and temperature T. Another closed vessel B having the same volume V contains He at the same pressure P but temperature 2T. The ratio of masses of N_2 and He in the vessels A and B is
a) 1 : 2 b) 3 : 2 c) 5 : 2 d) 14 : 1

160. The ratio of the total energy of all the molecules of one mole of O_2 to the total energy of all the molecules of two moles of He at the same temperature is:
a) 2 : 1 b) 1 : 2 c) 5 : 4 d) 5 : 6

161. For a real gas (van der Waals' gas):
a) Boyle temperature is a/ Rb b) Critical temperature is a/ Rb
c) Triple temperature is 2a/ Rb d) Inversion temperature is a/2Rb

162. The root mean square speed of hydrogen molecules at a certain temperature is 300 m/s. If the temperature is doubled and hydrogen gas dissociates into atomic hydrogen, the rms speed will become:

a) 424.26 mls b) 300 m/s c) 600 M/s d) 150 M/s

163. If the pressure in a closed vessel is reduced by drawing out some of the gas, the mean free path of two molecules:
a) is increased b) is decreased c) remains unchanged
d) increases or decreases according to the nature of the gas

164. A vessel of volume V contains a mixture of 1 mole of hydrogen and 1 mole of oxygen(both considered as ideal).Let f_1(V) dv, denotes the fraction of molecules with speed between v and (v+dv) with f_2 (v)dv, similarly for oxygen, then
a) $f_1(v)+f_2(v)=f(v)$ obeys the Maxwell's distribution law
b) $f_1(v),f_2(v)$ will obey the Maxwell's distribution law
c) Neither $f_1(v)$ nor $f_2(v)$ will obey the Maxwell's distribution law
d) $f_2(v)$ and $f_1(v)$ will be the same

165. If C_8 be the velocity of sound in air and C be the rms velocity, then:
a) Cs < C b) Cs = C c) Cs = $C\sqrt{\gamma/3}$ d) none of these

166. If one mole of a monoatomic gas $\gamma = \frac{5}{3}$ is mixed with one mole of a diatomic gas($\gamma = \frac{7}{5}$), the value of γ for mixture is
a) 1.40 b) 1.50 c) 1.53 d) 3.07

167. A sealed container with negligible thermal coefficient of expansion contains helium (a monoatomic gas). When it is heated from 300 K to 600 K, the average kinetic energy of helium atoms is:
a) halved b) left unchanged c) doubled d) increases by a factor of $\sqrt{2}$

168. If the pressure of an ideal gas contained in a closed vessel increased by 0.5%, the increase in temperature is 2 K. The initial temperature of the gas is:
a) 27°C b) 127°C c) 300^0C d) 400^0C

169. 1L of oxygen at a pressure of 1atm and 2L nitrogen at a pressure of 0.5 atm are introduced into a vessel of the volume 1L.If there is no change in the temperature, the final pressure of the mixture of gas (in atm) is
a) 1.5 b) 2.5 c) 2 d) 4

170. Two vessels having equal volume contain molecular hydrogen at one atmosphere and helium at two atmospheres respectively. If both samples are at the same temperature, the rms velocity of hydrogen molecules is:
a) equal to that of helium b) equal to that of helium c) equal to that of helium
d) $\sqrt{2}$ times that of helium

171. The temperature of a gas contained in a closed vessel increases by 2°C, when the pressure is increased by 2%. The initial temperature of the gas is:
a) 200 K b) 100 K c) 200°C d) 100°C

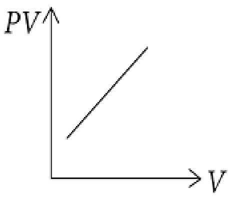
172. If the rms velocity ofagas is v, then:
a) v^2T = constant b) v^2/T = constant c) vT^2 = constant d) v is independent of T

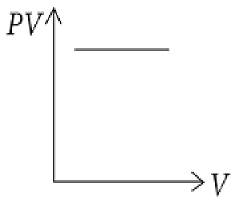
173. A gas at a temperature of 250 K is contained in a closed vessel. If the gas is heated through 1°C, the percentage increase in its pressure is nearly:
a) 0.4% b) 0.6% c) 0.8% d) 1.0%

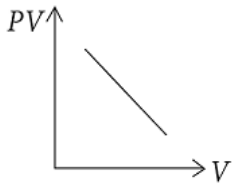
174. If the masses of all molecules of a gas are halved and their speeds doubled, then the ratio of initial and final pressures would be
a) 2:1 b) 1 : 2 c) 4 : 1 d) 1 : 4

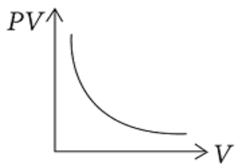
175. The root mean square and most probable speed of the molecules in a gas are:
a) same b) different c) cannot say d) depends on nature of the gas

176. Which one of the following graphs represents the behaviour of an ideal gas?

a) 

b) 

c) 

d) 

177. Ratio of V_{mp} (most probable speed), V_{av} (average speed), V_{rms} (root mean square speed) of gas molecules are related as
a) $\sqrt{3}:\sqrt{2}:\sqrt{\frac{8}{\pi}}$ b) $2:\sqrt{3}:\sqrt{\frac{\pi}{8}}$ c) $\sqrt{2}:\sqrt{3}:\sqrt{\frac{8}{\pi}}$ d) $\sqrt{2}:\sqrt{\frac{8}{\pi}}:\sqrt{3}$

