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UNIT – 1

NATURE OF PHYSICAL WORLD AND MEASUREMENT

TRY AND TEST YOURSELF

LEVEL – I (1 - 50 Questions)

1. One of the combinations from the fundamental physical constants is $\frac{hc}{G}$. The unit of this expression is
   a) kg^2 b) m^3 c) s^{-1} d) m
2. If the error in the measurement of radius is 2%, then the error in the determination of Volume of the sphere will be
   a) 8% b) 2% c) 4% d) 6%
3. If the length and time period of an oscillating pendulum have errors of 1% and 3% respectively then the error in measurement of acceleration due to gravity is [AMPMT 2008]
   a) 4% b) 5% c) 6% d) 7%
4. The length of a body is measured as 3.51 m, if the accuracy is 0.01mm, then the percentage error in the measurement is
   a) 351% b) 1% c) 0.28% d) 0.035%
5. Which of the following has the highest number of significant figures?
   a) 0.007 m2 b) 2.64x1024 kg c) 0.0006032 m2 d) 6.3200 J
6. If $\pi = 3.14$, then the value of π^2 is
   a) 9.8596 b) 9.860 c) 9.86 d) 9.9
7. Which of the following pairs of physical quantities have same dimension?
   a) force and power b) torque and energy c) torque and power d) force and torque
8. The dimensional formula of Planck's constant h is [AMU, Main, JEE, NEET]
   a) $[ML^2 T^{-1}]$ b) $[ML^2 T^{-3}]$ c) $[MLT^{-1}]$ d) $[ML^3 T^{-3}]$
9. The velocity of a particle v at an instant t is given by $v = at + bt^2$.The dimensions of b is
   a) [L] b) $[LT^{-1}]$ c) $[LT^{-2}]$ d) $[LT^{-3}]$
10. The dimensional formula for gravitational constant G is [AIPMT 2004]
    a) $[ML^3 T^{-2}]$ b) $[M^{-1}L^3 T^{-2}]$ c) $[M^{-1}L^{-3}T^{-2}]$ d) $[ML^{-3}T^2]$
11. The density of a material in CGS system of units 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, then the value of density of material will be
    a) 0.04 b) 0.4 c) 40 d) 400
12. If the force is proportional to square of velocity, then the dimension of proportionality constant is [JEE-2000]
    a) $[MLT^0]$ b) $[MLT^{-1}]$ c) $[ML^{-2}T]$ d) $[ML^{-1}T^0]$
13. The dimension of $(\mu_0 \in_0)^{-\frac{1}{2}}$ is [Main AIPMT 2011]
    (a) length (b) time (c) velocity (d) force
14. Planck's constant (h), speed of light in vacuum (c) and Newton's gravitational constant (G) are taken as three fundamental constants. Which of the following combinations of these has the dimension of length? [NEET 2016 (phase II)]
    (a) $\sqrt{\frac{hG}{C^{3/2}}}$ (b) $\sqrt{\frac{hG}{C^{5/2}}}$ (c) $\sqrt{\frac{hC}{G}}$ (d) $\sqrt{\frac{GC}{h^{3/2}}}$

15. A length-scale (l) depends on the permittivity (H) of a dielectric material, Boltzmann constant (k_B), the absolute temperature (T), the number per unit volume (n) of certain charged particles, and the charge (q) carried by each of the particles. Which of the following expression for l is dimensionally correct? [JEE (advanced) 2016]

(a) $l = \sqrt{\frac{nq^2}{\epsilon k_B T}}$ (b) $l = \sqrt{\frac{\epsilon k_B T}{nq^2}}$ (c) $l = \sqrt{\frac{q^2}{\epsilon n^{\frac{2}{3}} k_B T}}$ (d) $l = \sqrt{\frac{q^2}{\epsilon n k_B T}}$

16. If the units of mass, length and time are doubled unit of angular momentum will be
a) Doubled b) 8 times the original value c) Quadrupled d) Tripled

17. Planck's constant (h), speed of light in vacuum (c) and Newton's gravitational constant (G) are taken as three fundamental constant. Which of the following combination of these has the dimension of time?

a) $\frac{\sqrt{hG}}{C^{3/2}}$ b) $\frac{\sqrt{hG}}{C^{5/2}}$ c) $\sqrt{\frac{hc}{G}}$ d) $\sqrt{\frac{GC}{h^{3/2}}}$

18. Pressure is defined as:
a) Momentum per unit area b) Momentum per unit area per unit time
c) Momentum per unit volume d) Energy per unit volume

19. In C.G.S system the unit of Pressure are
a) Dynes / cm^2 b) Newton/ m^2 c) Pascal d) None of these

20. A physical quantity is measured and its value is found to be nu where n = numerical value and u = unit. Then which of the following relations is true.

a) $n \alpha u^2$ b) $n \alpha u$ c) $n \alpha \sqrt{u}$ d) $n \alpha \frac{1}{u}$

21. Which of the following pairs is wrong?
a) Heat and temperature b) Temperature and male
c) Heat and work d) Specific heat and heat

22. Joule – sec is the unit of
a) Work b) Momentum c) Pressure d) Angular momentum

23. Which of the following system of units is not based on units of mass, length and time alone
a) SI b) MKS c) FPS d) CGS

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

25. If the unit of length and force be increased four times, then the unit of energy is
a) Increased 4 times b) Increased 8 times
c) Increased 16 times d) Decreased 16 times

26. Number of base SI unit is
a) 4 b) 7 c) 3 d) 5

27. If the acceleration due to gravity is 10 ms^{-2} and the units of length and time are changed in kilometer and hour respectively, the numerical value of the acceleration is
a) 360000 b) 720000 c) 360000 d) 129600

28. The physical quantity that has no dimensions
a) Angular velocity b) Linear momentum
c) Angular momentum d) Strain

29. Energy of a photon is given by E=hv where v is number of vibrations per second and h is plank constant.Dimensions of plank constant are
a) $M^0L^0T^0$ b) $M^1L^2T^{-1}$ c) $M^1L^2T^{-2}$ d) $M^1L^2T^{-3}$

30. Energy of a photon is given by E = hc / λ, where c is speed of light in vaccum, λ is wave length and h is plank constant. Dimensions of plank's constant are.
a) $M^0L^0T^0$ b) $M^1L^2T^{-2}$ c) $M^1L^2T^{-1}$ d) $M^1L^2T^{-3}$

31. The dimension of $(\mu_0\epsilon_0)$ (or) $\sqrt{\mu_0\epsilon_0}$ is
a) $[L\ T^{-1}]$ b) $[L^{-1}\ T]$ c) $[L^{-1}\ T^{-1}]$ d) [L T]

32. One of the fundamental physical constant is hc. The unit of this expression is
a) Kg^2 b) Kg m^3 s^{-2} c) s^{-1} d) m

33. v is number of vibrations per second, λ is wavelength then physical quantity of v λ is
a) Acceleration b) force c) speed d) momentum

34. Which of the following relations is dimensionally correct:
a) $V^2 = u^2 + 2as$ b) $V^2 = u^2 + 2as^2$ c) $V^2 = u^2 + 2a^2s$ d) $V^2 = u^2 + 2\ a^2s^2$

35. Which one of the following has no dimension?
a) Angular velocity (ω) b) Angular displacement (θ)
c) Angular momentum (L) d) angular acceleration (α)

36. The relation between velocity and time of a body is given $V = A + \frac{B}{t} + Ct^2$ The units of A, B and C will be

	A	B	C		A	B	C
a)	m	m/sec	m/sec^2	b)	m/sec	m	m/sec^3
c)	m/sec^2	m/sec^3	m/sec^4	d)	m/sec	m/sec^2	m/sec^3

37. If Force = $\frac{X}{density}$ + C is dimensionally correct the dimensions of x are
a) $M\ L\ T^{-2}$ b) $M\ L\ T^{-3}$ c) $M\ L^2\ T^{-3}$ d) $M^2\ L^{-2}\ T^{-2}$

38. The ratio of the dimensions of plank constant and that of moment of Inertia has the dimensions of
a) Frequencyb) Velocity c) Angular momentum d) Time

39. In $S = at + bt + ct^2$. S is measured in meter and t in seconds. The unit of 'c' is
a) None b) m c) m sec^{-1} d) m sec^{-2}

40. Joule – sec is the unit of
a) Work b) Angular momentum c) Planck's constant d) both b & c

41. The equation of state of some gases can be expressed as $\left(p + \frac{a}{V^2}\right)\ (v - b) = RT$. Here P is the pressure, V is the volume, T is the absolute temperature and a, b, R are constants. The dimensions of 'a' are
a) $M\ L^5\ T^{-2}$ b) $M\ L^{-1}\ T^{-2}$ c) $M^0\ L^3\ T^0$ d) $M^0\ L^6\ T^0$

42. Dimensions of 'ohm' are same as that of (where h is planck's constant and e is charge)
a) $\frac{h}{e}$ b) $\frac{h^2}{e}$ c) $\frac{h}{e^2}$ d) $\frac{h^2}{e^2}$

43. If the velocity of light (c), gravitational constant (G) and planck's constant (h) are chosen as fundamental units then the dimensions of mass in new system is
a) $\sqrt{CGh}$ b) $\sqrt{\frac{CG}{h}}$ c) $\sqrt{\frac{Ch}{G}}$ d) $\sqrt{\frac{Gh}{C}}$

44. The velocity V of a particle is given in terms of time t by the equation $V = at + \frac{b}{t+c}$. The dimensions of a, b, c are

	A	B	C		A	B	C
a)	L^2	T	LT^{-2}	b)	LT^2	LT	L
c)	LT^{-2}	L	T	d)	L	LT	T^2

45. A particle has an acceleration of 1.8 km/minute^2 .In S.I it's acceleration is
    a) 0.5 ms^{-2} b) 30 ms^{-2} c) 108 ms^{-2} d) 1080 ms^{-2}
46. Which of the following is the dimensional formula for the energy per unit area per second
    a) [M L^0 T^0] b) [M L^0 T^{-3}] c) [M L^2 T^{-1}] d) [M T^{-1}]
47. E, m, J and G denote energy, mass, angular momentum and gravitational constant respectively.Then the dimension of $\frac{EJ^2}{m^5G^2}$ are
    a) Angle b) length c) mass d) time
48. Light year is a unit of
    a) Time b) Mass c) Distance d) Energy
49. Which unit is not for length?
    a) Parsec b) Light year c) Angstrom d) Nano
50. Temperature can be expressed as a derived quantity in terms of any of the following
    a) Length and mass b) Mass and time c) Length, mass and Time d) None of these

LEVEL – II (51 - 100 Questions)

51. If the dimensions of a physical quantity are given by $M^aL^bT^c$ then the physical quantity will be
    a) Pressure if a=1, b=-1, c= -2 b) Velocity if a=1, b= 0, c= -1
    c) Acceleration if a=1, b=1, c= -2 d) Force if a=0, b=-1, c= -2
52. Of the following quantities, which one has dimensions different from the remaining three
    a) Energy per unit volume b) Force per unit area
    c) Angular momentum per unit mass d) Energy densit
53. The dimensions of $(\mu_0\epsilon_0)^{-\frac{1}{2}}$(or) $\frac{1}{\sqrt{\mu_0\epsilon_0}}$ are
    a) [L T^{-1}] b) [L^{-1} T] c) [L^{-1} T^{-1}] d) [L T]
54. In a system of units if force (F),acceleration (A)and Time(T)are taken as fundamental units then the dimensional formula of energy is
    a) FA^{2}T b) FAT^2 c) F^{2}AT d) FAT
55. The dimensional formula of relative density is
    a) ML^{-3} b) LT^{-1} c) MLT^{-2} d) Dimensionless
56. Out of following four dimensional quantities which one quantity is to be called a dimensional constant?
    a) Acceleration due to gravity b) Surface tension of water
    c) Weight of a standard kilogram mass d) The velocity of light in vacuum
57. The physical quantities not having same dimensions are
    a) speed and $(\mu_0\epsilon_0)^{-\frac{1}{2}}$ b) Torque and work
    c) Momentum and planck's constant d) Stress and Young's constant
58. The dimensions of K in the equation W = $\frac{1}{2}$ Kx^2 is
    a) [M^1 L^0 T^{-2}] b) [M^0 L^1 T^{-1}] c) [M^1 L^1 T^{-2}] d) [M^{1}L^0 T^{-1}]
59. Density of liquid in C.G.S system is 0.625 $^g/_{cm^3}$ What is its magnitude in S.I system
    a) 0.625 b) 0.0625 c) 0.00615 d) 625
60. Which of the following measurement is most significant
    a) 0.005 mm b) 5.00 mm c) 50.00 mm d) 5.0 mm
61. The mass of block of wood is 87.2 gm and its volume is 25 cm^3. Its density upto the correct significiant figures is
    a) 3.488 $^g/_{cm^3}$ b) 3.5 $^g/_{cm^3}$ c) 3.48 $^g/_{cm^3}$ d) 3.4 $^g/_{cm^3}$

62. The sides of a rectangle are 6.01 m and 12 m Taking the significant figures into account the area of the rectangle is
    a) 72.12 m^2 b) 72.00m^2 c) 72.1 m^2 d) 72m^2
63. The number of significant figures in all the given numbers 25.12, 200 g, 4.156 and 1.217 x 10^{-4} is
    a) 1 b) 2 c) 3 d) 4
64. The radius of the sphere is (5.3 ± 0.1) cm. The percentage error in its volume is
    a) $\frac{0.1}{5.3}$ x 100 b) 3 x $\frac{0.1 \times 100}{5.3}$ c) $\frac{1}{3}$ x $\frac{0.1 \times 100}{5.3}$ d) 3 + $\frac{0.1 \times 100}{5.3}$
65. In an experiment to measure the height of a bridge by dropping stone into water underneath, If the error in measurement of time is 0.15 at the end of 25, then the error is estimation of height of bridge will be.
    a) 0.49 m b) 0.98 m c) 1.96 m d) 2.12 m
66. The resistance $R = \frac{V}{i}$ where V = 100± 5 volts And i = 10± 0.2 amperes. What is the total error in R
    a) 5% b) 7% c) 5.2% d) $\frac{5}{2}$ %
67. The unit of percentage error is
    a) same as that of physical quantity b) Different from that of physical quantity
    c) Percentage error is unit less d) None of these
68. The percentage errors in the measurement of mass and speed are 2% and 3% respectively. How much will be the maximum error in the estimation of the kinetic energy obtained by measuring mass and speed.
    a) 11% b) 8% c) 5% d) 1%
69. In a vernier callipers, one main scale division is x cm and n division of the vernier scale coincide with (n-1) divisions of the main scale. The least count (in cm) of the calliper is
    a) $\left(\frac{n-1}{n}\right)x$ b) $\frac{nx}{(n-1)}$ c) $\frac{x}{n}$ d) $\frac{x}{(n-1)}$
70. A screw gauge gives the following when used to measure the diameter of the wire Main scale reading:0 mm Circular scale reading:52 division Given that 1 mm on main scale corresponds to 100 divisions of the circular scale The diameter of wire from the above data is
    a) 0.52 cm b) 0.052 cm c) 0.026 cm d) 0.005 cm
71. Two full turns of the circular scale of a screw gauge cover a distance of 1 mm on its main scale.The total number of division on the circular scale is 50 further it is found that the screw gauge has a zero error of -0.03 mm. while measuring the diameter of thin wire, a students notes the main scale reading of 3 mm and the number of circular scale divisions in line with the main scale as 35. The diameter of the wire is
    a) 3.73 mm b) 3.67 mm c) 3.38 mm d) 3.32 mm
72. A wire has a mass 0.3 ± 0.003 g. radius 0.5 ± 0.005 mm and length 6 ± 0.006 cm. The maximum percentage error in the measurement of its density is
    a) 1 b) 2 c) 3 d) 4
73. A student measured the length of rod and wrote it as 3.50 cm which instrument did he use to measure it.
    a) meter scale
    b) A vernier capplary where the 10 division in vernier scale matches with a division in main scale and main scale has division in 1 cm
    c) A screw gauge having 100 division in the circular scale and pitch as 1 mm.
    d) A screw gauge having to division in circular scale and pitch as 1mm

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

75. Dimensions of electrical conductivity are
a) $M^{-1}L^{-3}T^{3}A^{2}$ b) $M\,L^{3}T^{3}A^{2}$ c) $M^{2}\,L^{3}T^{-3}A^{2}$ d) $M\,L^{3}T^{-3}\,A^{-2}$

76. Dimensions of magnetic moment of a current carrying coil are
a) $L^{3}\,A^{-1}$ b) $L^{2}\,A$ c) $L^{2}\,A^{-3}$ d) LA^{2}

77. The dimensional formula for specific Resistance in terms of M, L, T, Q is
a) $M\,L^{3}T^{-1}Q^{2}$ b) $M\,L\,T^{-2}Q^{2}$ c) $M\;LT^{-2}Q^{-1}$ d) $M\,L^{2}T^{-2}\,Q^{-2}$

78. The dimensional formula for intensity of magnetic field is
a) $M\,L^{-1}$ b) $M\,T^{-2}\,L^{-1}\,A^{-1}$ c) $A\,L^{-1}$ d) $M^{0}\,L^{0}T^{0}$

79. The energy stored in a capacitor between the plates is given by $\frac{1}{2}CV^{2}$, when 'C' is the capacitance and V is the potential difference between the plates of the capacitor.Then the dimensions of CV^{2} are.
a) $M\,L\,T^{-2}$ b) $M\,L^{2}\,T^{-2}$ c) $M\,L^{2}\,T^{2}$ d) $M^{0}\,L^{0}T$

80. The dimensions of Farad are
a) $M^{-1}L^{-2}T^{2}Q^{2}$ b) $M^{-1}\,L^{-2}\,T\,Q$ c) $M^{-1}\,L^{-1}\,T^{-2}\,Q$ d) $M^{-1}\,L^{-2}\,T\,Q^{2}$

81. Dimensional formula of capacitance is
a) $M^{-1}L^{-2}T^{4}A^{2}$ b) $M\,L^{2}\,T^{4}\,A^{-2}$ c) $M\,L\,T^{-4}\,A^{2}$ d) $M^{-1}\,L^{-2}\,T^{-4}\,A^{-2}$

82. The dimensional formula for Impedance of an A.C circuit is
a) $M^{0}\,L^{2}\,T^{-3}$ b) $M\,L^{2}\,T^{-3}\,A^{-2}$ c) $M\,L^{2}\,T^{-2}\,A^{-1}$ d) $M\,L\,T^{-3}\,A^{2}$

83. The dimension of η are, where $F = 6\pi\eta av$ F = Force, a = radius of sphere, V=Velocity
a) $M\,L^{-1}\,T^{-1}$ b) $M\,T^{-1}$ c) $M\,L\,T^{-1}$ d) $M\,L^{-3}$

84. Which one of the following has the dimensions of Pressure.
a) $M\,L^{-2}\,T^{-2}$ b) $M\,L^{-1}\,T^{-1}$ c) $M\,L\,T^{-2}$ d) $M\,L^{-1}\,T^{-2}$

85. Dimensions of magnetic field intensity is
a) $M^{0}L^{-1}T^{0}A^{-1}$ b) $M\,L\,T^{-1}\,A^{-1}$ c) $M\,L^{0}\,T^{-2}\,A^{-1}$ d) $M\,L\,T^{-2}\,A$

86. If L and R represent inductance and Resistance respectively,then the dimension of $\frac{L}{R}$ will be
a) $M\,L^{0}T^{0}$ b) $M^{0}\,L^{0}T$ c) $M^{0}\,L^{0}T^{-2}$ d) $M^{0}\,L\,T^{-2}$

87. The dimensional formula for Entropy is
a) $M\,LT^{-2}\,\theta^{-1}$ b) $M\,L^{2}\,T^{-2}$ c) $M\,L^{2}\,T^{-2}\theta^{-1}$ d) $M\,L^{-2}\,T^{-2}\theta^{-1}$

88. If C and R represent capacitance and Resistance respectively, then dimension of CR will be
a) M b) T^{-1} c) T d) T^{-2}

89. The Dimension of electric Current is
a) $T^{-1}\,Q$ b) $M\,L^{2}\,T^{-1}\,Q$ c) $M^{2}\,L^{2}\,T^{-1}\,Q$ d) $M^{2}\,L\,T^{-1}\,Q$

90. Dimension of Resistance is
a) $M\,L^{2}\,T^{-1}\,Q^{-2}$ b) $M\,L^{2}\,T\,Q^{2}$ c) $M\,L^{-2}\,T\,Q^{-2}$ d) $M\,L^{-2}\,T^{-1}\,Q^{-2}$

91. Dimension of Resistivity is
a) $M\,L^{3}\,T^{-3}\,A^{-2}$ b) $M\,L^{-3}\,T\,A^{-2}$ c) $M\,L^{3}\,T\,A^{2}$ d) $M\,L^{3}\,T^{-2}\,A^{-2}$

92. Dimension of $\frac{e^{2}}{4\pi\epsilon_{0}}$ is
a) $M\,L^{3}\,T^{-2}$ b) $M\,L^{-3}\,T^{-2}$ c) $M\,L^{-2}\,T^{-2}$ d) $M\,L^{-1}\,T^{-1}$

93. A physical quantity of the dimensions of length that can be formed out of C, G and $\frac{e^{2}}{4\pi\epsilon_{0}}$ is
[C is velocity of light, G is universal constant of gravitation and e is charge] (NEET – 2017)
a) $\frac{1}{C^{2}}\left[G\frac{e^{2}}{4\pi\epsilon_{0}}\right]^{1/2}$ b) $C^{2}\left[G\frac{e^{2}}{4\pi\epsilon_{0}}\right]^{1/2}$ c) $\frac{1}{C^{2}}\left[\frac{e^{2}}{G\ 4\pi\epsilon_{0}}\right]^{1/2}$ d) $\frac{1}{C}\ G\frac{e^{2}}{4\pi\epsilon_{0}}$

93. A student measured the diameter of a small steel ball using a screw gauge of least count 0.001 cm. The main scale reading is 5 mm and xero of circular scale division coincides with 25 divisions above the reference level. If screw gauge has a zero error of -0.004 cm, the correct diameter of the ball is
a) 0.053 cm b) 0.525 cm c) 0.521 cm d) 0.529 cm

95. The dimension of $\frac{1}{2}\in_0 E^2$, where $\in_0$ is permitivity of free space and E is electric field is
a) $M L^2 T^{-2}$ b) $M L^{-1} T^{-2}$ c) $M L^2 T^{-1}$ d) $M L T^{-1}$ (2015)

96. The dimension of $\frac{1}{2}\in_0 E^2 l A$
a) $M L^2 T^{-2}$ b) $M L^{-1} T^{-2}$ c) $M L^2 T^{-1}$ d) $M L T^{-1}$

97. If energy (E), Velocity (V) and time (T) are chosen as the fundamental quantities, the dimensional formula of surface tension will be (2015)
a) $[EV^{-2}T^{-2}]$ b) $[E^{-2}V^{-1}T^{-3}]$ c) $[EV^{-2}T^{-1}]$ d) $[EV^{-1}T^{-2}]$