178. If V_H, V_N and V_O denotes the root mean square velocities of molecules of hydrogen, notrogen and oxygen respectively at a given temperature then :
a) $V_H > V_N > V_O$ b) $V_O > V_N = V_H$ c) $V_O > V_H > V_N$ d) $V_N > V_O > V_H$

179. The equation of state corresponding to 8 g of O_2 is
a) PV = 8RT b) $PV = \frac{RT}{4}$ c) PV = RT d) $PV = \frac{RT}{2}$

180. A mixture of2 moles of helium gas (atomic mass = 4 amu) and 1 mole of argon gas (atomic mass = 40 amu) is kept at 300K in a container. The ratio of the rms speed

$\left[\frac{v_{rms}(helium)}{v_{rms}(argon)}\right]$ is:

a) 0.32 b) 0.45 c) 2.24 d) 3.16

181. At Upper atmospere,an astronaut feels:
a) extremely hot b) slightly hotter c) extremely cool d) slightly cooler

182. For a gas, $\frac{R}{C_V} = 0.67$, the gas is made up of molecules which are
a) monoatomic b) diatomic c) triatomic d) polyatomic

183. The root mean square velocity of O_2 at atmospheric pressure and at 0° C is:
a) more than that of air b) less than that of ai c) equal to that of air
d) nothing can be sa

184. Two thermally insulated vessels 1 and 2 are filled with air at temperatures (T_1, T_2), volume (V_1, V_2) and pressure (P_1, P_2)respectively. Ifthe valve joining the two vessels is opened, the temperature inside the vessel at equilibrium will be

a) T_1+T_2 b) $(T_1+T_2)/2$ c) $\frac{T_1T_2(P_1V_1+P_2V_2)}{P_1V_1T_2+P_2V_2T_1}$ d) $\frac{T_1T_2(P_1V_1+P_2V_2)}{P_1V_1T_2+P_2V_2T_2}$

185. The root mean square speeds of molecules of ideal gases at the same temperature are:
a) the same b) inversely proportional to the square root of the molecular weight
c) directly proportional to the molecular weight
d) inversely proportional to the molecular weight

186. If the Pressure of a gas contained in a vessel is increased by 0.4% when heated through 1^0C, the initial temperature has been:
a) 2500 K b) 250 K c) 250^0C d) 25^0C

187. Two gases of equal mass are in thermal equilibrium. If P_a ,P_b and V_a and V_b are their respective pressures and volumes, then which relation is true?
a) $P_aV_a = P_bV_b$ b) $P_a/V_a = P_b/V_b$ c) $P_a = P_b$; $V_a \neq V_b$ d) $P_a \neq P_b$; $V_a \neq V_b$

188. The rms speed of oxygen is vat a particular temperature. If the temperature is doubled and oxygen molecules dissociate into oxygen atoms, the rms speed becomes:
a) v b) $\sqrt{2}$ v c) 2 v d) 4 v

189. Two identical containers A and B with frictionless pistons contain the same ideal gas at the same temperature and the same volume V. The mass of gas A is mA and that of B is m_B. The gas in each cylinder is now allowed to expand isothermally to the same final volume 2V. The change in the pressure in A and B are found to be △P and 1.5 M respectively. Then:
a) $4m_A = 9m_B$ b) $3m_A = 3m_B$ c) $3m_A = 2m_B$ d) $9m_A = 4m_B$

190. At a given volume and temperature the pressure of a gas:
a) varies inversely as its mass b) varies inversely as the square of its mass
c) varies linearly as its mass d) is independent of its mass

191. Three perfect gases at absolute temperatures T_1 ,T_2 and T_3 are mixed. The masses of molecules are m_1 , m_2 and m_3 and the number of molecules are n_1 ,n_2 and n_3 respectively. Assuming no loss of energy, the final temperature of the mixture is:
a) $\frac{(T_1+T_2+T_3)}{3}$ b) $\frac{n_1T_1+n_2T_2+n_3T_3}{n_1+n_2+n_3}$ c) $\frac{n_1T_1^2+n_2T_2^2+n_3T_3^2}{n_1T_1+n_2T_2+n_3T_3}$ d) $\frac{n_1^2T_1^2+n_2^2T_2^2+n_3^2T_3^2}{n_1T_1+n_2T_2+n_3T_3}$

192. The root mean square velocity of the molecules in a sample of helium is 5/7th that of the molecules in a sample of hydrogen. If the temperature of hydrogen sample is O°C, that of helium sample is about:
a) O°C b) 283 K c) 0 K d) 100^OC

193. The air density at Mount Everest is less than that at sea level. It is found by mountaineers that for one trip lasting a few hours, the extra oxygen needed by them corresponds to 30,000 cc at sea level (pressure = 1 atmosphere, temperature = 27°C). Assuming that the temperature around Mount Everest is -73° e and that the oxygen cylinder has capacity of 5.2 litres, the pressure at which oxygen be filled (at site) in the cylinder is:
a) 3.86 atm b) 5.00 atm c) 5.77 atm d) I atm

194. Two containers of equal volume contain the same gas at the pressures p_1 and p_2 and absolute temperatures T_1 and T_2 respectively.On joining vessels, the gas reaches a common pressure p and a common temperature T.The ratio of p/T is

a) $\frac{p_1T_2+p_2T_2}{T_1\times T_2}$ b) $\frac{p_1T_2+p_2T_2}{T_1+T_2}$ c) $\frac{1}{2}[\frac{p_1T_2+p_2T_1}{T_1T_2}]$ d) $\frac{p_1T_2-p_2T_2}{T_1\times T_2}$

195. The temperature of gas is produced by:

a) the potential energy of its molecules b) the kinetic energy of its molecules

c) the attractive force between its molecules

d) the attractive force between its molecules

196. Real gas behaves as an ideal gas at

a) high temperature and high pressure b) low temperature and high pressure

c) low pressure and high temperature d) low pressure and low temperature

197. A gas at pressure P_o is contained in a vessel. Ifthe masses of all the molecules are halved and their speeds doubled, the resulting pressure would be:

a) $4P_0$ b) $2P_0$ c) P_0 d) $P_0/2$

198. A balloon contains 1500 m^3 of helium at 27°C and 4 atmospheric pressure. The volume of helium at -3°C temperature and 2 atmospheric pressure will be:

a) 1500 m^3 b) 1700 m^3 c) 1900 m^3 d) 2700 m^3

199. You are given samples of 1 cm^3 of H_2, 1 cm^3 of O_2 and 1 cm^3 of Cl_2, which are at NTP. The sample which has maximum number of molecules is:

a) H_2 b) O_2 c) Cl_2 d) all have same values

200. Oxygen and hydrogen are at the same temperature T. The ratio of the mean kinetic energy of oxygen molecules to that of the hydrogen molecules will be:

a) 16:1 b) 1:1 c) 4:1 d) 1:4

201. The mean kinetic energy of the mole of gas per degree of freedom (on the basis of Kinetic theory of gases) is ;

a) $\frac{1}{2}$ kT b) $\frac{3}{2}$ kT c) $\frac{3}{2}$ kT d) $\frac{1}{2}$ RT

202. By what percentage should the pressure of a given mass of a gas be increased so as to decrease its volume by 10% at a constant temperature?

a) 8.1% b) 9.1% c) 10.1% d) 11.1%

203. A real gas behaves like an ideal gas if its:

a) pressure and temperature are both high b) pressure and temperature are both low

c) pressure is high and temperature is low d) pressure is low and temperature is high

204. An ideal gas is

a) one which consists of massless particles

b) one satisfying assumption of kinetic theory c) a gas consisting small particles

d) one that consists of molecules

205. Two identical cylinders contain helium at 2.5 atmosphere and argon at one atmosphere respectively. If both the gases are filled in one of the cylinders. the pressure would be:

a) 3.5 atm b) 1.75 atm c) 1.50 atm d) 1 atm

206. Let $\bar{v}$, $\bar{v}$ and v_p respectively denote the mean speed, root mean square speed and most probable speed of the molecules in an ideal monoatomic gas at absolute temperature T. The mass of the molecule is m. Then:

a) No molecules can have a speed greater than $\left(\sqrt{2}v_{rms}\right)$

b) No molecules can have a speed less than $\frac{v_p}{\left(\sqrt{2}\right)}$ c) $\bar{v} < v_p < v_{rms}$

d) the average kinetic energy of the molecules is $\frac{3}{4}(mv_p^2)$

207. The ratio of the vapour densities of two gases at a given temperature is 9 : 8 .The ratio of the rms velocities of their molecules is :

a) $3 : 2\sqrt{2}$ b) $2\sqrt{2} : 3$ c) 9 : 8 d) 8 : 9

208. In the process PV = constant, pressure (P) versus density (p) , graph of an ideal gas is:

a) a straight line parallel to P-axis b) a straight line parallel to p-axis

c) a straight line passing through origin d) a parabola

209. 1 kg of diatomic gas is at a pressure of $8x14^4 Nm^{-2}$. The density of the gas is $4kgm^{-3}$. What is the energy of the gas due to its thermal motion?

a) $3x10^4$J b) $5x10^4$J c) $6x10^4$J d) $7x10^4$J

210. An insulated container of gas has two chambers separated by an insulating partition. One of the chambers has volume V_1 and contains ideal gas at pressure p_1 and temperature T_1. The other chamber has volume V_2 and contains ideal gas pressure p_2 and temperature T_2. If the partition is removed without doing any work on the gas, the final equilibrium temperature of the gas in the container will be

a) $\frac{T_1T_2(p_1V_1+p_2V_2)}{p_1V_1T_2+p_2V_2T_1}$ b) $\frac{p_1V_1T_1+p_2V_2T_2}{p_1V_1+p_2V_2}$ c) $\frac{p_1V_1T_2+p_2V_2T_1}{p_1V_1+p_2V_2}$ d) $\frac{T_1T_2(p_1V_1+p_2V_2)}{p_1V_1T_1+p_2V_2T_2}$