98. If force (F), Velocity (V) and Time (T) are taken as fundamental units, then the dimensions of mass are (2014)
a) $[F V T^{-1}]$ b) $[F V T^{-2}]$ c) $[F V^{-1} T^{-1}]$ d) $[F V^{-1} T]$

99. 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 = $\frac{a^3b^2}{cd}$% error P is
a) 7% b) 4% c) 14% d) 10%

100. If dimensions of critical velocity V_c of a liquid flowing through a tube are expressed as $[n^x p^y r^z]$ Where η = coefficient of viscocity,ρ = density of liquid, r = radius then the values of x, y and z are given by
a) -1, -1, -1 b) 1, 1, 1 c) 1, -1, -1 d) -1, -1, 1

LEVEL – III (101 - 141 Questions)

101. The pair of quantities having same dimensions is
a) Impulse and surface Tension b) Angular momentum and work
c) Work and Torque d) Young's modulus and Energy

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

103. The density of a material in CGS system of units 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) 0.04 b) 0.4 c) 40 d) 400 (2011)

104. Which two of the following five physical parameters have the same dimensions?
1) energy density 2) refractive index 3) dielectric constant
4) Young's modulus 5) Magnetic field
a) 1 and 4 b) 1 and 5 c) 2 and 4 d) 3 and 5

105. A student measures the distance traversed in free fall of a body, intially at rest in a given time. He uses this data to estimate g the acceleration due to gravity. If the maximum percentage errors in measurement of the distance and the time are e_1 and e_2 respectively the percentage error in the estimation of g is (2010).
a) $e_2 - e_1$ b) $e_1 + 2e_2$ c) $e_1 + e_2$ d) $e_1 - 2e_2$

106. The unit of permitivity of free space $\in_0$ is
a) coulomb / newton – metre b) newton – $metre^2$ / $coulomb^2$
c) $coulomb^2$/ newton – $metre^2$ d) $coulomb^2$ / (newton - $metre)^2$

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

108. 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 lengths are 3% and 2% respectively, the maximum error in the measurement of density would be.
a) 12% b) 14% c) 7% d) 9%

109. The dimensional formula of permeability of free space μ_0 is
a) $[M\ L\ T^{-2}\ A^{-2}]$ b) $[M^0\ L^1\ T]$ c) $[M^0\ L^2\ T^{-1}\ A^2]$ d) none of these

110. Kilogram–metre per second are the unit of
a) force b) work c) momentum d) power

111. In S.I system the unit of pressure are
a) Dynes / cm^2 b) Poundal / ft^2 c) Pascal d) None of these

112. One Pascal is equal to
a) one dyne / cm^2 b) 1 Newton/$metre^2$ c) 1 Newton / metre d) 1 N / M

113. The Bernoulli's equation is given by $P + \frac{1}{2} dv^2 + dgh$ = constant. The quantity $\frac{dv^2}{2}$ has the same units as that of
a) Force b) Impulse c) Strain d) Pressure

114. Which of the following is a dimensionless constant.
a) Young's modulus b) Poission ratio c) Bulk modulus d) Modulus of rigidity

115. The radius of curvature of a spherical surface is measuring
a) a spectrometer b) a spherometer c) screw gauge d) Vernier caliper

116. The surface tension of a liquid is 70 dynes/cm it may be expressed in S.I system as
a) 7×10^{-2} N/m b) 70 N/m c) 7×10^2 N/m d) None of the above

117. One nanometer is equal to
a) 10^9 cm b) 10^{-6} cm c) 10^{-7} cm d) 10^{-9} cm

118. 1 g/cm^3 is equal to
a) 10^3 kg/m^3 b) 10^{-3} kg/m^3 c) 10^2 kg/m^3 d) 10^{-2} kg/m^3

119. In C.G.S 1 litre is equal to $10^3\ cm^3$ then S.I system
a) $10^6\ cm^3$ b) $10^{-3}\ cm^3$ c) $10^3\ cm^3$ d) None of these

120. 'Torr' is the unit of
a) Pressure b) Volume c) Density d) Flux

121. Pick out the odd one
a) Calorie b) Kilowatt hour c) joule d) watt

122. The SI unit of Pressure gradient
a) Nm^{-2} b) Nm c) Nm^{-1} d) Nm^{-3}

123. Which of the following is unitless quantity?
a) Pressure gradient b) Displacement gradient
c) Force gradient d) Velocity gradient

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

125. What is the length of the arc of a circle of radius 30 cm which subtend on angle 30° at the entre?
a) 11.7 cm b) 14.7 cm c) 16.7 cm d) 15.7 cm

126. 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

127. 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) 1.39×10^9 m b) 1.39×10^{10} m c) 1.39×10^{11} m d) 1.39×10^{12} m

128. 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}
129. The ratio of one micron to one nanometre is
a) 10^{3} b) 10^{-3} c) 10^{-6} d) 10^{-9}
130. 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
131. The device used for measuring the mass of atoms and molecules is
a) spring balance b) torsional balance c) mass spectrograph d) common balance
132. The distance of a galaxy from the earth is of the order of 10^{25} m. The time taken by light to reach the earth from the galaxy is
a) 3×10^{14} s b) 3×10^{16} s c) 3×10^{18} s d) 3×10^{20} s
133. 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
134. Which of the following is the most preciase instrument for measuring length?
a) Metre rod of least count 0.1 cm b) Vernier callipers of least count 0.01 cm
c) Screw gauge of least count 0.001 cm d) None of these
135. 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
136. 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
137. 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
138. The number of significant figures in the numbers 4.8000×10^{14} and 48000. 50 are respectively
a) 5 and 6 b) 5 and 7 c) 2 and 7 d) 2 and 6
142. If the error in the measurement of momentum of a particle is 100% then the error in the measurement of kinetic energy is
a) 100% b) 200% c) 300% d) 400%
139. Subtract 2.6×10^{4} from 3.9×10^{5} with due regard to significant figures
a) 3.64×10^{5} b) 3.7×10^{5} c) 3.6×10^{5} d) 3.65×10^{6}
140. Add 3.8×10^{-6} to 4.8×10^{-5} with due regard to significant figures
a) 4.6×10^{-5} b) 4.6×10^{-6} c) 4.58×10^{-5} d) 4.586×10^{-5}
141. A student measured the diameter of a wire unsing a screw gauge with least count 0.001 cm and listed the measurements. The correct measurement is
a) 5.320 cm b) 5.3 cm c) 5.32 cm d) 5.3200 cm

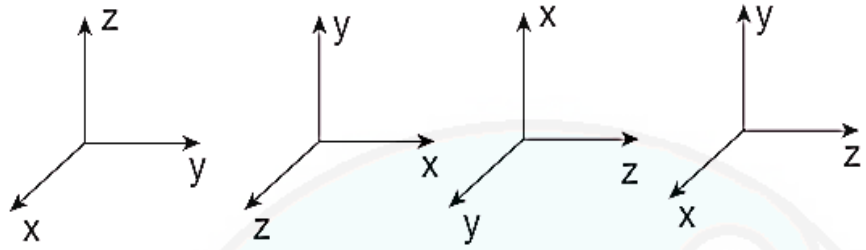
UNIT – II

KINEMATICS

TRY AND TEST YOURSELF

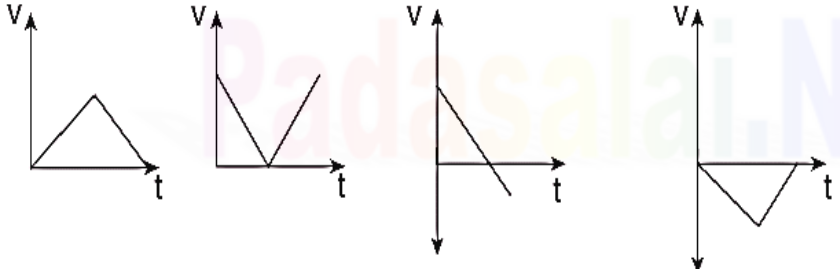
LEVEL – I (1 - 50 Questions)

1. Which one of the following Cartesian coordinate systems is not followed in physics?



a) b) c) d)

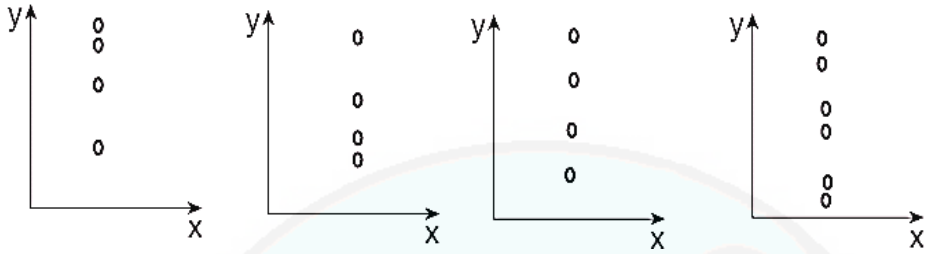
2. Identify the unit vector in the following.
   a) $\hat{\imath} + \hat{\jmath}$ b) $\frac{\hat{\imath}}{\sqrt{2}}$ c) $\hat{k} - \frac{\hat{\jmath}}{\sqrt{2}}$ d) $\frac{\hat{\imath} + \hat{\jmath}}{\sqrt{2}}$
3. Which one of the following physical quantities cannot be represented by a scalar?
   (a) Mass (b) length (c) momentum (d) magnitude of acceleration
4. Two objects of masses m1 and m2 fall from the heights h1 and h2 respectively. The ratio of the magnitude of their momenta when they hit the ground is (AIPMT 2012)
   a) $\sqrt{\frac{h_1}{h_2}}$ b) $\sqrt{\frac{m_1 h_1}{m_2 h_2}}$ c) $\frac{m_1}{m_2}\sqrt{\frac{h_1}{h_2}}$ d) $\frac{m_1}{m_2}$
5. If a particle has negative velocity and negative acceleration, its speed
   (a) increases (b) decreases (c) remains same (d) zero
6. If the velocity is $\vec{v} = 2\hat{\imath} + t^2\hat{\jmath} - 9\vec{k}$, then the magnitude of acceleration at t=0.5 s is
   a) 1 ms^{-2} b) 2 ms^{-2} c) Zero d) -1 ms^{-2}
7. If an object is dropped from the top of a building and it reaches the ground at T = 4 s , then the height of the building is (ignoring air resistance) (g = 9.8 ms^{-2})
   (a) 77.3 m (b) 78.4 m (c) 80.5 m (d) 79.2 m
8. A ball is provided vertically upwards with a velocity v.It comes back to ground in time t. Which v-t graph shows the motion correctly? (NSEP 00-01)



a) b) c) d)

9. If one object is dropped vertically downward and another object is thrown horizontally from the same height, then the ratio of vertical distance covered by both objects at any instant t is
   a) 1 (b) 2 (c) 4 (d) 0.5

10. If a particle executes uniform circular motion in the xy plane in clock wise direction, then the angular velocity is in
    (a) +y direction (b) +z direction (c) -z direction (d) -x direction
11. A ball is dropped from some height towards the ground. Which one of the following represents the correct motion of the ball?



a) b) c) d)

12. If a particle executes uniform circular motion, choose the correct statement (NEET 2016)
    (a) The velocity and speed are constant.
    (b) The acceleration and speed are constant.
    (c) The velocity and acceleration are constant.
    (d) The speed and magnitude of acceleration are constant.
13. If an object is thrown vertically up with the initial speed *u* from the ground,then the time taken by the object to return back to ground is
    a) $\frac{u^2}{2g}$ b) $\frac{u^2}{g}$ c) $\frac{u}{2g}$ d) $\frac{2u}{g}$
14. Two objects are projected at angles 30° and 60° respectively with respect to the horizontal direction. The range of two objects are denoted as R_{30^0} and R_{60^0} .Choose the correct relation from the following.
    a) $R_{30^0} = R_{60^0}$ b) $R_{30^0} = 4\,R_{60^0}$ c) $R_{30^0} = \frac{R_{60^0}}{2}$ d) $R_{30^0} = 2\,R_{60^0}$
15. An object is dropped in an unknown planet from height 50 m, it reaches the ground in 2 s. The acceleration due to gravity in this unknown planet is
    (a) g = 20 ms^{-2} (b) g = 25 ms^{-2} (c) g = 15 ms^{-2} (d) g = 30

ADDITIONAL QUESTIONS:

16. The vector projection of a vector $3\hat{\imath} + 4\hat{k}$ on y axis
    a) 5 b) 4 c) 3 d) zero
17. Position of a particle in a rectangular – co-ordinate system is (3, 2, 5) Then its position vector will be
    a) $3\hat{\imath} + 5\hat{\jmath} + 2\hat{k}$ b) $3\hat{\imath} + 2\hat{\jmath} + 5\hat{k}$ c) $5\hat{\imath} + 3\hat{\jmath} + 2\hat{k}$ d) None
18. A force of 5N acts on a particle along a direction making an angle of 60° with vertical. Its vertical component will be
    a) 10 N b) 3 N c) 4 N d) 2.5 N
19. The angle made by the vector $A = \hat{\imath} + \hat{k}$ with x-axis is
    a) 90° b) 45° c) 22.5° d) 30°

20. If the magnitude of sum of two vectors is equal to the magnitude of difference of two vectors, the angle between these vectors is
    a) 0° b) 90° c) 45° d) 180°
21. If $\vec{P} = \vec{Q}$ then which of the following is NOT correct
    a) $\hat{P} = \hat{Q}$ b) $|\hat{P}| = |\hat{Q}|$ c) $P\hat{Q} = Q\hat{P}$ d) $\vec{P} + \vec{Q} = \hat{P} + \hat{Q}$
22. Surface area is
    a) Scalar b) Vector
    c) Neither scalar nor vector d) Both scalar and vector
23. Among the following, which one is neither a vector nor scalar?
    a) Momentum b) Angular momentum c) Moment of Inertia d) None
24. Angular momentum is
    a) A scalar b) A polar vector c) An axial vector d) None of these
25. For two vectors $\vec{A}$ and $\vec{B}$ which of the following relation are not commutative
    a) $\vec{A} + \vec{B}$ b) $\vec{A} - \vec{B}$ c) $\vec{A} \times \vec{B}$ d) both b & c
26. If $|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}|$ the $\vec{A}$ and $\vec{B}$ are
    a) parallel b) perpendicular c) inclined d) None
27. The angle between $A = \hat{\imath} + \hat{\jmath}$ and $B = \hat{\imath} - \hat{\jmath}$ is
    a) 45° b) 90° c) 45° d) 180°
28. Which one of the following statement is true?
    a) A scalar quantity is the one that is conserved in a process
    b) A scalar quantity is the one that can never take negative value
    c) A scalar quantity is the one that does not vary from one point to another in space
    d) A scalar quantity has the same value for observers with different orientation of the axes
29. The component of a Vector $\vec{r}$ along x-axis will have maximum value if
    a) $\vec{r}$ is along positive y – axis b) $\vec{r}$ is along positive x - axis
    c) $\vec{r}$ makes at angle of 45° with the x - axis d) $\vec{r}$ is along negative y – axis
30. If $\vec{A}.\vec{B} = |\vec{A} \times \vec{B}|$ then the value of angle between $\vec{A}$ and $\vec{B}$
    a) $\frac{\pi}{2}$ b) π c) $\frac{\pi}{4}$ d) None
31. Two equal forces have their resultant equal to either. At what angle are they inclined?
    a) 60° b) 120° c) 30° d) 45°
32. The angle between vectors $(\vec{A} \times \vec{B})$ and $(\vec{B} \times \vec{A})$ is
    a) Zero b) π c) $\frac{\pi}{4}$ d) $\frac{\pi}{2}$
33. An object of m K_g with speed of V ms^{-1} strikes a wall at an angle θ and rebounds at the same speed and same angle.The magnitude of the change in momentum of the object will be
    a) 2 mv cos θ b) 2 mv sin θ c) 0 d) 2 mv
34. Consider a vector $\vec{F} = 4\hat{\imath} - 3\hat{\jmath}$. Another vector that is perpendicular to $\vec{F}$ is
    a) $4\hat{\imath} + 3\hat{\jmath}$ b) $6\hat{\imath}$ c) $7\hat{k}$ d) $3\hat{\imath} - 4\hat{\jmath}$
35. The speed of a boat is 5km/h in still water. T crosses a river of width 1 km along the shortest possible path in 15 minutes. The velocity of the river water is
    a) 1 km/h b) 3 km/h c) 4 km/h d) 5 km/h

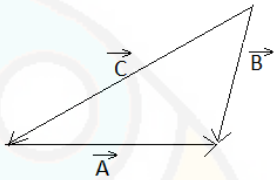
36. $0.4\hat{\imath} + 0.8\hat{\jmath} + c\hat{k}$ represents a unit vector when c is
    a) -0.2 b) $\sqrt{0.2}$ c) $\sqrt{0.8}$ d) 0

37. The angle between the vectors $\vec{A}$ and $\vec{B}$ is θ. The value of triple product is $\vec{A}(\vec{B} \times \vec{A})$ is
    a) A^2B b) Zero c) $A^2B \sin\theta$ d) $A^2B \cos\theta$

38. If $|\vec{A} \times \vec{B}| = \sqrt{3}\, \vec{A} \,.\, \vec{B}$ then the value of $|\vec{A} + \vec{B}|$ is
    a) $(A^2 + B^2 + AB)^{1/2}$ b) $\left(A^2 + B^2 + \frac{AB}{\sqrt{3}}\right)^{1/2}$ c) A + B d) $\left(A^2 + B^2 + \sqrt{3}AB\right)^{1/2}$

39. If a vector $2\hat{\imath} + 3\hat{\jmath} + 8\hat{k}$ is perpendicular to the vector $4\hat{\imath} - 4\hat{\jmath} + \alpha\hat{k}$. Then the value of α is
    a) $\frac{1}{2}$ b) $-\frac{1}{2}$ c) 1 d) -1

40. For the figure(1)
    a) $\vec{A} + \vec{B} = \vec{C}$
    b) $\vec{B} + \vec{C} = \vec{A}$
    c) $\vec{C} + \vec{A} = \vec{B}$
    d) $\vec{A} + \vec{B} + \vec{C} = 0$



Fig(1)

41. Which of the following statement is true?
    a) when the co-ordinate axes are translated the component of a vector in a plane changes
    b) when the co-ordinate axes are rotated through some angle components of the vector change but the vector's magnitude remains constant
    c) sum of $\vec{a}$ and $\vec{b}$ and $\vec{R}$. If the magnitude $\vec{a}$ alone is increased angle between $\vec{b}$ and $\vec{R}$ decreases
    d) The cross product $3\hat{\imath}$ and $3\hat{\jmath}$ is 12

42. For the following set(s) of forces the resultant can never be zero
    a) 10, 10, 10 b) 10, 10, 20 c) 10, 20, 30 d) 10, 20, 40

43. Two vectors $\vec{A}$ and $\vec{B}$ are such that $\vec{A} + \vec{B} = \vec{A} - \vec{B}$. Then,
    a) $\vec{A} \,.\, \vec{B} = 0$ b) $\vec{A} \times \vec{B} = 0$ c) $\vec{A} = 0$ d) $\vec{B} = 0$

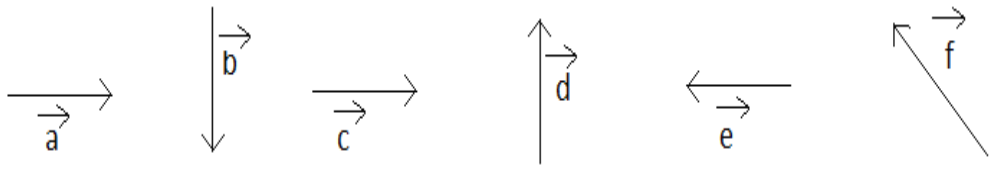
44. A vector $\vec{A}$ points vertically upward and $\vec{B}$ points towards north.The vector product $\vec{A} \times \vec{B}$ is
    a) zero b) along west c) Along east d) Vertically downward

45. The angle between $\vec{A}$ and $\vec{B}$ is θ $\vec{R} = \vec{A} \times \vec{B}$ makes an angle $\frac{\theta}{2}$ with $\vec{A}$ which of the following is true?
    a) A = 2B b) 2A=B c) AB=1 d) None

46. The maximum and minimum magnitudes of the resultant of two vectors are 17 units and 7 units respectively. If these two vectors are at right angles to each other, the magnitude of their resultant is
    a) 14 b) 16 c) 18 d) 13

47. Which of the following are polar vectors?
    i) Momentum ii) Moment of momentum iii) Impulse iv) Torque
    a) (i) and (ii) b) (ii) and (iii) c) (iii) and (iv) d) (ii) and (iv)

48. Six vectors $\vec{a}$ through $\vec{f}$ have the magnitudes and directions indicated in Fig(2). Which of the following statements is true?