211. For a gas molecule with 6 degrees of freedom, law of equipartition of energy gives the following relation between the molecular specific heat(C_V)and gas constant(R)

a) $C_V = \frac{R}{2}$ b) C_V=R c) C_V=2R d) C_V=3R

212. At which of the following temperatures would the molecules of a gas have twice the average kinetic energy they have at 27° C?

a) 313°C b) 373°C c) 393°C d) 586°C

213. If the intermolecular forces vanish away, the volume occupied by the molecules contained in 4.5 kg water at STP will be given by:

a) 5.6 m^3 b) 4.5 m^3 c) 11.2 m^3 d) 5.6 m^3

214. A bubble is at the bottom of the lake of depth h. As the bubble comes to sea level, its radius increases three times. If atmospheric pressure is equal to 1metres of water column, then h is equal to:

a) 26 l b) l c) 25 l d) 30 l

215. A vessel has 6 g of hydrogen at pressure P and temperature 500 K. A small hole is made in it so that hydrogen leaks out. How much hydrogen leaks out if the final pressure is P/2 and temperature falls to 300 K?

a) 2 g b) 3 g c) 4 g d) 1 g

216. On any planet, the presence of atmosphere implies; (v_{rms} = root mean square velocity of molecules and v_e = escape velocity))
a) $v_{rms} << v_e$ b) $u_{rms} > v_e$ c) $v_{rms} = v_e$ d) $v_{rms} = 0$

217. If γ is the ratio os specific heats and R is the universal gas constant, then the molar specific heat at constant volume C_V is given by
a) γR b) $\frac{\gamma-1}{\gamma}$ c) $\frac{R}{\gamma-1}$ d) $\frac{\gamma R}{\gamma-1}$

218. A thermally insulated vessel contains an ideal gas of molecular mass M and ratio of specific heats γ.It is moving with speed v and is suddenly brought to rest.Assuming no heat is lost to the surroundings, its temperature increases by
a) $\frac{(\gamma-1)}{2R}Mv^2K$ b) $\frac{(\gamma-1)}{2(\gamma+1)R}Mv^2K$ c) $\frac{(\gamma-1)}{2\gamma R}Mv^2K$ d) $\frac{\gamma Mv^2}{2R}K$

219. Some gas at 300 K is enclosed in a container. Now, the container is placed on a fast moving train. While the train is in motion, the temperature of the gas:
a) rises above 300 K b) falls below 300 K c) remains unchanged
d) becomes unsteady

220. If average velocity becomes 4 times then what will be the effect on rms velocity at that temperature?
a) 1.4 times b) 4 times c) 2 times d) $\frac{1}{4}$ times

221. Nitrogen is in equilibrium state at T = 421 K. The value of most probable speed , v_{mp} is:
a) 400 ms^{-1} b) 421 ms^{-1} c) 500 ms^{-1} d) 600 ms^{-1}

222. Consider a gas with density ρ and $\bar{c}$ as the root mean square velocity of its molecules contained in a volume. If the system moves as a whole with velocity u, then the pressure exerted by the gas is:
a) $\frac{1}{3}\rho\bar{c}^2$ b) $\frac{1}{3}\rho(\bar{c}+v)^2$ c) $\frac{1}{3}\rho(\bar{c}-v)^2$ d) $\frac{1}{3}\rho(\bar{c}^2-v)^2$

223. The total KE of all the molecules of helium having a volume V exerting a pressure P is 15001. The total KE (in joules) of all the molecules of N2 having the same volume V and exerting a pressure 2P is:
a) 3000 b) 4000 c) 5000 d) 6000

224. The mass of H_2 molecule is 3.32 x 10^{-24} g. if 10^{23} hydrogen molecules per second strike 2 cm^2 of wall at an angle of 45° with the normal, when moving with a speed of 10^5 cm/s, the cm/s, pressure exerted on the wall is nearly:
a) 1350 N/m^2 b) 2350 N/m^2 c) 3320 N/m^2 d) 1660 N/m^2

225. At a certain temperature, radius of an air bubble is doubled when it comes to the top from the bottom of a mercury column of height 'h'. If the pressure at the top is two atmospheres, the value of' h' (in metres) is:
a) 5.5 b) 10.64 c) 12.45 d) 15.00

226. To expel half the mass of air from a large flask at 27° C it must be heated to:
a) 54^0C b) 177^0C c) 277^0C d) 327^0C

227. A thermally insulated vessel contains an ideal gas of molecular mass M and ratio of specific heats γ.It is moving with speed v and is suddenly brought to rest.Assuming no heat is lost to the surroundings, its temperature increases by

a) $\frac{(\gamma-1)}{2R}Mv^2K$ b) $\frac{(\gamma-1)}{2(\gamma+1)R}Mv^2K$ c) $\frac{(\gamma-1)}{2\gamma R}Mv^2K$ d) $\frac{\gamma Mv^2}{2R}K$

228. If the pressure and temperature of an ideal gas is doubled and volume is halved, the number of molecules of the gas:

a) remains constant b) becomes half c) becomes two times d) becomes four times

229. A sample of gas is at 0° C to what temperature must it be raised in order to double the rms speed of its molecules?

a) 103^0C b) 273^0C c) 819^0C d) 1092^0C

230. One mole of an ideal gas undergoes a process in which $T=T_0+qv^3$, where T_0 and a are positive constants and v is volume.The volume for which pressure will be minimum

a) $(\frac{T_0}{2a})^{1/3}$ b) $(\frac{T_0}{3a})^{1/3}$ c) $(\frac{a}{2T_0})^{2/3}$ d) $(\frac{a}{3T_0})^{2/3}$