Fig(2)

a) $\vec{b} + \vec{c} = \vec{f}$ b) $\vec{d} + \vec{c} = \vec{f}$ c) $\vec{d} + \vec{e} = \vec{f}$ d) $\vec{b} + \vec{c} = \vec{f}$

49. If a distance covered by a particle is zero what can be its displacement?
a) It may or may not be zero b) It cannot be zero c) It must be zero d) It is negative

50. The numerical ratio of average speed to average velocity is
a) Always equal to one b) always less than one
c) Always more than one d) equal to more than one

LEVEL – II (51 - 100 Questions)

51. A body moves along a circular track of radius r. It starts from one end of a diameter. Moves along the circular track and completes one and a half revolution. The ratio of distance travelled by the body to its displacement is
a) $\frac{1}{2}\pi$ b) $\frac{2}{\pi}$ c) π d) $\frac{3\pi}{2}$

52. 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) 2 R c) $2\pi R$ d) $7\pi R$

53. A graph is drawn between velocity and time for the motion of a particle. The area under the curve between the time intervals t_1 and t_2 gives
a) Momentum of the particle b) Displacement of the particle
c) Acceleration of the particle d) Force on the particle

54. A person moves 30 m north and then 20 m towards east and finally $30\sqrt{2}$ m in south – west direction. The displacement of the person from the origin will be
a) 10 m along north b) 10 m long south c) 10 m along west d) zero

55. A body is moving along a straight line path with constant velocity. At an instant of time the distance travelled by it is S and its displacement is D, then
a) D < S b) D > S c) D = S d) D ≤ S

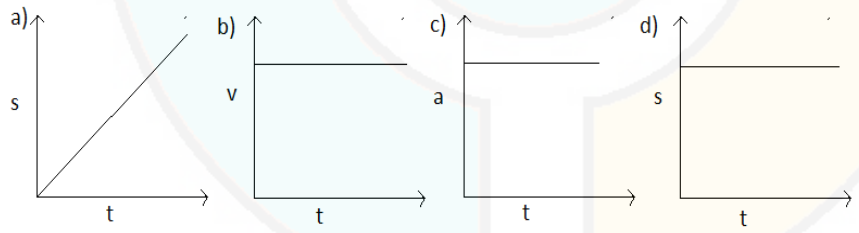
56. The displacement - time graph for two particles A and B are straight line inclined at angles of 30° and 60° with the time axis. The ratio of velocities of $V_A : V_B$ is
a) 1 : 2 b) $1 : \sqrt{3}$ c) $\sqrt{3} : 1$ d) 1 : 3

57. A car moves a distance of 200 m. It covers first half of the distance at speed 60 kmh^{-1} and the second half at speed v. If the average speed is 40 km h^{-1}, the value of v is
a) 30 km h^{-1} b) 13 km h^{-1} c) 60 km h^{-1} d) 40 km h^{-1}

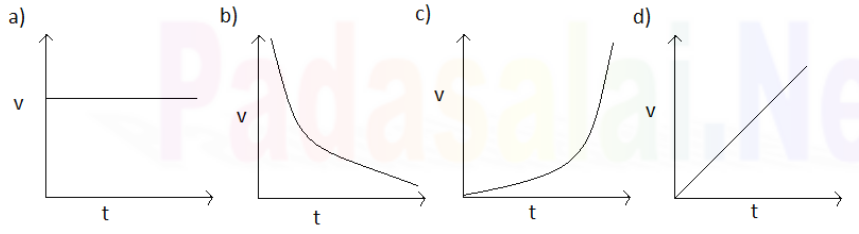
58. A car moves from x to y with a uniform speed v_u and returns to x with a uniform speed v_d. The average speed of round trip is
a) $\frac{2\,v_d v_u}{v_d + v_u}$ b) $\sqrt{v_u v_d}$ c) $\frac{v_d v_u}{v_d + v_u}$ d) $\frac{v_u + v_d}{2}$

59. A particle moves for 20 seconds with velocity 3 ms^{-1} and then velocity 4 ms^{-1} for another 20 seconds and finally moves with velocity 5 ms^{-1} for next 20 seconds. What is the average velocity of the particle.
    a) 3 ms^{-1} b) 4 ms^{-1} c) 5 ms^{-1} d) zero
60. 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 m is
    a) 56 sec b) 68 sec c) 80 sec d) 92 sec
61. A particle moves along a semicircle of radius 10 m in 5 seconds. The average velocity of the particle is
    a) 2π ms^{-1} b) 4π ms^{-1} c) 2 ms^{-1} d) 4 ms^{-1}
62. A person travels along a straight road for the first half time with a velocity V_1 and the next half time with a velocity V_2. The mean velocity V of the man is
    a) $\frac{2}{V} = \frac{1}{V_1} + \frac{1}{V_2}$ b) $V = \frac{V_1+V_2}{2}$ c) $V = \sqrt{V_1 V_2}$ d) $V = \sqrt{\frac{V_1}{V_2}}$
63. If a car covers $\frac{2}{5}^{th}$ of the total distance with V_1 speed and $\frac{3}{5}^{th}$ distance with V_2 then average speed is
    a) $\frac{1}{2}\sqrt{V_1 V_2}$ b) $\frac{V_1+V_2}{2}$ c) $\frac{2 V_1 V_2}{V_1+V_2}$ d) $\frac{5 V_1 V_2}{3V_1+2V_2}$
64. A particle has an initial velocity of $3\hat{\imath} + 4\hat{\jmath}$ and an acceleration of $0.4\hat{\imath} + 0.3\hat{\jmath}$. Its speed after 10 s is
    a) 10 units b) $7\sqrt{2}$ units c) 7 units d) 8.5 units
65. 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) $S_2 = 2S_1$ b) $S_2 = 3S_1$ c) $S_2 = 4S_1$ d) $S_2 = S_1$
66. Two trains 121 m and 99 m in length are running in opposite directions with velocities 40 km/h and 32 km/h . They will completely cross each other in
    a) 10 s b) 11 s c) 12 s d) 9 s
67. Two trains each of length 100 m, are running on parallel tracks. One overtakes the other in 20 second and one crosses the other in 10 second. Velocities of the two trains are
    a) 15 ms^{-1} and 5 ms^{-1} b) 5 ms^{-1} and 15 ms^{-1} c) 10 ms^{-1} and 15 ms^{-1} d) 15 ms^{-1} and 10 ms^{-1}
68. When a graph of one quantity versus another results in a straight line, the quantities are
    a) both constant b) equal
    c) directly proportional d) Inversely proportional
69. If the displacement-time graph of a particle is parallel to the time axis, the velocity of the particle is
    a) unity b) zero c) infinity d) none of these
70. In which of the following cases, the object does not possess an acceleration or retardation when it moves in?
    a) upward direction with decreasing speed b) downward direction with increasing speed
    c) with constant speed along circular path
    d) with constant speed along horizontal direction
71. The instantaneous velocity of a body can be measured
    a) vecorially b) using a speedometer c) graphically d) None
72. Kinematics is a part of mechanics which deals with the description of motion
    a) interms of energy b) without involving force
    c) interms of force d) All are true

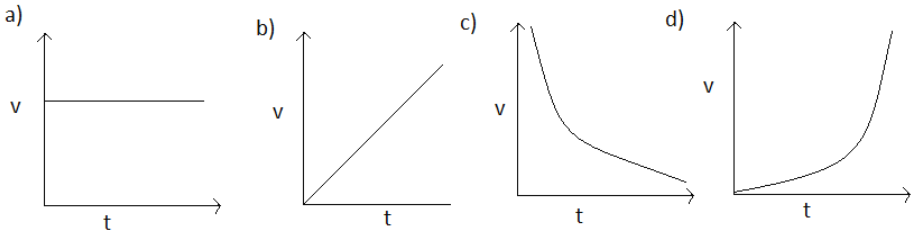
73. You observe an object covering distances in direct proportion to the square of time elapsed. What conclusion micht you draw about its acceleration? It is
    a) zero b) constant c) decreasing d) None
74. When a body falls freely under gravity
    a) it moves with constant acceleration b) it moves with constant velocity
    c) it moves with uniform velocity d) it covers equal distance in equal intervals of time
75. A ball is thrown vertically upward. As its highest point, it has
    a) an upward velocity b) un upward acceleration
    c) a downward velocity d) a downward acceleration
76. The graph between displacement and time for a particle moving with uniform acceleration is a
    a) Straight line with a positive slope b) parabola
    c) Ellipse d) Straight line parallel to time axis
77. The area under acceleration-time graph gives
    a) Distance travelled b) Change in acceleration c) Force acting d) Change in velocity
78. Consider the acceleration, velocity and displacement of a tennis ball as it falls to the ground and bounces back. Direction of which of these changes in the process
    a) Velocity only b) Displacement and velocity
    c) Acceleration, velocity and displacement d) Displacement and acceleration
79. Acceleration of a particle changes when
    a) Direction of velocity changes b) Magnitude of velocity changes
    c) Both of above d) Speed changes
80. Which graph represents a state of rest for an object?



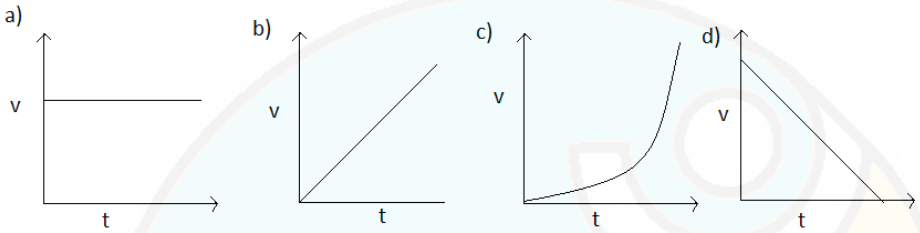
81. Which of the following velocity – time graphs represent uniform motion.



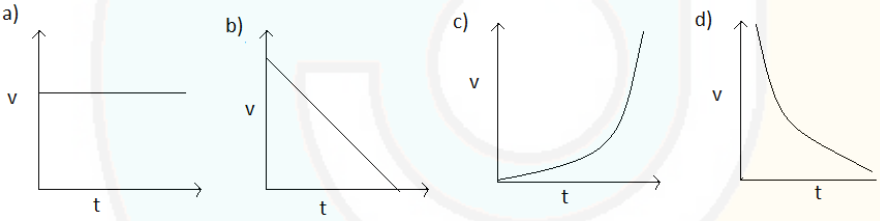
82. Which of the following velocity – time graphs represent uniform acceleration.



83. Which of the following velocity – time graph represents Variable acceleration.



84. Which of the following velocity – time graph represents some initial velocity and uniform retardation.



85. The path of a particle moving under the influence of a force fixed in magnitude and direction is
a) straight line b) Circle c) parabola d) Ellipse

86. A particle starts from rest at t=0 and moves in a straight line with an acceleration as shown below. The velocity of the particle at t = 3s is
a) 2 ms^{-1} b) 4 ms^{-1} c) 6 ms^{-1} d) 8 ms^{-1}

87. Equation of displacement for any particle is S = $3t^3 + 7t^2 + 14t + 8m$. Its acceleration at time t=1 sec is
a) 10 ms^{-1} b) 16 ms^{-1} c) 25 ms^{-1} d) 32 ms^{-1}

88. The motion of a particle is described by the equation $x = a + bt^2$ where a=15 cm and b=3 cms^{-2}. Its instantaneous velocity at time 3 sec will be
a) 36 cm/sec b) 18 cm/ sec c) 16 cm/sec d) 32 cm / sec

89. A particle moves along a straight line such that its displacement at any time t is given by S = $t^3 - 6t^2 + 3t + 4$ metres. The velocity when the acceleration is zero is
a) 3 ms^{-1} b) -12 ms^{-1} c) 42 ms^{-1} d) -9 ms^{-1}

90. The acceleration 'a' in ms^{-2} of a particle is given by a = $3t^2 + 2t + 2$ where t is the time. If the particle starts out with a velocity u=2 ms^{-1} at t=0. Then the velocity at the end of 2 second is
a) 12 ms^{-1} b) 18 ms^{-1} c) 27 ms^{-1} d) 36 ms^{-1}

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

92. 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

93. The velocity of a body depends on time according to the equation $v=20+0.1\ t^2$. The body is undergoing
a) uniform acceleration b) uniform retardation
c) Non-uniform acceleration d) zero acceleration

94. A motor boat covers a given distance in 6 hours moving downstream on a river. It covers the same distance in 10 hours moving upstream. The time it takes to cover the same distance in still water is
a) 9 hours b) 7.5 hours c) 6.5 hours d) 8 hours

95. A moves with 65 km/h while B is coming back of A 80 km/h. The relative velocity of B with respect to A is
a) 80 km/h b) 60 km/h c) 15 km/h d) 145 km/h

96. A person aiming to reach the exactly opposite point on the bank of a stream is swimming with a speed of 0.5 ms^{-1} at an angle of 120° with the direction of flow of water.
The speed of water in the stream is
a) 1 ms^{-1} b) 0.5 ms^{-1} c) 0.25 ms^{-1} d) 0.433 ms^{-1}

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

98. 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) $h_1= h_2 = h_3$ b) $h_1= 2h_2 = 3h_3$ c) $h_1= \frac{h_2}{3} = \frac{h_3}{5}$ d) $h_2= 3h_1$ and $h_3= 3h_2$

99. Two particles A and B having different masses are projected from a tower with same speed. A is projected vertically upward and B vertically downward. On reaching the ground.
a) velocity of A is greater than that of B
b) velocity of B is greater than that of A
c) Both A and B attain the same velocity
d) The particle with the larger mass attains higher velocity

100. A body, thrown upwards with some velocity, reaches the maximum height of 20 m. Another body with double the mass thrown up with double initial velocity will reach a maximum height of
a) 200 m b) 16 m c) 80 m d) 40 m

LEVEL – III (101 - 135 Questions)

101. A body projected vertically upwards with a velocity u returns to the starting point in 4 seconds. If $g=10ms^{-2}$ the value of 'u' is
a) 5 ms^{-1} b) 10 ms^{-1} c) 15 ms^{-1} d) 20 ms^{-1}

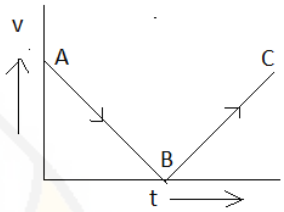
102. A ball is dropped from top of a tower of 100 m height simultaneously another ball was thrown upward from bottom of the tower with a speed of 50 ms^{-1} ($g=10\ ms^{-1}$) They will cross each other after
a) 1 s b) 2 s c) 3 s d) 4 s

103. The effective acceleration of a body, when thrown upwards with acceleration a will be.
a) $\sqrt{a-g^2}$ b) $\sqrt{a^2+g^2}$ c) (a-g) d) (a+g)

104. A body is thrown vertically upwards. If air resistance is to be taken into account, then the time during which the body rises is
a) Equal to the time of fall b) Less than the time of fall
c) Greater than the time of fall d) Twice the time of fall

105. If *x* denotes displacement in time t and *x* = a cost then acceleration is
a) a cost b) –a cost c) a sint d) –a sint

106. Following graph represents :
a) free falling body
b) body falling with uniform acceleration
c) body projected up with some initial velocity
d) uniformly retarded body



107. Area under v-t graph give
a) acceleration b) displacement c) momentum d) None

108. A stone is dropped from a certain height and at the same time another stone is thrown horizontally from the same height. Which one will reach the ground earlier?
a) First stone b) second stone c) simultaneously d) None

109. Path of the bomb released from an aeroplane moving with uniform velocity at certain height as observed by the pilot is
a) Straight line b) a parabola c) a circle d) None

110. 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) straight path b) circular path c) parabolic path d) Hyperbolic path

111. In the entire path of a projectile, the quantity that remains unchanged is
a) vertical component of velocity b) Horizontal component of velocity
c) Kinetic energy d) Potential energy

112. At what point of a projectile motion acceleration and velocity are perpendicular to each other
a) At the point of projection b) At the point of drop
c) At the topmost point d) None

113. The horizontal range and the maximum height of a projectile are equal. The angle of projection of the projectile are equal. The angle of projection of the projectile is
a) $\theta = tan^{-1}\left(\frac{1}{4}\right)$ b) $\theta = tan^{-1}(4)$ c) $\theta = tan^{-1}(2)$ d) $\theta = 45°$

114. A ball is projected horizontally with a velocity of 5 ms^{-1} from the top of a building 19.6 m high. How long will the ball take to hit the ground.
a) $\sqrt{2}$s b) 2 s c) $\sqrt{3}$s b) 3 s

115. A boy can throw a stone up to a maximum height of 10 m. The maximum horizontal distance that the boy can throw the same stone upto will be
a) $20\sqrt{2}$m b) 10 m c) $10\sqrt{2}$m d) 20 m

116. A projectile fixed with initial velocity u at some angle θ has a range R. If the initial velocity be doubled at the same angle of projection. Then the range will be
a) 2 R b) $\frac{R}{2}$ c)R d) 4R

117. A cricket ball is thrown at a speed of 28 ms^{-1} in a direction 30° above the horizontal the maximum height will be
a) 10 m b) 12 m c) 9 m d) None

118. In above problem the time taken by the ball to return to the sam level will be
a) 3 sec b) 2.5 sec c) 2.9 sec d) 1.5 sec

119. A body is moving in a circular path with acceleration a if the velocity gets doubled, find the ratio of acceleration after and before the change
a) 1:4 b) $\frac{1}{4}:2$ c) 2 : 1 d) 4 : 1

120. What is the angular velocity of earth?
a) $\frac{2\pi}{86400}$ rad/sec b) $\frac{2\pi}{3600}$ rad/sec
c) $\frac{2\pi}{24}$ rad/sec d) $\frac{2\pi}{6400}$ rad/sec

121. In 1.0 s a particle goes from point A to point B, moving in a semi circle of radius 1.0 m. The magnitude of average velocity is
a) 3.14 ms^{-1} b) 2.0 ms^{-1} c) 1.0 ms^{-1} d) zero

122. A particle is moving on a circular path with constant speed, then its acceleration will be
a) zero b) External radial acceleration
c) Internal radial acceleration d) constant acceleration

123. A body moves in a circle covers equal distance in equal intervals of time. Which of the following remains constant.
a) velocity b) Acceleration c) speed d) displacement

124. A particle moves in a circle of radius 5 cm with constant speed and time period 0.2 πs. The acceleration of the particle is
a) 5 ms^{-2} b) 15 ms^{-2} c) 25 ms^{-2} d) 36 ms^{-2}

125. What is the value of linear velocity if $\vec{\omega} = 3\hat{i} - 4\hat{j} + \hat{k}$ and $\vec{r} = 5\hat{i} - 6\hat{j} + 6\hat{k}$
a) $6\hat{i} + 2\hat{j} - 3\hat{k}$ b) $-18\hat{i} - 13\hat{j} + 2\hat{k}$ c) $4\hat{i} - 13\hat{j} + 6\hat{k}$ d) $6\hat{i} - 2\hat{j} + 8\hat{k}$

126. The angle turned by a body undergoing circular motion depnds on time as $\theta = \theta_0 + \theta_1 t + \theta_2 t^2$. Then the angular acceleration of the body is
a) θ_1 b) θ_2 c) $2\theta_1$ d) $2\theta_2$

127. If the velocity of a particle is given by $4.0\hat{i} + 5.0t\hat{j}$. then the magnitude of its acceleration is
a) 4 b) -5 c) 5 d) 0

128. A car is moving with speed 30 ms^{-1} on a circular path of radius 500 m. Its speed increasing at the rate of 2 ms^{-2}. What is the acceleration of the car.
a) 2 ms^{-2} b) 2.7 ms^{-2} c) 1.8 ms^{-2} d) 9.8 ms^{-2}

129. Centripetal acceleration is
a) a constant vector b) a constant scalar
c) a magnitude changing vector d) not a constant vector

130. Velocity vector and acceleration vector in a uniform circular motion are related as
a) Both in the same direction b) perpendicular to each other
c) Both in opposite direction d) not related to each other

131. A body executing uniform circular motion has its position vector and acceleration vector.
a) along the same direction b) in opposite direction
c) normal to each other d) not related to each other

132. The *x* and *y* co-ordinates of the particle at any time are x=5t-2t^2 and y = 10t respectively. Where *x* and *y* are in meters and t in seconds. The acceleration of the particle at t=2s is
a) 5 ms^{-2} b) -4 ms^{-2} c) -8 ms^{-2} d) 0

133. In the given figure, a=15 ms^{-2} total acceleration of a particle moving in the clockwise direction in a circle of radius R=2.5m at a given instant of time.The speed of the particle is
a) 4.5 ms^{-1} b) 5.0 ms^{-1} c) 5.7 ms^{-1} d) 6.2 ms^{-1}

134. A particle moves so that its position vector is given by $\vec{r}$ = 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 $\vec{r}$ and acceleration is directed towards the origin
b) Velocity is perpendicular to $\vec{r}$ and acceleration is directed away from the origin
c) Velocity and acceleration both are perpendicular to $\vec{r}$
d) Velocity and acceleration both are parallel to $\vec{r}$

135. 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 projectile fired from the earth. The value of the acceleration due to gravity on the planet is
a) 3.5 b) 5.9 c) 16.3 d) 110.8

UNIT – III

LAWS OF MOTION

TRY AND TEST YOURSELF

LEVEL – I (1 - 50 Questions)

1. An external force is required to keep a body in uniform motion. this statement was given by
   a) Aristotle b) Newton c) Galileo d) Archimedes
2. A particle is moving with a constant speed along a straight line path. A force is not required to
   a) increase its speed b) Decrease the momentum
   c) Change the direction d) keep it moving with uniform velocity
3. on applying a constant force to a body, it moves with uniform
   a) momentum b) speed c) acceleration d) velocity
4. Qualitative definition of force is given by
   a) Newton's first law of motion b) Newton's second law of motion
   c) Newton's third law of motion d) Newton's law of gravitation
5. Newton's first law defines
   a) force only b) inertia only c) both force and inertia d) Neither force nor Inertia
6. Inertia of a body has direct dependence on
   a) velocity b) mass c) area d) volume
7. when a horse starts suddenly,, the rider tends to backwards on account of
   a) Inertia of rest b) Inertia of motion c) Inertia of direction d) None of these
8. when a horse at full gallop stops suddenly, the rider falls forward on account of
   a) Inertia of rest b) Inertia of motion c) Inertia of direction d) None of these
9. when a car rounds a curve suddenly, the person sitting inside is thrown outwards due to
   a) Inertia of rest b) Inertia of motion c) Inertia of direction d) None of these
10. A man getting down a running bus falls forward because
    a) Due to Inertia of rest, the road is left behind and man reaches forward
    b) Due to Inertia of motion upper part of body continuous to be in motion in forward direction while feet come to rest as soon as they touch the road.
    c) He learns forward as matter of habit d) none of these
11. 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 linear motion
12. when the bodies in a frame obey Newton's law of inertia their frame of reference is said to be
    a) Non- inertial b) Inertial c) accelerated frame d) none of these
13. when a body not acted upon by an external force is accelerated then the frame of reference is called
    (a) Inertial frame (b) Non - inertial frame (c) reference frame (d) imaginary frame
14. Newton's law are not valid in
    (a) Inertial frames (b) Non - inertial frames (c) reference frames (d) all frames
15. Accelerated motion is always due to
    (a) Inertial force (b) friction (c) external force (d) none of these
16. Newton's second law gives the measure of
    a) acceleration b) force c) momentum d) angular momentum

17. A reference frame attached to the earth
    a) Is an inertial frame by definition
    b) can not be inertial frame because earth is revolving the sun
    c) is an inertial frame because Newton's laws applicable
    d) Is an inertial frame because the earth is rotating about its own axis
18. which of the following quantities measured from different inertial reference frames are same
    a) force b) velocity c) Displacement d) Kinetic energy
19. The law of conservation of linear momentum is Newton's
    a) first law b) Second law c) Third law d) all the three law
20. If action and reaction were to act on the same body
    a) the resultant would be zero b) the body would not move at all
    c) both (a) and (b) are correct d) neighter (a) nor (b) is correct.
21. we can derive Newton's
    a) second and third laws from the first law
    b) first and second olaws from the third law
    c) third and first laws from the second law
    d) all the three laws are independent of each other
22. when a horse pulls a wagon, the force that cause 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
23. A body whose momentum is constant, must have constant
    a)force b)velocity c) Acceleration d) all of these
24. The momentum is most closely related to
    a) force b)Impulse c) power d)Kinetic energy
25. Newton's second and third laws of motion lead to the conservation of
    a) Linear momentum b) Angular momentum c) force d) Kinetic energy
26. A large force acting on a body for a short time. The impulse imparted is equal to the change in
    a) acceleration b) momentum c) velocity d) displacement
27. which one of the following is not a force
    a) Impulse b) Tension c) Thrust d) Weight
28. when a fruit falls from a tree
    a) only the earth attracts the fruit b) only the fruit attracts the earth
    c) both the earth and the fruit attracts each other d) They repel each other
29. when a body is stationary
    a) there is no force acting on it b) the force acting on it is not in contact with it
    c) the combination of forces acting on it balances each other d) the body is in vacuum
30. A cricket player lower his hands while catching a ball. This example to illustrate
    a) Newton's first law of motion b) Newton's second law of motion
    c) Newton's Third law of motion d) None
31. The rate of change of momentum with respect to time is called
    a) force b) impulse c) Torque d) None of these
32. The change in momentum is called
    a) force b) impulse c) Torque d) None of these
33. Forces of action and reaction never cancel each other as they are
    a) Always equal b) always opposite c) acting on same body d) acting on different bodies
34. A block of mass M is pulled along a horizontal surface by a rope of mass m by applying a force F at one end of the rope. The force which the rope exerts on the block is
    a) $\frac{FM}{m-M}$ b) $\frac{mF}{m+M}$ c) $\frac{mF}{m-M}$ d) $\frac{MF}{M+m}$

35. Maximum value of static friction is called
a) Limiting friction b) rolling friction c) normal reaction d) co - efficient of friction
36. work done by frictional force is
a) Negative b) Positive c) zero d) all of the above
37. 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
38. which one of the following is not used to reduce friction
a) oil b) ball bearing c) sand d) Graphite
39. To avoid sliping while walking on ice one should take smaller steps because of the
a)friction of ice is large b) Larger normal reaction
c) friction of ice is small d) smaller normal reaction
40. which activity is not based upon friction
a) Writing b) Speaking c) Hearing d)Walking
41. The maximum speed that can be achieved without skidding by a car on a circular unbanked road of radius R and coefficient of static friction μ is
a) μRg b) $Rg\sqrt{\mu}$ c) $\mu\sqrt{Rg}$ d) $\sqrt{\mu}Rg$
42. when a body is moving on a surface, the force of friction is called
a) static friction b) Kinetic (or) dynamic friction c) limiting friction d)rolling friction
43. 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 co - efficient of friction is μ. The coin will revolve with the record if
a) $r \leq \frac{\mu g}{\omega^2}$ b) $r = \mu g\omega^2$ c) $r < \frac{\omega^2}{\mu g}$ d) $r \leq \frac{\mu g}{\omega^2}$
44. which of the following is a self adjusting force?
a) kinetic friction b) limiting friction c) static friction d)all the three
45. 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
a) MV b) 1.5 MV c) 2 MV d) zero
46. Mark the correct statements about the friction between two bodies
a) Limiting friction is always greater than the kinetic friction
b) Limiting friction is never less than the friction
c) co efficient of static friction is always greater than the coefficient of kinetic friction
d) both (a) and (b)
47. when a wheel is rolling on a level road, the direction of frictional force between the wheel and road is in
a) backward direction b) forward direction c) depends on speed d) cannot say
48. a particle moves in a circular path with decreasing speed. Choose the correct statement
a) Angular momentum remains constant
b) Acceleration is towards the center
c) Particle moves in a spiral path with decreasintg radius
d) the direction of angular momentum remains constant
49. the force required to keep a body in unform circular motion is
a) Centripetal force b) Centrifugal forcec) Resistance d) None of these
50. A particle of mass m describes uniform circular motion in a horizontal plane. The quantity that is conserved is
a) Linear velocity b) Linear momentum c) Angular momentum d) Linear acceleration

LEVEL – II (51 - 100 Questions)

51. A particle is moving on a circular path with constant speed then it acceleration will be
    a) zero b) External radial acceleration
    c) Internal radial acceleration d) constant acceleration
52. A particle revolves round a circular path. The acceleration of particle is
    a) Along the circumference of the circle b) Along the tangent c) Along the radius d) zero
53. Centripetal acceleration is
    a) a constant vector b) A constant scalar
    c) not a constant vector d) A magnitude changing vector
54. A car is moving with high velocity when it has a turn. A force acts on it outwardly because of
    a) centripetal force b) centrifugal force c) Gravitational force d) All the above
55. Two particles of equal masses are revolving circular paths of radi r_1 and r_2 respectively with the same speed. The ratio of their centripetal force is
    a) $\frac{r_2}{r_1}$ b) $\sqrt{\frac{r_2}{r_1}}$ c) $\left(\frac{r_1}{r_2}\right)^2$ d) $\left(\frac{r_2}{r_1}\right)^2$
56. if a car is to travel with a speed V along the frictionless banked circular track of radius r, the required angle of banking so that the car does skid is
    a) $\theta = \tan^{-1}\left(\frac{v^2}{rg}\right)$ b) $\theta = \tan^{-1}\left(\frac{v}{rg}\right)$ c) $\theta = \tan^{-1}\left(\frac{r^2}{vg}\right)$ d) $\theta < \tan^{-1}\left(\frac{v^2}{rg}\right)$
57. The term inertia was first used by
    a) Newton b) Galileo c) Aristotle d) Kepler
58. physical independence of force is consequence of
    a) First law of motion b) second law of motion c) third law of motion d) all of these
59. The relation $\overrightarrow{F} = m\vec{a}$ 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
60. A cyclist bends while taking turn to
    a) reduce friction b) generate required centripetal force c) reduce apparent weight d) reduced speed
61. one newton is equal to
    a) 10^3 dynes b) 10^7 dynes c) 10^5 dynes d) 10^{-4} dynes
62. The statement that in a rocket the hot gases shoot out backwards but the rocket moves forward is based upon
    a) First law of motion b) law of conservation of energy
    c) second law of motion d) third law of motion
63. Swimming is possible on account of
    a) first law of motion b) second law of mition
    c) third law of motion d) Newton's law of gravitation
64. when we jump out of a boat standing in water it moves
    a) forward b) side ways c) backward d) Stand still
65. one Kg weight is equal to
    a) 980 N b) 1000 lb. wt c) 980 dyne d) 9.8 newton
66. 1 gm weight is equal to
    a) 9.8 N b) 98 dynes c) 980 dynes d) 9.8 dynes
67. If the tension in the cable of 1000 Kg elevatior is 1000 Kg weight, the elevator is
    a) at rest b) accelerating upward c) accelerating downward d) on rest or in uniform motion
68. In the relation F = K ma, the value of K = 1 . this is true only

a) when speed is zero b) in C.G.S system c) when that force stops the body
d) when a unit force produce unit acceleration in a unit mass

69. when a body moves uniformly aong a circular path, its velocity
a) changes b) is perpendicular c) remains unaltered d) is not known

70. when a cyclist takes a circular turn he learns
a) outward b) forward c) backward d) inward

71. A bicyclist while taking a turn bends inwards and a passenger in a car taking the same turn is thrown outwards. The reason is
a) difference in the speed of two b) difference in the masses of two
c) the cyclist contracts the centrifugal force by bending and the car passenger is thrown away by it d) the statement appears to be wrong

72. Centripetal and centrifugal forces are
a) different in magnitude b) some times equal in magnitude
c) neither equal nor different in magnitude d) equal in magnitude

73. A stone of mass m is tied to a strain of length lm and rotated in a circle with a constant speed V. if the stone is released, the stone flies
a) with an acceleration mv^2 b) tangentially outward
c) tangentially inwarad d) radially outward

74. Pseudo force exist in
a) accelerated frames b) inertia frames
c) a frame moving with uniform velocity d) a frame at rest

75. Galilean principle of invariance holds good in
a) Inertial frames b) non - Inertial frames c) accelerated frames d) rotating frames

76. which of the following is a non- conservative force?
a) Centripetal force on a particle executing uniform circular motion
b) frictional force on a particle on an inclined plane
c) Gravitational force between two masses
d) force on the particle executing S.H.M.

77. Tennis shoes have rubber soles rather than leather because
a) rubber provides more friction than leather b) rubber sole is lighter than that of leather
c) rubber is more elastic than leather d) none of the above

78. A box of wood remains just stationary on an inclined plane making an angle of 45^o with the horizontal. Then the coefficient of static friction is
a) less than 1 b) greater than 1 c) equal to 1 d) none

79. an elastic collision conserves
a) kinetic energy but not momentum b) momentum but not kinetic energy
c) neither momentum nor kinetic energy d) both kinetic energy and momentum

80. A particle is moving in a circular path with a constant speed V. if θ is the angular displacement then starting from $\theta = 0$ the maximum and minimum changes in the momentum will occur when value of θ is respectively.
a) 45^0 and 90^0 b) 90^0 and 180^0 c) 180^0 and 360^0 d) 90^0 and 270^0

81. when milk is churned, Geam gets separated due to
a) centripedal force b) centrifugal force c) frictional force d) gravitational force

82. for a give change in linear momentum, when time of impact increase, force
a) decreases b) increases c) remains same d) none

83. For a body of given mass, graph between velocity of the body and its linear momentum is
a) a straight line with slope = 0 b) parabola

c) a straight line with +ve slope d) a straight line with -ve slope

84. In moving a body of mass m once up and down a smooth incline of inclination θ , total work done is (s is length of plane)
a) mg sin $\theta \times s$ b) mg cos$\theta \times s$ c) mg (sin $\theta - cos\theta)s$ d) zero

85. In moving a body of mass m up and down a rough incline of inclination θ, work done is (s → length, μ → co efficient of friction)
a) mg sin $\theta \times s$ b) mg cos $\theta = s$ c) 2 μmg cos $\theta \times s$ d) zero

86. A sparrow flying in air sits on a stretched telegraph wire. If weight of the sparrow is W which of the following is true about the tension T produced in the wire?
a) T = W b) T < W c) T = 0 d) T > W

87. A particle stays at rest as seen in a frame. We can conclude that
a) a frame may be inertial but resultant force on the particle is zero
b) the frame may be non-inertial but there is a non zero resultant force
c) the frame is inertial
d) both a and b

88. when a bicycle is in motion, the force of friction exerted by the ground on the two wheels is such that it as
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 backward direction on the rear wheel
c) In the backward direction on both the wheels
d) both a & b

Problems MCQ

89. Force of 15 N acts separately on two bodies on masses 3 kg and 5 kg. The ratio of the acceleration produced in the two cases will be
a) 5 : 3 b) 3 : 5 c) 8 : 15 d) 15 : 8

90. A and B are two objects with masses 6 kg and 34 kg respectively
a) A has more inertia than B b) B has more Inertia than A
c) A and B are of the same inertia d) Both A and B possible

91. A man pulls a car of mass 150 kg and produces acceleration of 4 ms^{-2}. Find the force excerted by the man
a) 37.5 N b) 0.0266 N c) 600 N d) None

92. What mass of a body will produce an acceleration of 2 ms^{-2} with 10 N force on it
a) 20 kg b) 0.2 kg c) 5 kg d) None

93. The linear momentum of a body changes at the rate of 10 kg ms^{-1} per second. Force acting on the body is
a) 1 N b) 10 N c) 1 kg f d) 10 kg f

94. A machine gun fires 35 g ballets at the rate of 100 bullets per minute with a speed of 300ms^{-1}. The force required to hold the gun in position is
a) 17500 N b) 1050 N c) 17.5 N d) None

95. A 10 gram bullet is shot from a 5 kg gun with a velocity of 400ms^{-1}. What is the speed of recoil of the gun?
a) 0.8 ms^{-1} b) -0.8 ms^{-1} c) -800 ms^{-1} d) None

96. A force of 10 Newton acts on a body of mass 20 kg for 10 seconds. Change in its momentum is (impulse)
a) 5 kg ms^{-1} b) 100 kg ms^{-1} c) 200 kg ms^{-1} d) 1000 kg ms^{-1}

97. A player caught a cricket ball of mass 150 gm moving at the rate of 20 ms^{-1}. If the catching process be completed in 0.1sec the force of the blow exerted by the ball on the hands of player

a) 0.3 N b) 30 N c) 300 N d) 3000 N

98. A block is lying static on the floor. The maximum value of static frictional force on the block is 10 N. If a horizontal force of 8 N is applied to the block. What will be the frictional force on the block.
a) 2 N b) 18 N c) 8 N d) 10 N

99. A block of mass 0.1 kg is held against a wall applying horizontal force of 5 N on the block. If coefficient of friction between the block and the wall is 0.5 the magnitude of frictional force acting on the block is
a) 2.5 N b) 0.49 N c) 0.98 N d) 4.9 N

100. A block of mass 3 kg in contact with a second block of mass 2 kg rest on a horizontal frictionless surface. A horizontal force of 10 N is applied to push the first block. The force with which the first block pushes the second block is
a) 10 N b) 6 N c) 4 N d) zero

LEVEL – III (101 - 150 Questions)

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

102. A block of mass 2 kg is placed on the floor. The co-efficient of static friction is 0.4. If a force of 2.8 N is applied on the block parallel to the floor the force of friction between the block and floor is (take g=10ms^{-2})
a) 2.8 N b) 8 N c) 2 N d) zero

103. A 20 kg block is initially at rest. A 75 N force required to set the block in motion. After the motion, a force of 60 N is applied to keep the block moving with constant speed. The co-efficient of static friction is
a) 0.6 b) 0.52 c) 0.44 d) 0.35

104. A fire man of mass 60 kg slides down a pole. He is pressing the pole with a force of 600 N. The co-efficient of friction between the hands and the pole is 0.5 with what acceleration will the fireman slide down (g = 10 ms^{-2})
a) 1 ms^{-2} b) 2.5 ms^{-2} c) 10 ms^{-2} d) 5 ms^{-2}

105. A car turns a corner on a slippery road at a constant speed of 10 ms^{-1}. If the coefficient of friction is 0.5, the minimum radius of the arc in meter in which the car turns is
a) 20 b) 10 c) 5 d) 4

106. A body moves along a circular path of radius 10 m and the co-efficient of friction is 0.5. What should angular speed in rad/s. If it is not to slip from the surface (g=9.8 ms^{-2})
a) 5 b) 10 c) 0.1 d) 0.7

107. Two bodies of mass 3 kg and 4 kg are suspended at the ends of massless string passing over a frictionless pulley. The acceleration of the system is (g=9.8 ms^{-2})
a) 4.9 ms^{-2} b) 2.45 ms^{-2} c) 1.4 ms^{-2} d) 9.5 ms^{-2}

108. A light string passes over a frictionless pulley. To one of its ends a mass of 6 kg is attached. To its other end a mass of 10 kg is attached. The tension in the thread will be
a) 24.5 N b) 2.45 N c) 79 N d) 73.5 N

109. As shown in figure the tension in the horizontal cord is 30 N. The weight w and tension in the string OA in Newton are
a) $30\sqrt{3}$,30 b) $30\sqrt{3}$, 60 c) $60\sqrt{3}$, 30 d) None of these

110. The adjacent figure is the part of a horizontally stretched net

section AB is stretched with a force of 10 N. The tension in the section BC and BF are

a) 10 N, 11 N b) 10 N, 6 N c) 10 N, 10 N d) None

111. Two block of masses 7 kg and 5 kg are placed in corner with each other on a smooth surface. If a force of 6N applied on the heavier mass, the force on the lighter mass

a) 3.5 N b) 2.5 N c) 7 N d) 5 N

112. A box is lying on a inclined plane what is the coefficient of static friction. If the box starts sliding when an angle of inclination 60°

a) 1.173 b) 1.732 c) 2.732 d) 1.677

113. The co-efficient of static friction, μ_s between block A of mass 2 kg and the table as shown in fig is 0.1 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 (g=10 ms^{-2})

a) 0.2 kg b) 0.4 kg c) 2.0 kg d) 4.0 kg

114. What is the angular velocity of earth

a) $\frac{2\pi}{86400}$ rad/sec b) $\frac{2\pi}{3600}$ rad/sec c) $\frac{2\pi}{24}$ rad/sec d) $\frac{2\pi}{6400}$ rad/sec

115. A particle moves in a circle of radius 5 cm constant speed and time period 0.2 π s. The acceleration of the particle is

a) 5 ms^{-2} b) 15 ms^{-2} c) 25 ms^{-2} d) 36 ms^{-2}

116. A stone is tied to one end of a string 50 cm long is whirled in a horizontal circle with a constant speed. If the stone makes 10 revolutions in 20 s what is the magnitude of acceleration of the stone

a) 493 cm s^{-2} b) 720 cm s^{-2} c) 860 cm s^{-2} d) 990 cm s^{-2}

117. Three identical blocks, each having a mass m, are pushed by a force f on a frictionless table as shown in Fig. What is the acceleration of the blocks? What is the net force on the block A? What force does A apply on B? What force does B apply on C? Show action – reaction pairs on the contact surfaces of the blocks.

a) F, $\frac{2F}{3}, \frac{F}{3}$ b) $\frac{2F}{3}, F, \frac{F}{3}$ c) $\frac{F}{3}, F, \frac{2F}{3}$ d) None

118. A body of mass 5 kg starts from the origin with an initial velocity $\vec{u} = 30\hat{\imath} + 40\hat{\jmath}$ ms^{-1}. If a constant force $\vec{F} = -(i + 5j)N$ acts on the body the time in which the y-component of the velocity becomes zero is

a) 5 seconds b) 20 seconds c) 40 seconds d) 80 seconds

UNIT – IV

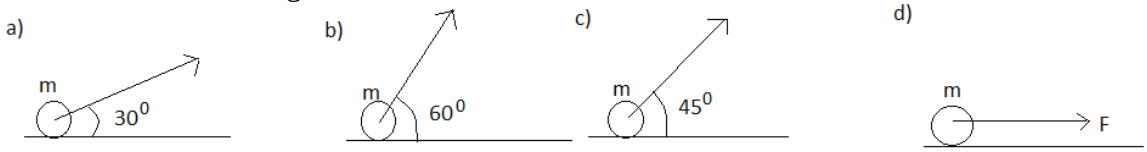
WORK, ENERGY AND POWER

TRY AND TEST YOURSELF

LEVEL – I (1 - 50 Questions)

1. A Man pushes a wall and fails to displace. He does
   a) Negative work b) positive but not maximum work
   c) No work at all d) Maximum work
2. Stopping distance of a moving vehicle is directly proportional to
   a) Square of the initial velocity b) Square of the initial acceleration
   c) Mass of the vehicle d) The initial velocity.
3. The correct relation between joule and erg is
   a) $1J = 10^{-7}erg$ b) $1J = 10^{7}erg$ c) $1J = 10^{-5}erg$ d) $1J: 10^{5}ergs$
4. The area under acceleration-displacement curve of body gives
   a) Impulse b) change in momentum per unit mass
   c) Change in K.E per unit mass d) Total change in energy.
5. When a body is thrown up, work done by gravity on the body is
   a) Positive b) zero c) negative d) None
6. A body at rest can have
   a) Speed b) velocity c) momentum d) energy
7. The slope of the kinetic energy versus position vector gives the rate of change of
   a) velocity b) force c) momentum d) power
8. The work done on a body does not depend upon the
   a) Force applied b) displacement
   c) Initial velocity of the body d) Angle at which force is inclined is the displacement.
9. Newton - meter is the unit of
   a) power b) work c) momentum d) gravitational intensity
10. Ns is equivalent to
    a) $Kg\ ms^{-2}$ b) $Kg\ ms^{-1}$ c) $Kg\ ms^{-3}$ d) $Nm^{-1}s$
11. $Kg\ m^2s^{-2}$ is associated with
    a) energy b) force c) power d) momentum
12. Two bodies of masses m_1 and m_2 have equal K.E their momenta shall be in the ratio of
    a) $m_1 : m_2$ b) $m_2 : m_1$ c) $\sqrt{m_1} : \sqrt{m_2}$ d) $\sqrt{m_2} : \sqrt{m_1}$
13. In which case does the potential energy decrease?
    a) on compressing the spring b) on stretching a spring
    c) on moving a body against gravitational pull
    d) on the raising of an air bubble in water
14. Potential energy of your body is minimum when you
    a) are standing b) are sitting on a chair
    c) are sitting on the ground d) lie down on the ground
15. A wound watch spring has
    a) no energy stored in it b) mechanical P.E stored in it
    c) mechanical K.E stored in it d) electrical energy stored in it.

16. In the figure, the same force (F) is applied on a given mass (m). For moving the mass through the same distance along the horizontal, work done is maximum in the case of



17. 1KW is equal to
    a) 1.34HP b) 1.20HP c) 1.5HP d) None
18. When the K.E of a body is increased by 300% the momentum of the body is increased by
    a) 20% b) 50% c) 100% d) 200%
19. If force and displacement of particle in direction of force are doubled work would be
    a) Double b) 4 times c) Half d) $\frac{1}{4}$ times
20. A block of mass 5Kg 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 40J after moving 4m.
    a) 30° b) 45° c) 60° d) 120°
21. A body moves a distance of 10m along a straight line under the action of force of 5N. If the work done is 25 joules the angle which the force makes with the direction of motion of the body is
    a) 0° b) 30° c) 60° d) 90°
22. A Force acts on 30g 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 t is in seconds. The work done during the first 4 seconds is
    a) 5.28 J b) 450 MJ c) 490 MJ d) 530 MJ
23. A ball is released from the top of a tower. The ratio of work done by force of gravity in first, second and third second of the motion of the ball is
    a) 1:2:3 b) 1:4:4 c) 1:3:5 d) 1:5:3
24. A man starts walking from a point on the surface of earth (assumed smooth) and reaches diagonally opposite point. What is the work done by him?
    a) Zero b) positive c) Negative d) Nothing can be said
25. The energy which an $\bar{e}$ acquires when accelerated through a potential difference of 1 volt is called
    a) 1 Joule b) 1 ev c) 1 Erg d) 1 watt
26. A body of mass 10kg at rest is acted upon simultaneously by two forces 4 N and 3N at right angles to each other. The kinetic energy of the body at the end of 10 sec is
    a) 100 J b) 300 J c) 50 J d) 125 J
27. 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) mv J c) $\frac{m}{v}J$ d) $\frac{v}{m}J$
28. The kinetic energy acquired by a body of mass m in travelling some distance S. starting from rest under the action of a constant force is directly proportional
    a) $m°$ b) m c) m^2 d) $\sqrt{m}$
29. A particle moves from a point (-2i+5j) to (4j+3k) when a force of (4i+3j) N is applied. How much work has been done by the force?
    a) 2J b) 8J c) 11J d) 5J
30. If we throw a body upwards with velocity of $4ms^{-1}$ at what height does its kinetic energy reduce to half of the initial value (Taking $g = 10ms^{-1}$)

a) 4m b) 2m c) 1m d) 0.4m

31. A long spring is stretched by 0.02m. Its potential energy is u. It the spring is stretched by 0.1m, then its potential energy will be
a) $\frac{u}{5}$ b) u c) 5u d) 25u

32. The spring extends by x on loading, then energy stored by the spring is (T→ $tension, k \rightarrow spring\ constant$)
a) $\frac{T^2}{2K}$ b) $\frac{T^2}{2K^2}$ c) $\frac{2K}{T^2}$ d) $\frac{2T^2}{K}$

33. Energy required to break one bond in DNA is
a) $10^{-10}J$ b) $10^{-18}J$ c) $10^{-20}J$ d) $10^{-7}J$

34. If a force F is applied on a body and it moves with velocity V the power will be
a) Fx V b) $\frac{F}{V}$ c) $\frac{F}{V^2}$ d) Fx V^2

35. A Particle is acted upon by a constant power. Then which of the following physical quantity remains constant.
a) Speed b) Rate of change of acceleration
c) Kinetic energy d) Rate of change of kinetic energy

36. 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 non-conservative force
c) By the system against a conservative force
d) Upon the system by a conservative force.