231. One kg of a diatomic gas is at a pressure of 8x 10^4 N/m ^{2}. The density of the gas is 4kg/m^3. What is the energy of the gas due to its thermal motion?

a) 3 x 10^4 J b) 5 x 10^4 J c) 6 x 10^4 J d) 7 x 10^4 J

232. The relation between rms velocity , v_{rms} and the most probable velocity , v_{rmp} , of a gas is:

a) $v_{rms} = v_{mp}$ b) $v_{rms} = \sqrt{\frac{3}{2}}\, v_{mp}$ c) $v_{rms} = \sqrt{\frac{2}{3}}v_{mp}$ d) $v_{rms} = \frac{2}{3}v_{mp}$

233. During an experiment an ideal gas is found to obey an additional law VP^2 = constant. The gas is initially at temperature T and volume V, when it expands to volume 2V, the resulting temperature is

a) T/2 b) 2T c) $\sqrt{2}$T d) T/$\sqrt{2}$

234. The quantity PV/kT(k= Boltzmann's constant) represents:

a) number of moles of the gas b) total mass of the gas

c) number of molecules in the gas d) density of the gas

235. We write the relation for Boyle's law in the form PV = C when the temperature remains constant. In this relation, the magnitude of C depends upon:

a) the nature of the gas used in the experiment b) the magnitude of g in the laboratory

c) the atmospheric pressure d) the quantity of gas enclosed

236. The average momentum of a molecule in an ideal gas depends on:

a) temperature b) volume c) molecular mass d) none of these

237. Equal volume of monoatomic and diatomic gases at the same temperature are given equal quantities of heat. Then:

a) the temperature of diatomic gas will be more

b) the temperature of monoatomic gas will be more

c) the temperature of both will be zero d) nothing can be said

238. For Boyle's law to hold, the gas should be:

a) perfect and of constant mass and temperature
b) real and of constant mass and temperature
c) perfect and at constant temperature but variable mass
d) real and at constant temperature but variable mass

239. A graph is plotted with PV/T on y-axis and mass of the gas along x-axis for different gases. The graph is:
a) a straight line parallel to x-axis for all the gases
b)
a straight line passing through origin with a slope having a constant value for all the gases
c)
a straight line passing through origin with a slope having different values for different gases
d) a straight line parallel to y-axis for all the gases

240. Hydrogen has maximum rms speed at NTP because:
a) it is the lightest gas b) it absorbs heat rapidly c) it is a good conductor of heat
d) it has only one electron in its atom

241. The temperature at which protons in proton gas would have enough energy to overcome Coulomb barrier of 4.14 x 10^{-14} is (Boltzmann constant 1.38 x 10^{-23} JK^{-1})
a) 2 x 10^9 K b) 10^9 K c) 6 x 10^9 K d) 3 x 10^9 K e) 4.5 10^9 K

242. One litre of oxygen at a pressure of 1 atm and two litres of nitrogen at a pressure of 0.5 atrn are introduced into a vessel ofvolurne I L. If there is no change in temperature, the final pressure of the mixture of gas (in atm) is:
a) 1.5 b) 2.5 c) 2 d) 4

243. In two vessels of same volume atomic hydrogen and helium at pressure of 1 atm and 2 atm are filled. If temperature of both the samples is same, then average speed of hydrogen atom (UH) will be related to helium (UHe) as:
a) $\langle v_H \rangle = \sqrt{2}\langle v_{He} \rangle$ b) $\langle v_H \rangle = \langle v_{He} \rangle$ c) $\langle v_H \rangle = 2\langle v_{He} \rangle$ d) $\langle v_H \rangle = \langle v_{He}/2 \rangle$

244. 1 kg of a diatomic gas its at a pressure of $8x10^4$ N/m^2.The density of gas is $4kg/m^3$.What is the energy of gas due to its thermal motion?
a) $3x10^4$J b) $5x10^4$J c) $6x10^4$J d) $7x10^4$J

245. One gram mole of nitrogen occupies 2 x 10^4 cc at a pressure of 10^6 dynes/cm ^{2}. The average energy of a nitrogen molecule (in erg) will be: (Avogadro's number = 6 x 10^{23})
a) 14 x 10^{-13} b) 10 x 10^{-12} c) 10^6 d) 2 x 10^6

246. At what temperature the molecules of nitrogen will have the same rms velocity as the molecules of oxygen a 127^0 C
a) 77^0C b) 350^0C c) 273^0C d) 457^0C

247. Two vessels A and B having equal volume contain equal Two vessels A and B having equal volume contain equal mark the correct statement.

a) The pressure exerted by hydrogen is half that exerted by helium.
b) The pressure exerted by hydrogen is half that exerted by helium.
c)
Average KE of the molecules of hydrogen is half the average KE of the molecules of helium.
d) The pressure exerted by hydrogen is twice that exerted by helium.