37. 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 instant just before the body hits the earth
c) It remains constant all through
d) At the instant just after the body is projected

38. 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 $13.6 * 10^3\ kgm^{-3} and\ g = 10ms^{-2}$ Then the power (in watt) is
a) 3.0 b) 1.50 c) 1.70 d) 2.35

39. One coolie takes 1 minute to raise a suitcase through a height of 2m but the second coolie takes 30s to raise the same suitcase to the same height the powers of two coolies are in the ratio.
a) 1:3 b) 2:1 c) 3:1 d) 1:2

40. 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 $x = o\ to\ x = 6m$ is
a) 18.0J b) 13.5 J c) 9.0 J d) 4.5 J

41. A child is sitting on a swing. Its minimum and maximum heights from the ground 0.75m and 2m respectively. It maximum speed will be ($g = 10ms^{-2}$)
a) $10ms^{-1}$ b) $5ms^{-1}$ c) $8ms^{-1}$ d) $15ms^{-1}$

42. What is the minimum velocity with which a body of mass m must enter a vertical loop of radius R. So that is can complete the loop?
a) $\sqrt{3gR}$ b) $\sqrt{5gR}$ c) $\sqrt{gR}$ d) $\sqrt{2gR}$

43. A 10 H.P motor pumps out water from a well of depth 20m and fills a water tank of volume 22380 litres at a height of 10m from the ground. The running time of the motor to fill the empty water tank is ($g = 10ms^{-2}$)

a) 5 minutes b) 10 minutes c) 15 minutes d) 20 minutes

44. A fighter plane is moving in a vertical circle of radius 'r'. Its minimum velocity at the highest point of the circle will be
a) $\sqrt{3gr}$ b) $\sqrt{2gr}$ c) $\sqrt{gr}$ d) $g\frac{r}{2}$

45. A 1 Kg stone at the end of 1 m long string is whirled in a vertical circle at constant speed of $4ms^{-1}$. The tension in the string is 6N. When the stone at $(g = 10ms^{-2})$
a) Top of the circle b) Bottom of the circle
c) Half way down d) None of the above

46. A particle is moving in a vertical circle. The tensions in the string when passing through two position at angle 30° and 60° from vertical (lowest position) are $T_1 and\ T_2$ respectively then
a) $T_1 = T_2$ b) $T_2 > T_1$ c) $T_1 > T_2$ d) None

47. A hollow sphere has radius 6.4m. Minimum velocity required by a motor cyclist at bottom to complete the circle will be
a) $17.7ms^{-1}$ b) $10.2ms^{-1}$ c) $12.4ms^{-1}$ d) $16.0ms^{-1}$

48. 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

49. A shell initially at rest explodes into two pieces of equal mass, then the two pieces will
a) Be at rest b) Move with different velocities in different directions
c) Move with same velocity in opposite direction
d) Move with same velocity in same direction.

50. When two bodies collide elastically, then
a) Kinetic energy of the system alone is conserved
b) Only momentum is conserved
c) Both energy and momentum are conserved
d) Neither energy nor momentum is conserved

LEVEL – I (51 - 60 Questions)

51. In an elastic collision of two particles the following is conserved
a) Momentum of each particle b) Speed of each particle
c) K.E of each particle d) Total K.E of both particle

52. A body of mass M_1 collides elastically with another mass M_2 at rest. There is maximum transfer of energy when
a) $M_1 > M_2$ b) $M_1 < M_2$ c) $M_1 = M_2$ d) Same for all values of M_1 and M_2

53. In an inelastic collision
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

54. A body of mass m_1 is moving with a velocity V. It collides with another stationary body of mass m_2. They get embedded. At the point of collision the velocity of the system.
a) Increases b) Decreases but does not become zero.
c) Remains same d) Become zero

55. Which of the following is not a perfectly inelastic collision
a) Striking of two glass balls b) A bullet striking a bag of sand
c) An electron captured by a proton d) A man jumping onto a moving cart

56. A body of mass m_1 moving with a velocity $3ms^{-1}$ collides with another body at rest of mass m_2. After collision the velocities of the two bodies are $2ms^{-1}$ and $5ms^{-1}$ respectively along the direction of motion of m_1. The ratio $\frac{m_1}{m_2}$ is

a) $\frac{5}{12}$ b) 5 c) $\frac{1}{5}$ d) $\frac{12}{5}$

57. A body of mass 4 kg moving with velocity 12 ms^{-1}collides with another body of mass 6kg at rest. If two bodies stick together after collision, then the loss of kinetic energy of system is

a) Zero b) 288 J c) 172.8 J d) 144 J

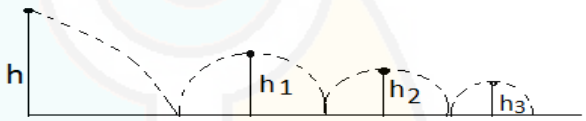
58. A particle of mass m moving with velocity V strikes a stationary particle of mass 2m and sticks to it. The speed of the system will be.

a) $\frac{v}{2}$ b) 2V c) $\frac{v}{3}$ d) 3v

59. A particle falls from a height h upon a fixed horizontal plane and rebounds. If e is the co-efficient of restitution, the total distance travelled before rebounding has stopped is

a) $h(\frac{1+e^2}{1-e^2})$ b) $h(\frac{1-e^2}{1+e^2})$

c) $\frac{h}{2}(\frac{1-e^2}{1+e^2})$ d) $\frac{h}{2}(\frac{1+e^2}{1-e^2})$



60. Two dimensional 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) $\frac{M}{4}(u_2-u_1)^2$

UNIT – V

MOTION OF SYSTEM OF PARTICLES AND RIGID BODIES

TRY AND TEST YOURSELF

LEVEL – I (1 - 50 Questions)

1. Which of the following statements are correct? NEET – 2017
(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 produces both translational and rotational motion in a body.
(iv) Mechanical advantage greater than one means that small effort can be used to lift a larg load
a) (1) and (2) b) (2) and (3) c) (3) and (4) d) (2) and (4)

2. 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 NEET –II – 2016
a) $\frac{m_1 m_2}{m_1+m_2} l^2$ b) $\frac{m_1+m_2}{m_1 m_2} l^2$ c) $(m_1 + m_2)l^2$ d) $\sqrt{m_1 m_2}\, l^2$

3. 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 NEET – 2015
a) $x = \frac{m_2}{m_1} L$ b) $x = \frac{m_2 L}{m_1+m_2}$ c) $x = \frac{m_1 L}{m_1+m_2}$ d) $x = \frac{m_1}{m_2} L$

4. Three masses are placed on the x-axis 300g at orgin, 500g at x = 40cm and 400g at x=70cm. The distance of the centre of mass from the origin is
a) 40 cm b) 45 cm c) 50 cm d) 30 cm

5. Two particles which are initially at rest move towards each other under the action of their internal attraction. If their speeds are V and 2V at any instant then the speed of centre of mass of the system will be
a) 2V b) zero c) 1.4 V d) V

6. Two bodies of mass 1 kg and 3 kg have position vectors $\hat{\imath} + 2\hat{\jmath} + \hat{k}$ and $-3\hat{\imath} - 2\hat{\jmath} + \hat{k}$ respectively. The centre of mass of this system has a position vector
a) $-2\hat{\imath} - \hat{\jmath} + \hat{k}$ b) $2\hat{\imath} - \hat{\jmath} - 2\hat{k}$ c) $-\hat{\imath} + \hat{\jmath} + \hat{k}$ d) $-2\hat{\imath} + 2\hat{k}$

7. Consider a system of two particles having masses m_1 and m_2. If the particle of mass m_1 is pushed towards the mass centre of particles through a distance d, by what distance would be particle of mass m_2 move so as to keep the mass centre of particles at the original position?
a) $\frac{m}{m_1+m_2}\, d$ b) $\frac{m_1}{m_2}\, d$ c) d d) $\frac{m_2}{m_1}\, d$

8. Three identical metal balls, each of the radius r are placed touching each other on a horizontal surface such that an equilateral triangle is formed when centres of three balls are joined. The centre of the mass of the system is located at
a) line joining centres of any two balls b) centre of one of the balls
c) horizontal surface d) point of intersection of the medians

9. The centre of mass of system of particles does not depend on
a) position of the particles b) relative distances between the particles
c) masses of the particles d) forces acting on the particle

10. The centre of mass of a body
a) lies always at the geometrical centre b) liew always inside the body

c) lies always outside the body d) may lie within or outside the body

11. The reduce mass of two particles having masses m and 2m is
a) 2m b) 3 m c) $\frac{2m}{3}$ d) $\frac{m}{2}$

12. 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_1 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) $\frac{d_1}{d_2} = \frac{m_2}{m_1+m_2}$

13. Two object of masses 200g and 500g possess velocities $10\hat{\imath}$ m/s and $3\hat{\imath} + 5\hat{\jmath}$ m/s respectively. The velocity of their centre of mass in m/s is
a) $5\hat{\imath} + 5\hat{\jmath}$ b) $\frac{5}{7}\hat{\imath} + 5\hat{\jmath}$ c) $5\hat{\imath} + \frac{25}{7}\hat{\jmath}$ d) $25\hat{\imath} - \frac{5}{7}\hat{\jmath}$

14. A disc is rolling, the velocity of its centre of mass is V_{CM}. Which one will be correct?
a) the velocity of highest point is $2V_{CM}$ and point of contact is zero.
b) the velocity of highest point is V_{CM} and point of contact is V_{CM}
c) the velocity of highest point is $2V_{CM}$ and point of contact is V_{CM}
d) the velocity of highest point is $2V_{CM}$ and point of contact is $2V_{CM}$

15. A system consists of 3 particles each of mass m located at point (1,1), (2,2) and (3,3) The co-ordinates of the centre of mass are
a) (6, 6) b) (3, 3) c) (1, 1) d) (2, 2)

16. Identify the correct statement for the rotational motion of a rigid body
a) Individual particles of the body do not undergo 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

17. Two masses m_1 and m_2 ($m_1 > m_2$) are connected by massless flexible and inextensible string passed over massless and frictionless palley. The acceleration of centre of mass is
a) $\left(\frac{m_1-m_2}{m_1+m_2}\right)^2 g$ b) $\frac{m_1-m_2}{m_1+m_2} g$ c) $\frac{m_1-m_2}{m_1+m_2} g$ d) zero

18. If Linear density of a rod of length 3m varies as $\lambda = 2 + x$ then the position of the centre of gravity of the rod is
a) $\frac{7}{3}\ m$ b) $\frac{12}{7}\ m$ c) $\frac{10}{7}\ m$ d) $\frac{9}{7}\ m$

19. A small disc of radius 2 cm is cut from a disc of radius 6 cm. If the distance between their centres is 3.2 cm what is the shift in the centre of mass
a) 0.4 cm b) 2.4 cm c) 1.8 cm d) 1.2 cm

20. Two bodies of different masses of 2 kg and 4 kg are moving with velocities 20 m/s and 10m/s towards each other due to mutual gravitational attraction. What is the velocity of their centre of mass
a) 5 ms^{-1} b) 6 ms^{-1} c) 8 ms^{-1} d) zero

21. A fire cracker following a parabolic path explodes in mid air. The centre of mass of all the fragments will follow a path
a) along horizontal b) along vertical c) along same parabola d) along circle

22. 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

23. A solid sphere is rotating freely about its symmetry axis in free space. The radius of the sphere is increased keeping its mass same. Which of the following physical quantities would remain constant for the sphere? NEET - 2018
a) Rotational kinetic energy b) Moment of Inertia
c) Angular velocity d) Angular momentum

24. The moment of the force $\vec{F} = 4\hat{\imath} + 5\hat{\jmath} - 6\hat{k}$ at (2, 0, -3) about the point (2, -2, -2) is given by
a) $-7\hat{\imath} - 8\hat{\jmath} - 4\hat{k}$ b) $-4\hat{\imath} - \hat{\jmath} - 8\hat{k}$ c) $-8\hat{\imath} - 4\hat{\jmath} - 7\hat{k}$ d) $-7\hat{\imath} - 4\hat{\jmath} - 8\hat{k}$

25. A rope is wound around a hollow cylinder of mass 3 kg and radius 40 cm. what is the angular acceleration of the cylinder if the rope is pulled with a force of 30 N? NEET - 2017
a) 0.25 rad s^{-2} b) 25 rad s^{-2} c) 5 ms^{-2} a) 25 ms^{-2}

26. A uniform circular disc of radius 50 cm at rest is free to turn about an axis which perpendicular to its plane and passes through it centre. It is subjected to a torque which produces a constant angular acceleration of 2.0 rad s^{-2}. Its net acceleration in ms^{-2} at the end of 2.0 s is approximately. NEET - 2016
a) 6.0 b) 3.0 c) 8.0 d) 7.0

27. A force $\vec{F} = \alpha\vec{\imath} + 3\vec{\jmath} + 6\vec{k}$ is acting at a point $\vec{r} = 2\vec{\imath} - 6\vec{\jmath} - 12\vec{k}$. The value of α for which angular momentum about origin is conserved is
a) zero b) 1 c) -1 d) 2

28. A solid cylinder of mass 50 kg and radius 0.5 m is free to rotate 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 5^2 is
a) 25 N B) 50 N c) 78.5 N d) 157 N

29. Two discs are rotating about their axes. Normal to the discs and passing through the centres of the discs. Disc D_1 has 2 kg mass and 0.2 m radius and initial angular velocity of 50 rad s^{-1}. Disc D_2 has 4 kg mass and 0.1 m radius and initial angular velocity of 200 rad s^{-1}. The two discs are brought in contact face to face with their axes of rotation coincident. The final angular velocity (in rad s^{-1}) of the system is (2013)
a) 60 b) 100 c) 120 d) 40

30. When a mass is rotating in a plane about a fixed point, its angular momentum is directed along
a) a line perpendicular to the place of rotation
b) the line making an angle of 45° to the plane of rotation
c) the radius d) the tangent to the orbit

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

32. A thin circular ring of mass M and radius r is rotating about its axis with constant angular velocity ω. Two objects each of mass m are attached gently to the opposite ends of a diameter of the ring. The ring now rotates with angular velocity given by
a) $\frac{(M+2M)\omega}{2m}$ b) $\frac{2M\,\omega}{M+2m}$ c) $\frac{(M+2M)\omega}{M}$ d) $\frac{M\,\omega}{M+2m}$

33. 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 ω. If two objects each of mass m be attached gently to the oposite 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) $\frac{M\,\omega}{M+m}$ d)) $\frac{\omega(M-2M)}{M+m}$

34. 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 $\vec{F}.\vec{\tau} = 0$

35. A particle of mass m moves in the 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 AB
c) $L_A < L_B$ d) $L_A > L_B$

36. A wheel has angular acceleration of 3.0 rad/sec^2 and an initial angular speed of 2.00 rad/sec In a time of 2 sec it has rotated through an angle of
a) 10 b) 12 c) 4 d) 6

37. A disc is rotating with angular speed ω If a child sits on it, what is conserved. (2002)
a) linear momentum b) angular momentum
c) kinetic energy d) potential energy

38. A particle of mass m= 5 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 (1991)
a) 60 units b) $3\sqrt{2}$ units c) zero d) 7.5 units

39. The correct relation between linear velocity $\vec{V}$ and angular velocity $\vec{\omega}$ of a particle is
a) $\vec{V} = \vec{\omega} \times \vec{r}$ b) $\vec{\omega} = \vec{V} \times \vec{r}$
c) $\vec{\omega} = \vec{r} \times \vec{V}$ d) $\vec{V} = \vec{r} \times \vec{\omega}$

40. The expression for torque in polar co-ordinates is
a) $\tau = rF\ sin\emptyset$ b) $\tau = rF\ cos\emptyset$
c) $\tau = rF\ tan\emptyset$ d) $\tau = \frac{F\ sin\emptyset}{r}$

41. The moment of linear momentum is called
a) torque b) couple c) angular momentum d) none of these

42. The correct relation between torque τ and angular momentum L is
a) $\tau = \frac{dL}{dt}$ b) $L = \frac{d\tau}{dt}$ c) $\tau = L \times t$ d) $L = \tau \times t$

43. Angular velocity of minute's hand of a clock in radian/sec is
a) $\frac{\pi}{30}$ b) $\frac{\pi}{1800}$ c) $\frac{2\pi}{30}$ d) $\frac{2\pi}{1800}$

44. A particle of mass 2 kg located at the position $(\hat{\imath} + \hat{\jmath})$m has velocity $2(\hat{\imath} - \hat{\jmath} + \hat{k})$ m/s. Its angular momentum about z axis in Kg m^2/s is
a) +4 b) -8 c) +8 d) -4

45. 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 an radian and t is in seconds, then the angular velocity of the particle after 2 second is
a) 12 rad/s b) 8 rad/ s c) 36 rad/s d) 24 rad/s

46. A disc of mass 2 kg and radius 0.2m is rotating with angular velocity 30 rad/s what is angular velocity if a mass of 0.5 kg is put on periphery of the disc?
a) 24 rad/s b) 26 rad/ s c) 20 rad/s d) 15 rad/s

47. A rigid body rotates about a fixed axis with variable angular velocity equal to $(\alpha - \beta t)$ at the time t, where α, β are constants. The angle through which it rotates before it stops.
a) $\frac{\alpha+\beta}{2}$ b) $\frac{\alpha-\beta}{2}$ c) $\frac{\alpha^2-\beta^2}{2\beta}$ d) $\frac{\alpha^2}{2\beta}$

48. The direction of the angular velocity vector is along
a) the tangent to the circular path b) the inward radius
c) the outward direction d) the axis of rotation

49. When the 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

50. If linear velocity is constant then anglar velocity is proportional to
a) $\frac{1}{r}$ b) $\frac{1}{r^2}$ c) $\frac{1}{r^3}$ d) $\frac{1}{r^5}$

LEVEL – II (51 - 100 Questions)

51. In rotational motion of a rigid body, all particles move with
    a) same linear & angular velocity
    b) same linear and different angular velocity
    c) with different linear velocities and same angular velocities
    d) with different linear velocities and different angular velocities
52. The wheel of a car is rotating at the rate of 1200 revolutions per minute. On pressing the accelerator for 10 seconds. It starts rotating at 4500 revolution per minute. The angular acceleration of the wheel is
    a) 30 radian/ second^2 b) 1880 degrees/ second^2
    c) 40 radians/ second^2 d) 1980 degrees/ second^2
53. When a steady torque acts on the body the body
    a) continues in its state of rest or of uniform circular motion
    b) gets linear acceleration
    c) gets angular acceleration d) rotates at constant speed
54. If the external torque acting on a system $\vec{\tau} = 0$, then
    a) $\omega = 0$ b) $\alpha = 0$ c) J= 0 d) F = 0
55. A constant torque acting on a unifrm circular wheel changes its angular momentum from A_0 to $4A_0$ in 4 seconds. The magnitude of this torque is
    a) $\frac{3A_0}{4}$ b) A_0 c) $4A_0$ d) 12 A_0
56. The motion of planets in the solar system is an example of the conservation of
    a) Mass b) Linear momentum
    c) Angular momentum d) Energy
57. If a force acts on a body at a point away from the centre of mass, then
    a) Linear acceleration changes b) Angular acceleration changes
    c) Both change d) None of these
58. A rigid body is said to be in translational equillibrius. When its velocity $\vec{V}$ is
    a) zero b) constant
    c) constant or zero d) neither constant nor zero
59. 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)
60. A couple produces
    a) linear and rotational motion b) no motion
    c) Purely linear motion d) purely rotational motion
61. A car of mass 1000kg negotiates a banked curve of radius 90 m on a frictionless road. If the banking angle is 45° the speed of the car is (2012)
    a) 20 ms^{-1} b) 30 ms^{-1} c) 5 ms^{-1} d) 10 ms^{-1}
62. A rod of length is 3 m and its mass acting per unit length is directly proportional to distance *x* from one of its end then its centre of gravity from that end will be at (2002)
    a) 1.5 m b) 2 m c) 2.5 m d) 3.0 m
63. 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? NEET - 2016
    a) $\frac{11MR^2}{32}$ b) $\frac{9MR^2}{32}$ c) $\frac{15MR^2}{32}$ d) $\frac{13MR^2}{32}$

64. Three identical spherical shells, each of mass m and radius r are placed as show 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 (2015)
a) $\frac{1}{2}mr^2$ b) $4\ mr^2$ c) $\frac{11}{5}mr^2$ d) $3\ mr^2$

65. The moment of inertia of a uniform circular disc is maximum about an axis perpendicular to the disc and passing through (2012)
a) B b) C c) D d) A

66. 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 (2011)
a) $I_0 + {ML^2}/{2}$ b) $I_0 + {ML^2}/{4}$ c) $I_0 + 2ML^2$ d) $I_0 + ML^2$

67. From a circular disc of radius R and mass 9M, a small disc of mass M and radius $\frac{R}{3}$ is removed concentrically. The moment of inertia of the remaining disc about an axis perpendicular to the plane of the disc and passing through the centre is (2010)
a) $\frac{40}{9}MR^2$ b) MR^2 c) $4\ MR^2$ d) $\frac{4}{9}MR^2$

68. The moment of inertia of a uniform circular disc of radius R and mass M about an axis touching the disc at its diameter and normal to the disc (2006)
a) $\frac{1}{2}MR^2$ b) MR^2 c) $\frac{2}{5}MR^2$ d) $\frac{3}{2}MR^2$

69. 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 (2005)
a) MR^2 b) $\frac{1}{2}MR^2$ c) $\frac{3}{2}MR^2$ d) $\frac{7}{2}MR^2$

70. A circular disc is to be made by using iron and aluminium so that it acquired maximum moment of inertia about geometrical axis. It is possible with (2002)
a) aluminium at interior and iron surround to it
b) Iron at interior and aluminium surround to it
c) using iron and aluminium layers in alternate order
d) sheet of iron is used at both external surface and aluminium sheet as internal layers

71. 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 diameter is
a) $\frac{5}{4}MR^2$ b) $\frac{2}{3}MR^2$ c) $\frac{3}{2}MR^2$ d) $\frac{4}{5}MR^2$

72. A fly wheel rotating about 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 (1990)
a) 0.6 kg m^2 b) 0.15 kg m^2 c) 0.8 kg m^2 d) 0.75 kg m^2

73. 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 (1990)
a) 5I b) 3I c) 6I d) 4I

74. Moment of Inertia of a body depends upon
a) mass of body
b) shape and size of body
c) position of orientation of axis of rotation
d) all the above

75. What is the moment of inertia of a solid sphere of density ρ and radius R about it diameter?
a) $\frac{105}{176}R^5\rho$ b) $\frac{176}{105}R^5\rho$ c) $\frac{105}{176}R^2\rho$ d) $\frac{176}{105}R^2\rho$

76. The moment of inertia of a solid sphere and a spherical shell of equal masses about their diameter are equal. The ratio of their radii is

a) 5 : 3 b) 3 : 5 c) $\sqrt{5} : \sqrt{3}$ d) $\sqrt{3} : \sqrt{5}$

77. A cylindrical solid of mass M has radius R and length L. Its moment of Inertia about a generator is
a) $M\left(\frac{L}{2R}+\frac{R^2}{4}\right)$ b) $M\left(\frac{L}{3}+\frac{R^2}{4}\right)$ c) $\frac{1}{2}MR^2$ d) $\frac{3}{2}MR^2$

78. The moment of Inertia of a body does not depend upon
a) The angular velocity of the body b) The mass of the body
c) The distribution of mass of the body d) The axis of rotation of the body

79. Analogue of mass in rotational motion is
a) Moment of Inertia b) Angular momentum
c) Torque d) None of these

80. The ratio of radii of gyration of a circular disc, of the same mass and radius about an axis passing through their centres and perpendicular to their planes are (2013)
a) $1 : \sqrt{2}$ b) 3 : 2 c) 2 : 1 d) $\sqrt{2} : 1$

81. The ratio of the radii of gyration of a circular disc to that of a circular ring , watch of same mass an radius, around their respective (2008)
a) $\sqrt{2} : 1$ b) $\sqrt{2} : \sqrt{3}$ c) $\sqrt{3} : \sqrt{2}$ d) $1 : \sqrt{2}$

82. The ratio of the radii of gyration of a circular disc about a tangential axis in the plane of the disc and a circular ring of the same radius about a tangential axis in the plane of the ring (2004)
a) 2 : 3 b) 2 : 1 c) $\sqrt{5} : \sqrt{6}$ d) $1 : \sqrt{2}$

83. The radius of gyration of a uniform circular disc of radius R about any diameter of the disc is
a) K = R b) K = $\frac{R}{2}$ c) K = 2R d) none of these

84. A wheel of mass 10kg has a moment of Inertia of 160 kgm^2 about its own axis, the radius of gyration will be
a) 10 m b) 8 m c) 6 m d) 4 m

85. Radius of gyration of a body depends on
a) Mass and size of body b) Mass distribution and axis of rotation
c) Size of body d) Mass of body

86. The radius of gyration of disc of mass 50 g and radius 2.5 cm about an axis passing through its centre of gravity and perpendicular to the plane is
a) 0.52 cm b) 1.76 cm c) 3.54 cm d) 6.54 cm

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

88. Kinetic energy of a body rolling without slipping is
a) k = $\frac{1}{2}mv^2$ b) k = $\frac{1}{2}I\omega^2$ c) k = $\frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$ d) k = $\frac{1}{2}mv^2 - \frac{1}{2}I\omega^2$

89. A particle perform uniform circular motion with an angular momentum L. If the frequency of the particles motion is doubled and kinetic energy halved, the angular momentum becomes
a) 2 L b) 4 L c) $\frac{L}{2}$ d) $\frac{L}{4}$

90. An automobile engine develops 100 kw. When rotating at a speed of 1800 rev/min. What tor1ue does it deliver.
a) 350 N-m b) 440 N- m c) 531 N-m d) 628 N- m

91. A fly wheel of moment of inertia 3 x 10^2 kg m^2 is rotating with uniform angular speed of 4.6 rad s^{-1}. If a torque of 6.9 x 10^2 Nm retards the wheel, then the time in which the wheel comes to rest is
a) 1.5 s b) 2 s c) 0.5 s d) 1 s

92. 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

93. The moment of inertia of a flywheel having kinetic energy 360 J and angular speed 20 rad/s is
a) 18 kg m^2 b) 1.8 kg m^2 c) 2.5 kg m^2 d) 9 kg m^2

94. Two rigid bodies A and B rotate with rotational kinetic energies E_A and E_B respectively. The moment of inertia of A and B about the axis of rotation are I_A and I_B respectively. If and $I_A = \frac{I_B}{4}$ and $E_A = 100\ E_B$ the ratio of angular momentum (L_A) of A to the angular momentum (L_B) of B is
a) 25 b) $\frac{5}{4}$ c) 5 d) $\frac{1}{4}$

95. Two bodies with moment of Inertia I_1 and I_2 (such that $I_1 > I_2$) have equal angular velocity. If their kinetic energy of rotation are E_1 and E_2 then
a) $E_1 \geq E_2$ b) $E_1 > E_2$ c) $E_1 < E_2$ d) $E_1 = E_2$

96. If the angular momentum of a rotating body about a fixed axis is increased by 10%. Its kinetic energy will be increased by
a) 10% b) 20% c) 21% d) 5%

97. Three objects A: (a solid sphere), B(a thin circular disc) and C : (a circular ring), each have the same mass M and radius R. They all spin with the same angular speed ω about their own symmetry axes. The amounts of work (W) required to bring them to rest, would satisfy the relation.
NEET 2018
a) $W_B > W_A > W_C$ b) $W_A > W_B > W_C$ c) $W_C > W_B > W_A$ d) $W_A > W_C > W_B$

98. A solid sphere is rolling motion. In rolling motion a body possesses translational kinetic energy (K_t) as well as rotational kinetic energy (K_r) simultaneously. The ratio $K_t : (K_t + K_r)$ for the sphere is
NEET 2018
a) 10 : 7 b) 5 : 7 c) 7 : 10 d) 2 : 5

99. Two discs of sme moment of inertia rotate 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 cotact face to face coinciding the axis of rotation. The expression for loss of energy during this process is
NEET 2017
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) $\frac{1}{2}\ I\ (\omega_1 + \omega_2)^2$

100. Two rotating bodies A and B of masses m and 2m with moment 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 them
a) $L_A = \frac{L_B}{2}$ b) $L_A = 2\ L_B$ c) $L_B > L_A$ d) $L_A > L_B$

LEVEL – III (101 - 148 Questions)

101. 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 it geometrical axis with an angular speed twice that of the sphere. The ratio of their kinetic energies of rotation will be
a) 2 : 3 b) 1 : 5 c) 1 : 4 d) 3 : 1

102. An Automobile moves on a road with a speed of 54 kmh^{-1}. The radius of its wheels its 0.45 m and the moment of inertia of the wheel about its axis of rotation is 3 kgm^{-2}. If the vehicle is brought to rest in 15 s, the magnitude of average torque transmitted by its brakes to the wheel is (2015)
a) 10.86 kg m^2 s^{-2} b) 2.86 kg m^2 s^{-2} c) 6.66 kg m^2 s^{-2} d) 8.58 kg m^2 s^{-2}

103. 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 $\frac{R_0}{2}$. The final value of the kinetic energy is (2015)

a) $2\,mv_0^2$ b) $\frac{1}{2}mv_0^2$ c) mv_0^2 d) $\frac{1}{4}mv_0^2$

104. 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 (2014)

a) 5 : 7 b) 2 : 3 c) 2 : 5 d) 7 : 5

105. 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 (2013)

a) hollow spher b) disc c) ring d) solid sphere

106. A solid cylinder and a hollow cylinder both of the same mass and same external diameter are released from the same height at the same time on an inclined plane. Both roll down without slipping. Which one will reach the bottom first ? (2010)

a) Both together only when angle of inclination of plane is 45°
b) Both together
c) Hollow cylinder d) Solid cylinder

107. A drum of radius R and mass M, rolls down without slipping along an inclined plane of angle θ. The frictional force (2005)

a) dissipates energy as heat
b) decreases the rotational motion
c) decreases the rotational and translational motion
d) converts translational energy to rotational energy

108. Two bodies have their moment of inertia I and 2I respectively about their axis of rotation. If their kinetic energies of rotation are equal their angular velocity will be in the ratio (2005)

a) 2 : 1 b) 1 : 2 c) $\sqrt{2}$:1 d) 1 : $\sqrt{2}$

109. 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 (2004)

a) $\frac{2\pi}{15}$ Nm b) $\frac{\pi}{12}$ Nm c) $\frac{\pi}{15}$ Nm d) $\frac{\pi}{18}$ Nm

110. 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 disc is (2004)

a) $\frac{I_2\omega}{I_1+I_2}$ b) ω c) $\frac{I_1\omega}{I_1+I_2}$ d) $\frac{(I_1+I_2)\omega}{I_1}$

111. 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 (2003)

a) $\frac{k^2+R^2}{R^2}$ b) $\frac{k^2}{R^2}$ c) $\frac{k^2}{k^2+R^2}$ d) $\frac{R^2}{k^2+R^2}$

112. 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? (2003, 1989)

a) $\sqrt{2gh}$ b) $\sqrt{\frac{3}{4}gh}$ c) $\sqrt{\frac{4}{3}gh}$ d) $\sqrt{4gh}$

113. 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 to two perpendicular diameters of the ring. The angular velocity of the ring will be

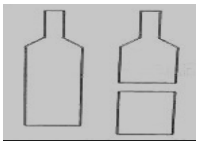
a) $\frac{M\omega}{4m}$ b) $\frac{M\omega}{m+4m}$ c) $\frac{(m+4m)\omega}{M}$ d) $\frac{(M-4m)\omega}{M+4m}$

114. A solid sphere of radius R is placed on smooth horizontal surface. A horizontal force F is applied at a height h from the lowest point. For the maximum acceleration of centre of mass. Which is correct? (2002)
a) h=R b) h = 2R
c) h = 0 d) no relation between h and R

115. A disc is rotating with angular speed ω. If a child sits on it. What is conserved. (2002)
a) linear momentum b) angular momentum
c) kinetic energy d) potential energy

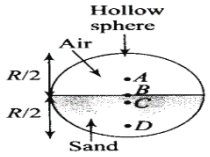
116. For a hollow cylinder and a solid cylinder rolling without slipping on an inclined plane then which of these reaches earlier. (2000)
a) Solid cylinder b) hollow cylinder
c) both simultaneously d) can't say anything

117. A cricket bat is cut at the location of its centre of mass as shown. Then



a) The two pieces will have the same mass
b) The bottom piece will have larger mass
c) The handle piece will have larger mass
d) Mass of handle piece is double the mass of bottom piece.

118. Which of the following points is the likely position of the centre of mass of the system shown in Fig.

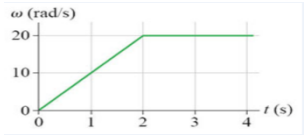


a) A b) B c) C d) D

119. A rod PQ 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 (2013)

a) $\frac{2g}{L}$ b) $\frac{2g}{2L}$ c) $\frac{3g}{2L}$ d) $\frac{g}{L}$

120. Shows the angular velocity versus time graph of a flywheel. The angle in radians through which the fly wheel turns during 25 s is



a) 750 b) 120 c) 480 d) 600

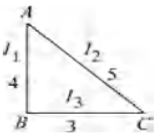
121. A wheel of radius R rolls on the ground with a uniform Velocity V. The velocity of top most point relative to bottom most point is
a) zero b) 2 V c) V d) $\frac{V}{2}$

122. 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) $\frac{4}{3}Ml^2$

123. 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) $\frac{ML^2}{6}$ b) $\frac{\sqrt{2}ML^2}{24}$ c) $\frac{ML^2}{24}$ d) $\frac{ML^2}{12}$

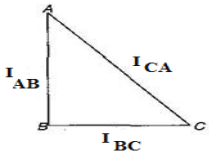
124. Three particles each of mass m gram are situated at the vertices of an equilateral triangle ABC of side *l* cm. The moment of inertia of the system about a line Ax peroendicular to AB and in the plane of ABC in gram - cm^2 units will be (2004)
a) $\frac{3}{4}Ml^2$ b) $2Ml^2$ c) $\frac{5}{4}Ml^2$ d) $\frac{3}{2}Ml^2$

125. For the adjoining diagram, the correct relation between I_1, I_2 and I_3 is (I – moment of Inertia)



a) $I_1 > I_2$ b) $I_2 > I_1$ c) $I_3 > I_1$ d) $I_3 > I_2$

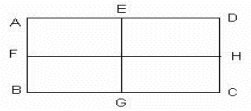
126. The ABC is a triangular plate of uniform thickness. The sides are in the ratio shown in the figure. I_{AB} I_{BC} and I_{CA} are the moments of inertia of the plate about AB, BC and CA respectively. Which one of the following relations is correct? (1995)



a) $I_{AB} + I_{BC} = I_{CA}$ b) I_{CA} is maximum

c) $I_{AB} > I_{BC}$ d) $I_{BC} > I_{AB}$

127. In a rectangle ABCD (BC = 2AB). The moment of inertia is minimum along axis through (1993)

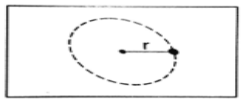


a) BC b) BD c) HF d) EG

128. Three identical rods, each of length L, are joined to form a rigid equilateral triangle. Its radius of gyration about an axis passing through a corner and perpendicular to plane of triangle is

a) $\frac{L}{\sqrt{2}}$ b) $\frac{L}{\sqrt{3}}$ c) $\frac{L}{2}$ d) $\frac{L}{3}$

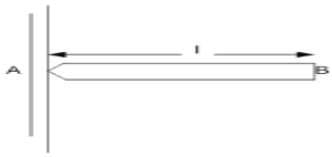
129. A small mass attached to a string rotates on a frictionless table top as shown. If the tension in the string is increased by pulling the string causing the radius of the circular motion to decrease by a factor of 2. The kinetic energy of the mass will (2011)



a) decrease by a factor of 2 b) remain constant

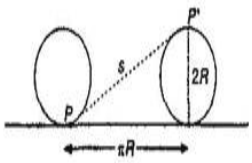
c) increase by a factor of 2 d) increase by a factor of 4

130. 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. Give that the moment of Inertia of the rod about A is $\frac{ml^2}{3}$ the initial angular acceleration of the rod will be (2007, 2006)



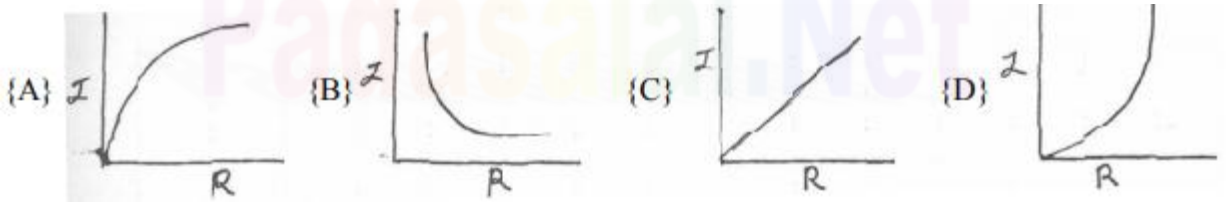
a) $\frac{mgl}{2}$ b) $\frac{3}{2}\ gl$ c) $\frac{3g}{2l}$ d) $\frac{2g}{3l}$

131. A point p consider at contact point of a wheel on ground which rolls on ground without slipping then value of displacement of point p when wheel completes half rotation (If radius of wheel is 1m)

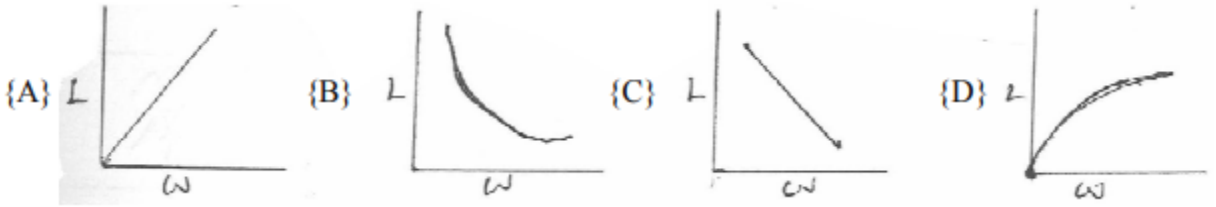


a) 2m b) $\sqrt{\pi^2 + 4}\ m$ c) πm d) $\sqrt{\pi^2 + 2}\ m$

132. Moment of Inertia of a sphere of Mass M and radius R is I. Keeping M constant If a graph is plotted between I and R then its form would be



133. The graph between the angular momentum and angular velocity ω will be



134. The center of mass of a system of particles does not depend upon, [AIPMT 1997, AIEEE 2004]
(a) position of particles (b) relative distance between particles
(c) masses of particles (d) force acting on particle

135. A couple produces, [AIPMT 1997]
(a) pure rotation (b) pure translation
(c) rotation and translation (d) no motion

136. A particle is moving with a constant velocity along a line parallel to positive X-axis. The magnitude of its angular momentum with respect to the origin is, [IIT 2002]
(a) zero (b) increasing with x
(c) decreasing with x (d) remaining constant

137. A rope is wound around a hollow cylinder of mass 3 kg and radius 40 cm. what is the angular acceleration of the cylinder if the rope is pulled with a force of 30 N? NEET - 2017
a) 0.25 rad s^{-2} b) 25 rad s^{-2} c) 5 ms^{-2} a) 25 ms^{-2}

138. A closed cylindrical container is partially fi lled with water. As the container rotates in a horizontal planeabout a perpendicular bisector, its moment of inertia, [IIT 1998]
(a) increases (b) decreases
(c) remains constant (d) depends on direction of rotation.

139. A rigid body rotates with an angular momentum L. If its kinetic energy is halved, the angular momentum becomes, [AFMC 1998, AIPMT 2015]
(a) L (b) L/2 (c) 2L (d) L/ $\sqrt{2}$

140. A particle undergoes uniform circular motion. Th e angular momentum of the particle remain conserved about, [IIT 2003]
(a) the center point of the circle. (b) the point on the circumference of the circle.
(c) any point inside the circle. (d) any point outside the circle.

141. When a mass is rotating in a plane about a fi xed point, its angular momentum is directed along, [AIPMT 2012]
(a) a line perpendicular to the plane of rotation
(b) the line making an angle of 45° to the plane of rotation
(c) the radius (d) tangent to the path

142. Two discs of sme moment of inertia rotate 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 cotact face to face coinciding the axis of rotation. The expression for loss of energy during this process is NEET 2017
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) $\frac{1}{2} I (\omega_1 + \omega_2)^2$

143. A disc of moment of inertia *Ia* is rotating in a horizontal plane about its symmetry axis with a constant angular speed ω. Another discinitially at rest of moment of inertia *Ib* is dropped coaxially on to the rotating disc. Then, both the discs rotate with same constant angular speed. The loss of kinetic energy due to friction in this process is, [AIPMT 2001]
(a) $\frac{1}{2} \frac{{I_b}^2}{(I_a+I_b)} \omega^2$ (b) $\frac{{I_b}^2}{(I_a+I_b)} \omega^2$

(c) $\frac{(I_b-I_a)^2}{(I_a+I_b)}\omega^2$ (d) $\frac{1}{2}\frac{I_aI_b}{(I_a+I_b)}\omega^2$

144. The ratio of the acceleration 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, [AIPMT 2014]
a) 5 : 7 b) 2 : 3 c) 2 : 5 d) 7 : 5

145. 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? NEET - 2016
a) $\frac{15\,MR^2}{32}$ b) $\frac{13\,MR^2}{32}$ c) $\frac{11\,MR^2}{32}$ d) $\frac{9\,MR^2}{32}$

146. The speed of a solid sphere after rolling down from rest without sliding on an inclined plane of vertical height h is,
(a) 10 7 *gh* (b) 2*gh* (c) 12 *gh* (d) 2

147. The speed of the center of a wheel rolling on a horizontal surface is *vo*. A point on the rim in level with the center will be moving at a speed of speed of, [PMT 1992, PMT 2003, IIT 2004]
(a) zero (b) v_o (c) $\sqrt{2}\,v_o$ (d) $2v_o$

148. A round object of mass M and radius R rolls down without slipping along an inclined plane. The fractional force, [PMT 2005]
(a) dissipates kinetic energy as heat.
(b) decreases the rotational motion.
(c) decreases the rotational and transnational motion
(d) converts transnational energy into rotational energy

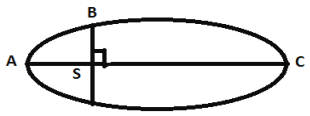
UNIT – VI

GRAVITATION

TRY AND TEST YOURSELF

LEVEL – I (1 - 50 Questions)

1. The linear momentum and position vector of the planet is perpendicular to each other at
   (a) Perihelion and aphelion (b) at all points (c) Only at perihelion (d) no point
2. If the masses of the Earth and Sun suddenly double, the gravitational force between them will
   (a) Remain the same (b) increase 2 time (c) Increase 4 times (d) decrease 2 times
3. A planet moving along an elliptical orbit is closest to the Sun at distance r_1 and farthest away at a distance of r_2. If v_1 and v_2 are linear speeds at these points respectively, then the ratio v_1/v_2 is (NEET 2016)
   (a) $\frac{r_2}{r_1}$ (b) $\left(\frac{r_2}{r_1}\right)^2$ (c) $\frac{r_1}{r_2}$ (d) $\left(\frac{r_1}{r_2}\right)^2$
4. The time period of a satellite orbiting Earth in a circular orbit is independent of
   (a) Radius of the orbit (b) The mass of the satellite
   (c) Both the mass and radius of the orbit (d) Neither the mass nor the radius of its orbit
5. If the distance between the Earth and Sun were to be doubled from its present value, the number of days in a year would be
   (a) 64.5 (b) 1032 (c) 182.5 (d) 730
6. By the Kepler's second law, the radial vector to a planet from the Sun sweeps out equal areas in equal intervals of time. This law is a consequence of
   (a) conservation of linear momentum (b) conservation of angular momentum
   (c) conservation of energy (d) conservation of kinetic energy
7. The gravitational potential energy of the Moon with respect to Earth is
   (a) Always positive (b) always negative (c) Can be positive or negative (d) always zero
8. The kinetic energies of a planet in an elliptical orbit about the Sun, at positions A, B and C are K_A, K_B and 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 (NEET 2018)
   (a) $K_A > K_B > K_C$ (b) $K_B < K_A < K_C$
   (c) $K_A < K_B < K_C$ (d) $K_B > K_A > K_C$



9. The work done by the Sun's gravitational force on the Earth is
   (a) always zero (b) always positive (c) Can be positive or negative (d) always negative
10. If the mass and radius of the Earth are both doubled, then the acceleration due to gravity g'
    (a) Remains same (b) g/2 (c) 2 g (d) 4 g
11. The magnitude of the Sun's gravitational field as experienced by Earth is
    (a) Same over the year
    (b) Decreases in the month of January and increases in the month of July
    (c) Decreases in the month of July and increases in the month of January
    (d) Increases during day time and decreases during night time.
12. If a person moves from Chennai to Trichy, his weight
    (a) Increases (b) decreases (c) remains same (d) increases and then decreases
13. An object of mass 10 kg is hanging on a spring scale which is attached to the roof of a lift. If the lift is in free fall, the reading in the spring scale is
    (a) 98 N (b) zero (c) 49 N (d) 9.8 N

14. If the acceleration due to gravity becomes 4 times its original value, then escape speed
(a) remains same (b) 2 times of original value (c) becomes halved (d) 4 times of original value
15. The kinetic energy of the satellite orbiting around the Earth is
(a) Equal to potential energy (b) less than potential energy
(c) Greater than kinetic energy (d) zero

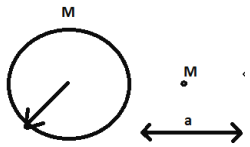
ADDITIONAL QUESTIONS:

16. The Earth's revolution around the sun is faster during the period of
(a) June to July
(b) August to September
(c) December to January
(d) April to May
17. The following table gives the Time period (T) taken and area swept by different planets during revolution. Only one data is right and the others are wrong. Pick out the correct data.