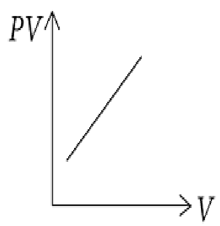
248. What is an ideal gas?
a) One that consists of molecules b) A gas satisfying the assumptions of kinetic theory
c) A gas having Maxwellian distribution of speed
d) A gas consisting of massless particles

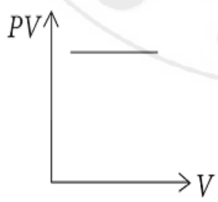
249. One mole of an ideal gas undergoes a process:
$$P = \frac{P_0}{1+(V_0/V)^2}.$$
Here Po and Vo are constants. Change in temperature of the gas when volume is changed from V = Vo to V = 2Vo IS:
a) $P = \frac{2P_0V_0}{5R}$ b) $P = \frac{11P_0V_0}{10R}$ c) $P = \frac{5P_0V_0}{4R}$ d) P_0V_0

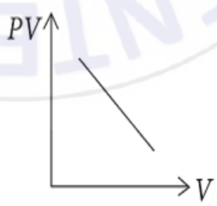
250. Air inside a closed container is saturated with water vapour The air pressure is p and the saturated vapour pressure of water is $\bar{p}$.if the mixture is compressed to one half of its volume by maintaining temperatures constant, the pressure becomes ;
a) $2(p+\bar{p})$ b) $2p+\bar{p}$ c) $\frac{(p+\bar{p})}{2}$ d) $p+2\bar{p}$

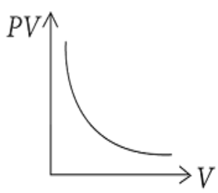
251. Which of the following gases possesses maximum rms velocity, all being at the same temperature?
a) Oxygen b) Air c) Carbon dioxide d) Hydrogen

252. Which one of the following graphs represent the behaviour of an ideal gas?

a) 

b) 

c) 

d) 

253. The speeds of 5 molecules of a gas (in arbitrary units) are as follows 2, 3, 4, 5, 6 The root mean square speed for these molecules is:
a) 2.91 b) 4.00 c) 3.52 d) 4.24

254. The average kinetic energy of a gas molecule at 27^0C is 6.2×10^{-21}J. Its average kinetic energy at 127^0C will be
a) 12.2×10^{-21}J b) 8.28×10^{-21}J c) 10.35×10^{-21}J d) 11.35×10^{-21}J

255. A vessel contains 32 gm of O_2 at a temperature T. The pressure of the gas is P. An identical vessel containing 4 gm of H_2 at a temperature 2T has a pressure of:
a) 8P b) 4P c) 9 d) $\frac{P}{8}$

256. At constant temperature the value of Vrms will be same for which of the following?

a) H_2 and O_2 b) N_2 and CO_2 c) Air and N_2 d) None of these

257. IF both the temperature and the volume of an ideal gas are doubled , the pressure:
a) Increases by a factor of 4 b) is also doubled c) remains unchanged
d) is diminshed by a factor $\frac{1}{4}$

258. The equation of state for 5g of O_2 at a pressure P and temperature T, when occupying a volume V, will be:
a) PV = 5/32 RT b) PV = 5RT c) PV = 5/2 RT d) PV = 5/16 RT

259. Some gas at 300K is enclosed in a container.Now the container is placed on a fast moving jet.While the jet is in motion, the temperature of gas
a) rises above 300K b) falls below 300K c) remains unchanged
d) becomes unsteady

260. The root mean square velocity of the molecules of a gas is 1260 m/s. The average speed of the molecules is
a) 1029 ms^{-1} b) 1161 ms^{-1} c) 1671 ms^{-1} d) 917 ms^{-1}

261. When temperature of an ideal gas is increased from 27°C to 227°C, its rms speed is changed from 400 m/s to v_s. The V_s is:
a) 516 m/s b) 450 m/s c) 310 m/s d) 746 m/s

262. In a container neon gas two isotopes Ne^{20} and Ne^{22}. the ratio of rms Velocities of Ne^{20} and Ne^{22} is
a) $\sqrt{11}:\sqrt{10}$ b) $\sqrt{10}:\sqrt{11}$ c) 10 : 11 d) 10 : 10

263. Two monoatomic ideal gases A and B occupying the same volume V, are at the same temperature T and pressure P. If they are mixed, the resultant mixture has volume V and temperature T. The pressure of the mixture is:
a) P b) $\frac{P}{2}$ c) 4P d) 2P

264. The gas in a vessel is subjected to a pressure of 20 atmosphere at a temperature 27° C. The pressure of the gas in the vessel after one half of the gas is released from the vessel and the temperature of the remainder is raised by, 50° C, is:
a) 8.5 atm b) 10.8 atm c) 11.67 atm d) 17 atm

265. If oxygen (O_2) has root mean square velocity of Cms^{-1}, then root mean square velocity of hydrogen (H_2) will be:
a) C ms^{-1} b) $\frac{1}{C}ms^{-1}$ c) 4C s^{-1} d) C/4 ms^{-1}

266. A jar has a mixture of hydrogen and oxygen gases in the ratio of 1 : 5. The ratio of mean kinetic energies of hydrogen and oxygen molecules is:
a) 1:16 b) 1:4 c) 1:5 d) 1:1