Options	Planets	a	T
(a)	A	3	9
(b)	B	4	8
(c)	C	2	4
(d)	D	5	6

18. The minimum and maximum distance of a satellite from the center of the earth are 2R and 4R respectively, where R is the radius of earth and M is the mass of the earth. What is its maximum speed
(a) v = $\sqrt{\frac{2GM}{3R}}$ (b) v = $\sqrt{\frac{GM}{6R}}$ (c) v = $\sqrt{\frac{6GM}{6}}$ (d) v = $\sqrt{\frac{3GM}{2R}}$
19. If the distance between the earth and the sun were half its present value, the number of day in a year would have been
a) 64.5 (b) 129 (c) 182.5 (d) 730
20. At what altitude will the acceleration due to gravity be 25% of that at the earth's surface (given radius of earth is R)?
(a) R/4 (b) R (c) 3R/8 (d) R/2
21. Let ω be the angular velocity of the earth's rotation about its axis. Assume that the acceleration due to gravity on the earth's surface has the same value at the equator and the poles. An object weighed at the equator gives the same reading as a reading taken at a depth d below earth's surface at a pole (d<<R). The value of d is
(a) $\frac{\omega^2R^2}{g}$ (b) $\frac{\omega^2R^2}{2g}$ (c) $\frac{2\omega^2R^2}{g}$ (d) $\sqrt{Rg}$/g
22. If the radius of the earth be increased by a factor of 5, by what factor its density be changed to keep the value of g the same?
(a) 1/25 (b) 1/5 (c) $1/\sqrt{5}$ (d) 5
23. The mass and diameter of a planet are twice those of earth. What will be the period of oscillation of a pendulum on this planet if it is a second's pendulum on earth?
(a) $\sqrt{2}$ second (b) 2 $\sqrt{2}$ second (c) $1/\sqrt{2}$ second 2 (d) $1/2\sqrt{2}$ second

24. A particle of mass M is at a distance a form surface of a thin spherical shell of equal mass and having radius a.



(a) Gravitational field and potential both are zero at centre of the shell.
(b) Gravitational field is zero not only inside the shell but at a point outside the shell also.
(c) Inside the shell, gravitational field alone is zero.
(d) Neither gravitational field nor gravitational potential is zero inside the shell

25. A spherical uniform planet is rotating about its axis. The velocity of a point on its equator is v. Due to the rotation of the planet about its axis the acceleration due to gravity g at the equator is 1/ 2 of g at poles. The escape velocity of a particle on the pole of the planet in terms of v.
(a) $v_e = 2v$ (b) $v_e = v$ (c) $v_e = v\sqrt{2}$ (d) $v_e = \sqrt{3}\,v$

26. Two planets A and B have the same material density. If the radius of A is twice that of B, then the ratio of the escape velocity v_A/v_B is.
(a) 2 (b) $\sqrt{2}$ (c) $1/\sqrt{2}$ (d) ½

27. The escape velocity for a planet is v_e. A tunnel is dug along a diameter of the planet and a small body is dropped into it at the surface. When the body reaches the center of the planet, its speed will be
(a) v_e (b) $v_e/\sqrt{2}$ (c) $v_e/2$ (d) Zero

28. A particle of mass 10 g 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 surface. ($G = 6.67 \times 10^{-11}\ Nm^2/Kg^2$) [AIEEE 2005]
(a) 3.33×10^{-10} J (b) 13.34×10^{-10} J (c) 6.67×10^{-10} J (d) 6.67×10^{-9} J

29. A hollow spherical shell is compressed to half its radius. The gravitational potential at the centre
(a) Increases (b) Decreases
(c) Remains same (d) During the compression increases then returns at the previous value.

30. A (nonrotating) star collapses onto itself from an initial radius i R with its mass remaining unchanged. Which curve in the following figure best gives the gravitational acceleration g a on the surface of the star as function of the radius of the star during the collapse?
(a) a (b) b (c) c (d) d

31. A satellite of the earth is revolving in circular orbit with a uniform velocity v. If the gravitational force suddenly disappears, the satellite will
(a) Continue to move with the same velocity in the same orbit.
(b) Move tangentially to the original orbit with velocity v.
(c) Fall down with increasing velocity.
(d) Come to a stop somewhere in its original Orbit.

32. A satellite revolves in the geostationary orbit but in a direction east to west. The time interval between its successive passing about a point on the equator is:
a) 48 hrs (b) 24 hrs (c) 12 hrs (d) Never

33. Select the correct choice(s)
(a) The gravitational field inside a spherical cavity, within a spherical planet must be non-zero and uniform.
(b) When a body is projected horizontally at an appreciable large height above the earth, with a velocity less than for a circular orbit, it will fall to the earth along a parabolic path
(c) A body of zero total mechanical energy placed in a gravitational field if it is travelling away from source of field will escape the field.
(d) Earth's satellite must be in equatorial plane.

34. A satellite of mass m, initially at rest on the earth, is launched into a circular orbit at a height equal to the radius of the earth. The minimum energy required is.
(a) $\frac{\sqrt{3}}{4}$ mgR (b) ½ mgR (c) ¼ mgR (d) ¾ mgR
35. When a satellite moves around the earth in a certain orbit, the quantity which remains constant is:
(a) Angular velocity (b) Kinetic energy (c) Aerial velocity (d) Potential energy
36. A satellite of mass 5 M orbits the earth in a circular orbit. At one point in its orbit, the satellite explodes into two pieces, one of mass M and the other of mass 4M. After the explosion the mass M ends up travelling in the same circular orbit, but in opposite direction. After explosion the mass 4M is.
(a) In a circular orbit (b) Unbound
(c) Elliptical orbit (d) Data is insufficient to determine the nature of the orbit
37. A satellite can be in a geostationary orbit around earth at a distance r from the center. If the angular velocity of earth about its axis doubles, a satellite can now be in a geostationary orbit around earth if its distance from the centre is
(a) r/ 2 (b) $\frac{r}{2\sqrt{2}}$ (c) $\frac{r}{4^{\frac{1}{3}}}$ (d) $\frac{r}{2^{\frac{1}{3}}}$
38. A planet of mass m is in an elliptical orbit around the sun ($m << M_{sun}$) with an orbital period T. If A be the area of orbit, then its angular momentum would be:
(a) 2mA /T (b) mAT (c) mA /2T (d) 2mAT
39. Satellite A and B are orbiting around a planet in orbits of ratio R and 4R respectively. The ratio of their aerial velocities is:
(a) 1:2 (b) 1:4 (c) 1:8 (d) 1:16
40. In older times, people used to think that the Earth was flat. Imagine that the earth is indeed not a sphere of radius R, but an infinite plate of thickness H. What value of H is needed to allow the same gravitational acceleration to be experienced as on the surface of the actual Earth? (Assume that the Earth's density is uniform and equal in the two models.)
(a) 2R/ 3 (b) 4R/ 3 (c) 8R/ 3 (d) R/ 3
41. A planet revolves about the sun in elliptical orbit. The aerial velocity dA/ dt of the planet is 4.0×10^{16} m/s. The least distance between planet and the sun is 2×10^{12} m. Then the maximum speed of the planet in km/s is:
(a) 10 (b) 20 (c) 40 (d) None of these

42. The change in the value of 'g' at a height 'h' above the surface of the earth is the same as at a depth 'd' below the surface of the earth. When both'd' and 'h' are much smaller than the radius of the earth, then which one of the following is correct? [AIEEE 2005, 2003]
(a) d= 3h/2 (b) d = h/2 (c) d = h (d) d = 2h
43. Average density of the earth [AIEEE 2005, 2003]
(a) is a complex function of 'g' (b) does not end on g
(c) is inversely proportional to g (d) is directly proportional to 'g'
44. A satellite of mass m revolves around the earth of radius R at a height x from its surface. If g is the acceleration due to gravity on the surface of the earth, the orbital speed of the satellite is [AIEEE 2004]
(a) gx (b) $\frac{gR}{(R-x)}$ (c) $\frac{gR^2}{(R-x)}$ (d) $\left[\frac{gR^2}{(R+x)}\right]^{1/2}$

45. If 'g' is the acceleration due to gravity of the earth's surface, the gain in the potential energy of an orbit of mass m raised from the surface of the earth to a height equal to the radius R of the earth is [AIEEE 2004, IIT 1983]
(a) 2 mgR (b) $\left(\frac{1}{2}\right)$ mgR (c) $\left(\frac{1}{4}\right)$ mgR (d) mgR

46. Suppose the gravitational force varies inversely as the n th power of the distance, then the time period of a planet in circular orbit of radius R around the sun will be proportional to [AIEEE 2004]
(a) $R^{(n+1)/2}$ (b) $R^{(n-1)/2}$ (c) R^n (d) $R^{(n-2)/2}$

47. The time-period of a satellite of 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 [AIEEE 2003]
(a) 10 hrs (b) 20 hrs (c) 40 hrs (d) 80 hrs

48. The escape velocity for a body projected upwards from the surface of the earth is 11 km/s. if the body is projected at an angle of 45^0 with the vertical, the escape velocity will be [AIEEE 2003]
(a) $\frac{11}{\sqrt{2}} km/s$ (b) $11\sqrt{2}\ km/s$ (c) 2 km/s (d) 11 km/s

49. A body weighs 500 N on the surface of the earth. How much would it weigh half way below the surface of the earth? [AIEEE 2002]
(a) 1000 N (b) 500 N (c) 250 N (d) 125 N

50. The time-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? [AIEEE 2002]
(a) 2 (b) 3 (c) 4 (d) 5

LEVEL – II (51 - 100 Questions)

51. The angular velocity of rotation of a star (of mass M and radius R) at which the matter will start escaping from its equator is [AIEEE 2002]
(a) $\sqrt{\frac{2GR}{M}}$ (b) $\sqrt{\frac{2gM}{R^3}}$ (c) $\sqrt{\frac{2GM}{R}}$ (d) $\sqrt{\frac{2GM^3}{R}}$

52. Energy required to move a body of mass m from an orbit of radius 2R to 3R is [AIEEE 2002]
(a) $\frac{GMm}{12R^2}$ (b) $\frac{GMm}{3R^2}$ (c) $\frac{GMm}{8R}$ (d) $\frac{GMm}{6R}$

53. A geostationary satellite orbits around the earth in a circular orbit of radius 36000 km. Then, the time period of a spy satellite orbiting a few hundred km above the earth's surface (R earth = 6400 km) T approximately be
(a) ½ hr (b) 1 hr (c) 2 hr (d) 4 hr

54. 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. [IIT 1998]
(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.

55. If the radius of the earth were to shrink by one percent, its mass remaining the same, the acceleration due to gravity on the earth's surface would
(a) decrease (b) remain unchanged (c) increase (d) none of the above

56. The magnitude of the gravitational field at a distance r_1 and r_2 from the centre of 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 $r_1 < R$ and $r_2 < R$
    (b) $\frac{F_1}{F_2} = \frac{{r_2}^2}{{r_1}^2}$ if $r_1 > R$ and $r_2 > R$
    (c) $\frac{F_1}{F_2} = \frac{r_1}{r_2}$ if $r_1 > R$ and $r_2 > R$
    (d) $\frac{F_1}{F_2} = \frac{{r_2}^2}{{r_1}^2}$ if $r_1 < R$ and $r_2 < R$
57. 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 [IIT 1989]
    (a) T^2 is proportional to R^2 (b) T^2 is proportional to $R^{7/2}$
    (c) T^2 is proportional to $R^{3/2}$ (d) T^2 is proportional to $R^{3.75}$
58. V_e and V_p denote escape velocities from the earth and another planet having twice the radius and the same mean density as the earth, then [NCERT 1974]
    (a) $v_e = v_p$ (b) $v_e = 0.5\ v_p$ (c) $v_e = 2\ v_p$ (d) $v_e = 2.5\ v_p$
59. The ratio of the kinetic energy required to raise a satellite upto a height 'h' to the kinetic energy of the satellite at that height (R- radius of the earth)
    (a) 2h:R (b) h:R (c) R:2h (d) R:h
60. If v_e and v_0 represent the escape velocity and orbital velocity of a satellite corresponding to a circular orbit of radius R, then [CPMT 1982; MP PMT 1997; KCET (ENGG./med.) 1999; AIIMS 2002]
    (a) $v_e = v_0$ (b) $2\sqrt{v_0} = V_e$ (c) $V_e = \sqrt{2}\ V_0$ (d) v_e and v_0 are not related
61. The ratio of the kinetic energy required to be given to the satellite to escape earth's gravitational field to the kinetic energy required to be given so that the satellite moves in a circular orbit just above earth's atmosphere is
    (a) one (b) two (c) half (d) infinity
62. g_e and g_p denote the acceleration due to gravity on the surface of the earth and another planet whose mass and radius are twice that of the earth, then [NCERT 1973]
    (a) $g_p = g_e$ b) $g_p = 0.5\ g_e$ c) $g_p = 2\ g_e$ d) $g_p = g_e/\sqrt{2}$
63. The weight of an object in the coal mine, sea level and at the top of the mountain are respectively W_1,W_2 and W_3,then [EAMCET 1990]
    a) $W_1 < W_2 > W_3$ b) $W_1 = W_2 > W_3$ c) $W_1 < W_2 < W_3$ d) $W_1 > W_2 > W_3$
64. The radius of the Earth is reduced by 4%. The mass of the Earth remains unchanged. What will be the change in escape velocity?
    (a) 1% (b) 2% (c)0.5% (d) 1.5%
65. 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 earth.
    (a) Is the same (b) Is smaller (c) Is greater (d)Varies with its phase Correct
66. A body is projected vertically upwards from the surface of the earth with a velocity equal to ¾ th the escape velocity of the earth. If 'R' is the radius of earth, the maximum height attained by the body is:
    a) 9/7 R (b) 10/3 R (c) 9/8 R (d) 10/9 R
67. A body is projected vertically from the surface of the earth of radius R with velocity equal to half of the escape velocity. The maximum height reached by the body is
    (a) R (b) R/2 (c) R/3 (d) R/4

68. The escape velocity from the earth's surface is 11 km/s. A planet has a radius twice that of the earth but its mean density is the same as that of the earth. The value of the escape velocity from this planet would be [CPMT 1990]
a) 22 km/s (b) 11 km/s (c) 5.5 km/s (d) 16.5 km /s

69. If R is the radius of the earth and g the acceleration due to gravity on the earth's surface, the mean density of the earth is [CPMT 1990]
(a) (4πG) / (3gR) (b) (3 πR)/ (4gG) (c) (3g)/ (4πRG) (d) (πRg)/(12G)

70. The radius of the earth is 6400 km and g = 10m/s2. In order that a body of 5 kg weighs zero at the equator, the angular speed of the earth is [MP, PMT 1985]
(a) 1/80 rad/s (b) 1/400 rad/s (c) 1/800 rad/s (d) 1/1600 rad/s

71. If the earth were at one-fourth its present distance from the sun, the duration of the year will be
(a) Half the present year (b) One-eighth the present year
(c) One-fourth of present year (d) One-sixth the present year

72. If the distance two masses is doubled, the gravitational attraction between them
(a) Is doubled (b) Becomes four times (c) Is reduced to half (d) Is reduced to a quarter

73. If the radius of the earth were to increase by 1%, its mass remaining the same, the acceleration due to gravity on the surface of the earth will
(a) Increase by 1 % (b) decrease by 2%
(c) Decrease by 1 % (d) increase by 2 %

74. Two identical point masses, each of mass 1 kg lie in the x-y plane at points (0.2m, 0), (0, 0.2m). The net gravitational force on the mass at the origin is
(a) 1.67×10^{-9} $(\hat{\imath}+\hat{\jmath})$N (b) $3.34\times 10^{-10}(\hat{\imath}+\hat{\jmath})$N
(c) 1.67×10^{-9} $(\hat{\imath}-\hat{\jmath})$N (d) 3.34×10^{-10} $(\hat{\imath}+\hat{\jmath})$N

75. Four particles of masses m, 2m, 3m, and 4m are kept in sequence at the corners of a square of side a. The magnitude of gravitational force acting on a particle of mass m placed at the centre of the square will be
(a) $\frac{24m^2G}{a^2}$ (b) $\frac{6m^2G}{a^2}$ (c) $\frac{4\sqrt{2}Gm^2}{a^2}$ (d) zero

76. The distance of the centres of moon and earth is D. The mass of earth is 81 times the mass of the moon. At what distance from the centre of the earth, the gravitational force will be zero
(a) D/ 2 (b) 2D/ 3 (c) 4D/ 3 (d) 9D /10

77. Four identical point masses each equal to m are placed at the corners of a square of side a. The force on a point mass m' placed at the point of intersection of the two diagonals is:
(a) $\frac{4Gmm'}{a^2}$ (b) $\frac{2Gmm'}{a^2}$ (c) $\frac{Gmm'}{a^2}$ (d) zero

78. Two planets have the same average density but their radii are R_1 and R_2. If acceleration due to gravity on these planets be g_1 and g_2 respectively, then
(a) $\frac{g_1}{g_2}=\frac{R_1}{R_2}$ (b) $\frac{g_1}{g_2}=\frac{R_2}{R_1}$ (c) $\frac{g_1}{g_2}=\frac{R1^2}{R2^2}$ (d) $\frac{g_1}{g_2}=\frac{R1^2}{R2^2}$

79. An iron ball and a wooden ball of the same radius are released form 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

80. A body weighs 700 gm wt on the surface of the earth. How much will it weigh on the Surface of a planet whose mass is 1/ 7 and radius is half that of the earth?
(a) 200 gm wt (b) 400 gm wt (c) 50 gm wt (d) 20 gm wt

81. Assume that the acceleration due to gravity on the surface of the moon is 0.2 times the acceleration due to gravity on the surface of the earth. If Re is the maximum range of a projectile on the earth's surface, what is the maximum range on the surface of the moon for the same velocity of projection?
(a) 0.2 Re (b) 2 Re (c) 0.5 Re (d) 5 Re

82. The escape velocity for a body projected vertically upwards from the surface of the earth is 11.2 km s^{-1}. if the body is projected in a direction making an angle 45° with the vertical, the escape velocity will be :
(a) $\frac{11.2}{\sqrt{2}}$ kms^{-1} (b) 11.2 x $\sqrt{2}$ kms^{-1} (c) 11.2 x 2 kms^{-1} (d) 11.2 kms^{-1}

83. A spring balance is graduated on sea level. If a body is weighed with this balance at consecutively increasing heights from earth's surface, the weight indicated by the balance
(a) Will go on increasing continuously (b) Will go on decreasing continuously
(c) Will remain same Option (d) Will first increase and then decrease

84. An object weights 72 N on earth. Its weight at a height of $\frac{R}{2}$ from earth is
(a) 32 N (b) 56 N (c) 72 N (d) Zero

85. The depth d at which the value of acceleration due to gravity becomes 1/ n times the value at the surface, is [R = radius of the earth]
(a) $\frac{R}{n}$ (b) $\frac{R(n-1)}{n}$ (c) $\frac{R}{n^2}$ (d) R $\left(\frac{n}{(n+1)}\right)$

86. 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) $\frac{1}{2}$ mgh (b) $\frac{5}{6}$ mgh (c) $\frac{3}{5}$ mgh (d) $\frac{6}{7}$ mgh

87. The acceleration due to gravity of that planet whose mass and radius are half those of the earth will be (g is acceleration due to gravity of earth's surface)
(a) 2g (b) g (c) $g_e/2$ (d) g/4

88. A simple has a time period T_1, when on the earth's surface and T_2 when taken to a height R above the earth's surface, where R is the radius of the earth. The value of T_2/T_1 is
(a) 1 (b)$\sqrt{2}$ (c) 4 (d) 2

88. The decrease in the value of g on going to a height R/2 above the earth's surface will be
(a) g/2 (b) 5g/9 (c) 4g/9 (d)g/3

89. Which is easier to lift?
(a) 1 g of iron (b) 1 kg of water. (c) 1 kg of loosely packed feather (d) All are same

90. Read the assertion and reason carefully to mark the correct option out of the options given below:
Assertion :Smaller the orbit of the planet around the sun, shorter is the time it takes to complete one revolution.
Reason : According to Kepler's third law of planetary motion, square of the time period is proportional to cube of the mean distance from the sun.
(a) Both assertion and reason are true and the reason is the correct explanation of the assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of the assertion
(c) Assertion is true but reason is false
(d) Assertion and reason are false

91. Assertion:The universal Gravitational constant is the same as acceleration due to gravity.
Reason:Gravitational constant and acceleration due to gravity have same dimensional formula.
(a) Both assertion and reason are true and the reason is the correct explanation of the assertion
(b) Both assertion and reason are true but reason is not the correct explanation of the assertion
(c) The assertion is true but the reason is false
(d) Both the assertion and reason are false

92. Assertion:The value of acceleration due to gravity does not depend upon mass of the body on which the force is applied.
Reason :Acceleration due to gravity is a constant quantity
(a) Both assertion and reason are true and the reason is the correct explanation of the assertion
(b) Both assertion and reason are true but reason is not the correct explanation of the assertion
(c) The assertion is true but the reason is false
(d) Both the assertion and reason are false

93. Assertion:If a pendulum is suspended in a lift and the lift is falling freely, then its time period becomes infinite.
Reason : Free falling body has acceleration due to gravity.
(a) Both assertion and reason are true and the reason is the correct explanation of the assertion
(b) Both assertion and reason are true but reason is not the correct explanation of the assertion
(c) The assertion is true but the reason is false
(d) Both the assertion and reason are false

94. Assertion:If the earth suddenly stops rotating about its axis, then the value of acceleration due to gravity will become same at all places.
Reason : The value of acceleration due to gravity is independent of rotation of the earth
(a) Both assertion and reason are true and the reason is the correct explanation of the assertion
(b) Both assertion and reason are true but reason is not the correct explanation of the assertion
(c) The assertion is true but the reason is false
(d) Both the assertion and reason are false

95. Assertion: The difference in the value of acceleration due to gravity at pole and equator is proportional to square of the angular velocity of earth.
Reason: The value of acceleration due to gravity is minimum are the equator and maximum at the pole.
(a) Both assertion and reason are true and the reason is the correct explanation of the assertion
(b) Both assertion and reason are true but reason is not the correct explanation of the assertion
(c) The assertion is true but the reason is false
(d) Both the assertion and reason are false

96. At what height above the earth's surface does the acceleration due to gravity fall to1% of its value at the earth's surface?
(a) 9 R (b) 10 R (c) 99 R (d) 100 R

97. At what depth below the surface of the earth acceleration due to gravity will be half its value 1600 km above the surface of the earth?
(a) 4.3×10^6 m (b) 2.4×10^6 m (c) 3.2×10^6 m (d) 1.6×10^6 m

98. 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

99. The magnitude of gravitational potential energy of a body at a distance r from the centre of earth is u. Its weight at a distance 2r from the centre of earth is
(a) u/ r (b) u /4r (c) u/ 2r (d) 4r/ u

Assertion Reasoning Type
(a) Statement-I is true, statement-II is true and statement-II is correct explanation for statement-I.
(b) Statement-I is true, statement-II is true and statement-II is NOT the correct the explanation for statement-I.
(c) Statement-I is true, statement-II is false.
(d) Statement-I false, statement-II is true.