267. N molecules, each of mass m, of gas A and 2N molecules, each of mass 2m, of gas B are contained in the same vessel which are maintained at a temperature T.The mean square of the velocity of molecules of B type is denoted by v^2 and the mean square of the X component of the velocity of A type is denoted by w^2 ; then $w^{2/}v^2$ is:
a) 2 b) 1 c) (1/3.) d) (2/3)

268. An insulated box containing a diatomic gas of molar mass M is moving with a velocity u. The box is suddenly stopped. The resulting change in temperature is:

a) $\frac{mv^2}{2R}$ b) $\frac{mv^2}{3R}$ c) $\frac{mv^2}{5R}$ d) $\frac{2mv^2}{5R}$

269. The phenomenon of Brownian movement may be taken as evidence of ;

a) kinetic theory of matter b) electromagnetic theory of radiation

c) corpuscular theory of light d) photoelectric phenomenon

270. The temperature of an ideal gas is increased from 120 K to 480 K. If at 120 K, the root mean square speed of gas molecules is u, then at 480 K it will be:

a) 4v b) 2v c) $\frac{v}{2}$ d) $\frac{v}{4}$

271. The average kinetic energy of a helium atom at 30°C is:

a) 50-60 eV b) 13.6 eV c) a few KeV d) less than leV

272. If there were no atmosphere, the average temperature on the surface of the earth would be:

a) lower b) higher c) same as now d) 0^0C

273. Two gases A and B having same pressure P, volume V and temperature T are mixed. If mixture has volume and temperature as V and T respectively, then the pressure of the mixture will be:

a) 4P b) 3P c) 2P d) P

274. In an ideal gas without preferred direction of motion molecules,

a) None of the above b) $v_x = v_y = v_z$ c) $v_x^2 = v_x^y = v_z^2$ d) $\bar{v}_x^2 = \bar{v}_y^2 = \bar{v}_z^2$

275. A container has N molecules at absolute temperature T. If the number of molecules is doubled but kinetic energy in the box remains the same as before, the absolute temperature of the gas is:

a) T b) T/2 c) 2T d) zero

276. If C_p and C_V denote the specific heats of nitrogen per unit mass at constant pressure and constant volume respectively, then

a) C_p-C_V=$\frac{R}{28}$ b) C_p-C_V=$\frac{R}{14}$ c) C_p-C_V=R d) C_p-C_V=2R

277. The value of molar specific heat at constant pressure for one mole of triatomic gas (triangular arrangement)of temperature TK is(R=universal gas constant)

a) 3R b) $\frac{2}{7}$R c) $\frac{5}{2}$R d) 4R

278. The root mean square velocity, vrms, the avaerage velocity, v_{av} and the most probable velocity , v_{mp} of the molecules of the gas are in the order:

a) $v_{mp} > v_{av} > v_{rms}$ b) $v_{rms} > v_{av} > v_{mp}$ c) $v_{av} > v_{mp} > v_{rms}$ d) $v_{mp} > v_{rms} > v_{av}$

279. The root mean square (rms) speed of oxygen molecule (O_2)at a certain temperature T is V.If temperature is doubled and oxygen gets dissociated into atomic oxygen, what is speed of atomic oxygen?

a) 2v b) 3v c) v/2 d) 5v

280. At room temperature the nns speed of the molecules of a certain diatomic gas is found to be 1930 m/s; the gas is:
a) hydrogen b) fluorine c) oxygen d) chlorine

281. Two balloons are filled, one with pure He gas and other by air, respectively. If the pressure and temperature of these balloons are same, then the number of molecules per unit volume is:
a) more in the He filled balloon b) same in both balloons c) more in air filled balloon
d) in the ratio of 1 : 4

282. A vessel contains a mixture of Imole of oxygen and 2 moles of nitrogen at 300 K. The ratio of average rotational kinetic energy per 0_2 molecule to that of per N_2 molecule is:
a) 1:1 b) 1 : 2 c) 2 : 1

283. 10,000 small balls, each weighing 1 g, strike one square em of area per second with a velocity 100 m/s in a normal direction and rebound with the same velocity. The value of pressure on the surface will be:
a) 2 x 10^3 N/m^2 b) 2 x 10^5 N/m^2 c) 10^7 N/m^2 d) 2 x 10^7 N/m^2

284. The gas having average speed four times as that of $S0_2$ (molecular mass 64) is:
a) He (molecular mass 4) b) O_2 (molecular mass 32) c) H_2 (molecular mass 2)
d) CH_4 (molecular mass 16)

285. The value of $\frac{PV}{T}$ for one mole of an ideal gas is nearly equal
a) 2.7 mol^{-1} k^{-1} b) 8.3 mol^{-1} k^{-1} c) 4.2 J mol^{-1} k^{-1} d) 2 cal mol^{-1} k^{-1}

286. A gaseous mixture consists of 16g of helium and 16g of oxygen.The ratio $\frac{C_p}{C_V}$ of the mixture is
a) 1.59 b) 1.62 c) 1.4 d) 1.54

287. Half a mole of helium at 27° C and at a pressure of 2 atmosphere is mixed with I.5 mole of Nj at 77° C and at a pressure at 5 atmosphere so that the volume of the mixture is equal to the sum of their initial volumes. If the temperature of the mixture is 69° C, its pressure is:
a) 3.5 atm b) 3.8 atm c) 3.95 atm d) 4.25 atm

288. Consider I cc sample of air at absolute temperature To at sea level and another 1 cc sample of air at a height, where pressure is one-third atmosphere.The absolute temperature T of the sample at the height is:
a) equal to (T_0 / 3) b) equal to (3 / T_0) c) equal to T_o
d) cannot be determind in terms of T_0 from the above data

289. A closed vessel of fixed volume contains a mass m of an ideal gas, the root mean square speed being u. Additional mass m of the same gas is pumped into the vessel and the pressure rises to 2P, the temperature remaining the same as before. The root mean square speed of the molecules now is:
a) $\left(v/\sqrt{2}\right)$ b) $v\sqrt{2}$ c) 2v d) v

290. Internal energy of n_1 mole of hydrogen at temperature T is equal to internal energy of n_2 mole of helium at temperature 2T.Then, ratio $\frac{n_1}{n_2}$ is

a) $\frac{3}{2}$ b) $\frac{2}{3}$ c) $\frac{6}{5}$ d) $\frac{3}{7}$

291. The terms velocity of a particle is v_{rms} at pressure P. If Pressure is increased to two times, then rms velocity becomes:

a) $2v_{rms}$ b) $3v_{rms}$ c) $0.5v_{rms}$ d) v_{rms}

292. If a given mass of gas occupies a volume of 10 cc at 1 atmospheric pressure and temperature 100^0 C (373.15 K). What will be its volume at 4 atmospheric pressure; the temperature being the same?

a) 104 cc b) 2.5 cc c) 400 cc d) 100 cc

293. The average kinetic energy of a gas molecule is:

a) proportional to pressure of gas b) inversely proportional to volume of gas

c) inversely proportional to absolute temperature of gas

d) proportional to absolute temperature of gas

294. At which of the following temperature would the molecules of a gas have twice the average kinetic energy they have at 20^0 C?

a) 586°C b) 313°C c) 80^0C d) 400^0C

295. The mass of oxygen gas occupying a volume of 11.2 litres at a temperature 27°C and a pressure of 760 mm of mercury is: (molecular weight of oxygen = 32)

a) 0.001456 kg b) 0.01456 kg c) 0.1456 kg d) 1.1456 kg

296. We have ajar A filled with gas characterised by parameters P, V and T and another jar B filled with gas with parameters 2P, V/4 and 2T, when the symbols have their usual meanings. The ratio of the number of molecules of jar A to those of jar B is:

a) 1:1 b) 1:2 c) 2:1 d) 4:1

297. When the temperature of a gas is increased:

a) its molecular kinetic energy increases

b)

molecular potential energy decreases and molecular kinetic energy also decreases; total energy remaining constant

c)

molecular potential energy increases and molecular kinetic energy decreases; total energy remaining constant

d) its molecular potential energy increases

298. Under which of the following conditions is the law PV = RT obeyed most closely by a real gas?

a) High pressure and high temperature b) Low pressure and low temperature

c) Low pressure and low temperature d) High pressure and low temperature

299. The root mean square velocity of the gas molecules is 300 m/s. What will be the root mean square speed of the molecules if the atomic weight is doubled and absolute temperature is halved?

a) 300 m/s b) 150 m/s c) 600 m/s d) 75 m/s

300. Which of the following methods will enable the volume of an ideal gas to be made four times greater? (Consider absolute temperature)

a) Quarter the pressure at constant temperature

b) Quarter the temperature at constant pressure

c) Half the temperature, double the pressure

d) Double the temperature, double the pressure

301. If the Avogadro's number was tend to infinity; the phenomenon of Brownian motion would:

a) remain completely unaffected

b)

become more vigorous than that observed with present finite values of Avogadro's number, for all sizes of the Brownian particles

c)

become more vigorous than that observed with the present finite value of Avogadro's number, only for relatively large Brownian particles

d)

become practically unobservable as the molecular impact would tend to balance one another, for practically all sizes of Brownian particles

302. Four cylinders contain equal number of moles of argon, hydrogen and carbon dioxide at same temperature.The energy is minimum in

a) argon b) carbon dioxide c) nitrogen d) hydrogen

303. The number of molecules in V litre of a gas NTP is

a) $\frac{N_0}{22.4} \times V$ b) $\frac{22.4}{N_0} \times V$ c) $\frac{N_0 \times 22.4}{V}$ d) $N_0 \times V \times 22.4$

304. The mean square speed of 4 molecules of a gas having speeds 1,2,3 and 4 m/s is

a) 2.44 m/s b) 7.5 m/s c) 2.5 m/s d) 9 m/s

305. The temperature of an ideal gas enclosed in a chamber is raised from 300 K to 600 K. The pressure becomes two fold because the:

a) mean molecular velocity becomes $\sqrt{2}$ fold

b) root mean square velocity becomes $\sqrt{2}$ fold

c) number of molecules striking the wall per unit time becomes 2 fold

d) energy transfer to walls per unit time becomes halved