100. Statement-I: Moon revolving around earth does not come despite earth's gravitational attraction.
Statement-II:A radially outward force balances earth's force of attraction during revolution of moon.

LEVEL – III (101 - 133 Questions)

101. Statement-I: Time period of simple pendulum in an orbiting geostationary satellite in infinite.
Statement-II: Earth's gravitational field becomes negligible at large distance from it.

102. Statement-I: Geostationary satellite may be setup in equatorial plane in orbits of any radius more than earth's radius.
Statement-II: Geostationary satellite have period of revolution of 24 hrs.

103. Statement-I: For the calculation of gravitational force between any two uniform spherical shells, they can always be replaced by particles of same mass placed at respective centers.
Statement-II : Gravitational field of a uniform spherical shell out side it is the same as that of particle of same mass placed at its center of mass.

104. Statement-I: It takes more fuel for a spacecraft to travel from the earth to moon than for the return trip.
Statement-II: Potential energy of spacecraft at moon's surface is greater than that at earth surface.

105. Energy required in moving a body of mass m from a distance 2R to 3R from centre of earth of mass M is
(a) $\frac{GMm}{12R^2}$ (b) $\frac{GMm}{3R^2}$ (c) $\frac{GMm}{8R}$ (d) $\frac{GMm}{6R}$

106. If orbital velocity of planet is given by $v = G^a M^b R^c$, then
a) $a = \frac{1}{3}, b = \frac{1}{3}, c = \frac{1}{3}$ b) $a = \frac{1}{2}, b = \frac{1}{2}, c = -\frac{1}{2}$
c) $a = \frac{1}{2}, b = -\frac{1}{2}, c = \frac{1}{2}$ d) $a = \frac{1}{2}, b = -\frac{1}{2}, c = \frac{1}{2}$

107. Two satellite A and B go round a planet P in circular orbits having radii 4R and R respectively. If the speed of the satellite A is 3v,the speed of the satellite B will be
(a) 12v (b) 6v (c) $\frac{4v}{3}$ (d) $\frac{3v}{2}$

108. Three crewmen are having a discussion whether a walnut can be cracked by using a hammer in the spaceship. Person X disagrees saying that inside the spaceship the hammer is in a state of weightlessness. Person Y agrees saying that though hammer is in weightlessness condition it has a fixed mass which can be checked by using an arm balance. Person Z, too agrees but he says that the mass of the hammer cannot be verified in a spaceship by using an arm balance.
(a) Person X is correct (b) person Y is correct (c) person Z is correct (d) all the three are correct

109. The masses and the radii of the earth and the moon are M_1, R_1 and M_2, R_2 respectively. Their centres are'd' distance apart. What is the minimum speed with which the particle of mass 'm' should be protected from a point midway between the two centres so as to escape to infinity?
(a) $v = 2\sqrt{\frac{2G(M_1+M_2)}{d}}$ (b) $v = 2\sqrt{\frac{G(M_1+M_2)}{3d}}$ (c) $v = 2\sqrt{\frac{G(M_1+M_2)}{d}}$ (d) $v = 2\sqrt{\frac{G(M_1+M_2)}{2d}}$

110. What will be the percentage change in the acceleration due to gravity, if the earth's radius shrinks by 4 %
(a) 1 % (b) 2 % (c) 4 % (d) 8%

111. A rocket is fired vertically from the surface of Mars. If it is fired with a speed of 2 km/s and lost 20% of its initial kinetic energy due to atmospheric resistance, how far will the rocket go from the surface of Mars before returning back to it?
Mass of Mars = 6.4 x 10^{23} kg. Radius of mars = 33395 km and G = 6.67 x 10^{-11} Nm^2 kg^{-2}
(a) 395 km (b) 495 km (c) 500 km (d) 535 km

112. The rotation of the earth about its axis speeds up such that a man on the equator becomes weightless. In such a situation, what would be the duration of one day?
(a) $2\pi\sqrt{\frac{R}{g}}$ (b) $\frac{1}{2\pi}\sqrt{\frac{R}{g}}$ (c) $2\pi\sqrt{Rg}$ (d) $\frac{1}{2\pi}\sqrt{Rg}$

113. There are two bodies of masses 10^3 kg and 10^5 kg separated by a distance of 1 km. At what distance from the smaller body, the intensity of gravitational field will be zero
(a) 1/9 km (b) 1/10 km (c)1/11 km (d) 10/11 km

114. At what distance from the centre of the earth, the value of acceleration due to gravity g will be half that on the surface(R= radius of earth)
(a) 2 R (b) R (c) 1.414 R (d) 1/2 R

115. Kepler's second law is in accordance with
(a) Force of attraction (b) Gravitation (c) angular momentum (d) repulsive force

116. If we place an object of mass 'm' inside a hollow sphere of mass M, the force experienced by the mass 'm' will be
(a) Higher (b) lower (c) zero (d) constant

117. Newton's law of gravitation states that everybody in this universe attracts every other body with a gravitational force of attraction. But, in our day to day life, we do not feel the force of attraction between any objects.Why this is so?
a) The value of acceleration due to gravity plays a vital role in attraction between two objects
b) The value of G is much smaller,so that the product of masses become negligible when multiplied with the value of G
c) Distance between the objects is much smaller
d) None of the above

118. Mohan and Raja is in an argument.Mohan tells, "1. According to Newton's law there is a force of attraction between both of us. 2. It is very meagre that it cannot be felt." Raja refuses it telling, "1. Newton's law of gravitation holds good only for heavenly bodies. 2. There is no force of attraction between us". Both of them made two statements each.
a) Raja's first statement alone is correct. b) Raja's second statement alone is correct.
c) Mohan's both statements are correct d) Mohan's both statements are wrong.

119. An object falls down from a three storey building. The acceleration due to gravity of this object
a) Equal to the acceleration due to gravity of the Moon towards the Earth.
b) less than the acceleration due to gravity of the Moon towards the Earth
c) greater than the acceleration due to gravity of the Moon towards the Earth
d) Cannot be compared with moon's gravity.

120. Time taken by Neptune to revolve around the Sun is
(a) 84 yrs (b) 165 yrs (c) 160 yrs (d) 30 yrs

121. The unit of gravitational field is similar to that of
(a) Velocity (b) Force (c) Acceleration (d)Energy

122. The amount of work required to bring unit mass from infinity to a particular distance is
(a) Gravitational energy (b) gravitational constant
(c) Gravitational field (d) gravitational potential

123. Which among the following is not true for acceleration experienced by any object on the surface of the Earth?
(a) Acceleration due to gravity depends on mass of the Earth.
(b) Acceleration due to gravity depends on the radius of the Earth
(c) Acceleration due to gravity depends on the gravitational constant
(d) Acceleration due to gravity depends on the mass of the falling object

124. Pick out the incorrect statement
(a) Acceleration due to gravity increases when we move upward from the Earth's surface
(b) Acceleration due to gravity decreases when we move upward from the Earth's surface
(c) Acceleration due to gravity decreases surface
(d) Acceleration due to gravity is the maximum at the surface of the Earth

125. These are the most abundant elements in the universe
(a) Hydrogen and helium (b) nitrogen and phosphorous
(c) Hydrogen and nitrogen (d) Nitrogen and helium

126. Which of the following symptoms may not affect an astronaut in space
(a) Swollen feet (b) swollen face (c) headache (d)orientation problem

127. The planet Mars retrograde during the months of
(a) October, November, December (b) July, August, September
(b) January, February, March (d) April, May, June

128. The natural phenomena used by our astronomers to find the radius of the Moon is
(a) Waxing and waning of moon (b) solar eclipse (c) Lunar eclipse (d) Moons rotation

129. Kepler's laws are applicable to
(a) Natural satellites only (b) artificial satellites only
(c) Both natural and artificial satellites (d) not at all applicable

130. A satellite is launched into a circular orbit of radius R around the Earth. A second satellite is launched into an orbit of radius (1.01) R. The period of the second satellite is larger than that of the first one by approximately [IIT 1995]
(a) 05% (b) 1.0% (c) 1.5% (d) 3.0%

131. The tidal waves in the sea are primarily due to
(a) The gravitational effect of the Moon on the Earth
(b) The gravitational effect of Sun on the earth
(c) The gravitational effect of Venus on the Earth
(d) The atmospheric effect of the Earth itself

132. The weight of a body at the centre of the Earth is
(a) Zero (b) Infinite (c) None of the above (d) Same as on the surface of earth

133. A satellite of the Earth is revolving in a circular orbit with a uniform speed v. If the gravitational force suddenly disappears, the satellite will
a) Continue to move with velocity v along the original orbit
b) Move with a velocity v, tangentially to the original orbit
c) Fall down with increasing velocity
d) Ultimately come to rest somewhere on the original orbit

UNIT – VII

PROPERTIES OF MATTER

TRY AND TEST YOURSELF

LEVEL – I (1 - 50 Questions)

1. Which one of the following substances possesses the highest elasticity?
   a) Rubber b) Glass c) steel d) Copper
2. Which is the most Elastic
   a) Iron b) copper c) Quartz d) Wood
3. Which of the following has the least elasticity
   a) Rubber b) Steel c) Copper d) Iron
4. Write copper, steel, Glass and rubber in order of increasing co-efficient of elasticity
   a) Steel, Rubber, copper, Glass. b) Rubber, Copper, Glass, Steel
   c) Rubber, Glass, Steel, Copper d) Rubber, Glass, Copper, Steel.
5. After effects of elasticity are maximum for
   a) Glass b) quartz c) Rubber d) Steel
6. Which one of the following quantities does not have the unit of force per unit area?
   a) Stress b) Strain
   c) Young's Modulus of elasticity d) Pressure.
7. Young's modulus of substance depends on
   a) Its length b) Its length c) Acceleration due to Gravity d) None
8. Which one of the following statement is wrong?
   a) Young's modulus for a perfectly rigid body is zero.
   b) Bulk modulus is relevant for solid, liquid and gases.
   c) Rubber is less elastic than steel.
   d) The young's modulus and shear modulus are relevant for solid.
9. The young's modulus of the material of a wire is equal to the
   a) Stress required to produce unit strain. b) Strain produced in it.
   c) Stress required to increase it length four times. d) Stress acting on it.
10. According to Hooke's law of elasticity, if stress is increased the ratio of stress to strain
    a) Increases b) Decreases c) Becomes Zero d) Remains constant.
11. Match the following

a) Young's modulus of elasticity	i) Solid
b) Bulk modulus of elasticity	ii) Liquid
c) Modulus of rigidity	iii) Gases
d) Poisson's ratio.	iv) Plasma)

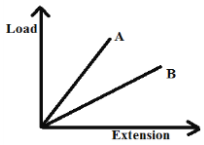
a) a-i b-ii c-iii d-iv b) a-i b-i , ii , iii , iv c-i d-i
c) a-iv b-iii c-ii d-I d) a-ii b-iii c-iv d-i

12.

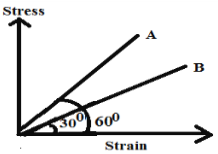
A) $\frac{Tensile\ Stress}{Tensile\ Strain}$	i.	Young's modulus
B) $\frac{Normal\ stress}{Volumetric\ Strain}$	ii.	Bulk Modulus
C) $\frac{Shearing\ Stress}{Angle\ of\ shear}$	iii.	Rigidity Modulus
D) $\frac{lateral\ Strain}{longitudinal\ Strain}$	iv.	Poisson's ratio.

a) A-I B-ii C) iii d) iv b) A-iv B-iii C-ii D-i
c) A-ii B-iii C) iv d) i d) A-iii B-ii C-iv D-i

13. The effect of temperature on the value of modulus of elasticity for various substances in general
    a) It increases with increase in temperature b) Remains constant
    c) Decreases with rise in temperature d) None
14. In the given fig (1). If the dimensions of the two wires are the same and materials are different, young's modulus is
    a) more than A than B b) more for B than A
    c) Equal for A and B d) None.



15. The Bulk modulus of a spherical object is 'B'. If it is subjected to uniform pressure 'P' the fractional decrease in radius is
    a) $\frac{B}{3P}$ b) $\frac{3P}{B}$ c) $\frac{P}{3B}$ d) $\frac{P}{B}$
16. The approximate depth of an ocean is 2700m.The compressibility of water is 45.4×10^{-11} pa^{-1} and density of water is 10^3 kg m^{-3} .What fractional compression of water will be obtained at the bottom of the ocean?
    a) 1.2×10^{-2} b) 1.4×10^{-2} c) 0.8×10^{-2} d) 1.0×10^{-2}
17. A structural steed rod has a radius 10mm.When a force 100 KN is applied then the stress is
    a) 31.8×10^8 NM^{-2} b) 31.8×10^8 NM^{-2} c) 318×10^8 NM^{-2} d) None
18. Young's modulus of the wire depends on
    a) Length of the wire b) Diameter of the wire
    c) Material of the wire d) Mass hanging from the wire.
19. The breaking stress of a wire depends upon
    a) Length of the wire b) Radius of the wire.
    c) Material of the wire d) Shape of the cross section.
20. In steel, the young's modulus and the strain at the breaking points are 2×10^{11} NM^{-2} and 0.15 respectively. The stress of the breaking point for steel is
    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}
21. A stress of 3.18×10^8 NM^{-2} is applied to a steel rod of length 1m along its length. Its Young's modulus is $2\times10^{11}NM^{-2}$ .Then the elongation produced in the rod in mm is
    a) 3.18 b) 6.36 c) 5.18 d) 1.59
22. The work done in stretching an elastic wire per unit volume is or strain energy in a stretched string is
    a) Stress × strain b) $\frac{1}{2}\times$ Stress × strain c) 2× strain*strain d) stress/strain
23. The elastic energy stored per unit volume in a stretched wire is
    a) $\frac{1}{2}(youngs\ modulus)(strain)^2$ b) $\frac{1}{2}$(stress)(strain)^2
    c) $\frac{1/2\ stress}{strain}$ d) $\frac{1}{2}(youngs\ modulus)(stress)$.
24. The elastic energy stored in wire young's modulus by is
    a) Y$\times\frac{strain^{\ 2}}{volume}$ b) Stress$\times\ strain\times volume$
    c) $\frac{stress^2\times volume}{2Y}$ d) $\frac{1}{2}$Y$\times\ stress\times strain\times volume$
25. The isothermal elasticity of a gas is equal to
    a) Density b) Volume c) Pressure d) specific heat
26. The bulk modulus for an incompressible liquid is
    a) Zero b) Unity c) Infinity d) Between 0 to 1
27. The stress versus strain graph for wires of two materials A and B are shown in figure. If YA and YB are the Young's modulus of the materials then
    a) $Y_B=2Y_A$ b) $Y_A=Y_B$ c) $Y_B=3Y_A$ d) $Y_A=3Y_B$



28. The value of Poisson's ratio lies between
a) -1 to $\frac{1}{2}$ b) $-\frac{3}{4}$ to $-\frac{1}{2}$ c) $-\frac{1}{2}$ *to* 1 d) 1 to 2

29. Stress to strain ratio is equivalent to
a) Modulus of elasticity b) Poisson's ratio c) Reynold number d) None

30. If longitudinal strain for a wire is 0.03 and its Poisson's ratio is 0.5, then its lateral strain is
a) 0.003 b) 0.0075 c) 0.015 d) 0.4

31. Which is correct relation
a) $Y < \sigma$ b) $Y > \sigma$ c) $Y = \sigma$ d) $\sigma = +1$

32. Shearing stress causes change in
a) Length b) Breadth c) Shape d) Volume.

33. On applying a stress of 20×10^8 NM^{-2} the length of a perfect elastic wire is doubled) It's young's modulus will be
a) $40\times10^8 NM^{-2}$ b) 20×10^8 NM^{-1} c) 10×10^8 NM^{-1} d) 5×10^8 NM^{-2}

34. Normal Atmospheric pressure is equal to
a) 76 cm of height of mercury in the Barometer b) 1.013×10^5 Pa (or) NM^{-2}
c) Both a and b d) None

35. Which of the following conversion is correct
a) 1 torn = 1mm of mercury b) 1 Pascal = $1NM^{-2}$
c) 1 bar = 10^6 dyne/cm^2 d) All the above.

36. Why the darn of water reservoir is thick at the bottom
a) Quantity of water increase with depth.
b) Density of water increases with depth
c) Pressure of water increases with depth.
d) Temperature of water increases with depth.

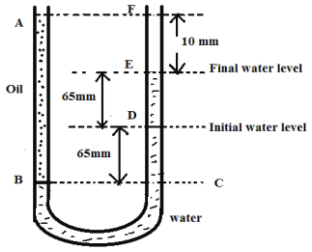
37. If pressure at half the depth of a lake is equal to $\frac{2}{3}$ pressure at the bottom of the lake hen what is the depth of the lake
a) 10m b) 20m c) 60 m d) 30 m

38. By sucking through a straw, a student can reduce the pressure in his lungs to 750 mm of Hg (P_{Hg}=13.6 gm/cm^3) using the straw, he can drink water from a glass up to a maximum depth of
a) 10 cm b) 75cm c) 13.6 cm d) 1.36cm

39. The pressure on a swimmer 20 m below the surface of water at sea level is
a) 1.0 atm b) 2.0 atm c) 2.5 atm d) 3.0 atm

40. If the atmospheric pressure is Pa, then the pressure P depth below surface of a liquid of density P open to the atmosphere is
a) Pa - $\frac{pgh}{2}$ b) Pa-pgh c) Pa+pgh d) Pa

41. A U tube with both ends open to the atmosphere is partially filled with water, 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 by65 mm from its original level. The density of the oil is



a) 650Kg m^{-3} b) 425 Kg m^{-3}
c) 800 Kg m^{-3} d) 928 Kg m^{-3}

42. An open glass tube is immersed in mercury in such a way that a length of 8 cm extends above the mercury level. The open end of the tube is then closed and sealed and the tube is raised vertically up by additional 46 cm. What will be length of the air column above mercury in the tube now(Atmospheric pressure=76 cm of Hg)
a) 16cm b) 22 cm c) 38 cm d) 6 cm

43. Torricelli's barometer used mercury. Pascal duplicated it using French wine of density 884Kgm^{-3}.Determine the height of the wine column for normal atmospheric pressure
a) 10.5 m b) 5.25 m c) 10m d) None.

44. Pressure is a scalar quantity because
a) It is the ratio of force to area and both force and area vectors.
b) It is the ratio of the magnitude of the force to area)
c) It is the ratio of the component of the force normal to the area)
d) It does not depend on the size of the area chosen
e) Both c and d

45. Construction of submarines is based on
a) Archimede's principle b) Bernoulli's Theorem
b) Pascal's Law d) Newton's Law

46. An ice block contains a glass ball when the ice melts with in the water containing vessel, the level of water
a) Rises b) Falls c) Unchanged d) First rises and then falls

47. Two solid pieces one of steel and the other of aluminum when immersed completely in water have equal weights when the solid pieces are weighed in air
a) The weight of aluminum is half the weight of steel
b) Steel piece will weigh more.
c) They have same weight
d) Aluminum piece will weigh more.

48. If there were no gravity, which of the following will there for a fluid
a) Viscosity b) surface tension
c) Pressure d) Archimede's upward thrust

49. Hydraulic brakes are based on
a) Pascal's lawb) Torricelli's law c) Newton's Law d) Boyle's law

50. The volume of 30g of a solid is 20cm^3.If the density of water is 1g cm^{-3}, will the solid float (or) sink
a) float b) sink c) None d) partially float, partially sink

LEVEL – II (51 - 100 Questions)

51. There are two liquid drops of different radii. The excess pressure inside over the outside is
a) more in the big drops. b) more in the small drop
c) equal in both drops. d) there is no excess pressure inside the drops.

52. In order that a floating object be in a stable equilibrium its centre of buoyancy should be
a) vertically below its centre of gravity.
b) vertically below its centre of gravity
c) Horizontally in line with its centre of grsvity
d) May be anywhere

53. A block of ice is floating on water contained beaker. When all the ice melts, the level of water
a) Rises b) Falls c) Remains unchanged d) None.

54. Hydrometers are used to determine
a) specific gravity of liquid b) Pressure of liquid
c) surface Tension d) Temperature.

55. Surface tension is due to
a) Nuclear forces b) Gravitational forces
c) Electric force d) Cohesive molecular forces.

56. The liquid meniscus in capillary tube will be convex if the angle of contact is
a) greater than 90^0 b) less than 90^0 c) equal to 90^0 d) equal to 0^0

57. if a glass rod is dipped in mercury and with drawn out the mercury does not wet the rod because
    a) angle of contact is acute. b) cohesive force is more
    c) adhesion force is more. d) density of mercury is more.
58. Water neither rises nor falls in a capillary tube. Then the angle of contact must be
    a) 0^0 b) 90^0 c) Acute d) obtuse
59. The liquid rises in a capillary tube when the angle of contact is
    a) An acute angle b) An obtuse angle
    c) π radian d) $\frac{\pi}{2}$ radian
60. The molecular range for solids and liquids is of the order
    a) 10^{-9} cm b) 10^{-8} cm c) 10^{-7} cm d) 10^{-2} cm
61. A needle or a pin floats on the surface of water because of
    a) surface tension b) surface energy c) Viscosity d) None
62. When a soap bubble is charged
    a) It contracts b) It expands c) Not changed d) None
63. With a rise in temperature, the surface tension of a liquid
    a) Increases b) Decreases c) Does not change d) None
64. Water rises to a height h in capillary tube. If the length of capillary tube above the surface of water is made less than h then
    a) water rises upto appoint a little below the top and stay there.
    b) Water does not rise at all.
    c) Water rises upto the tip of capillary tube and then starts overflowing like a fountain
    d) Water rises upto the top of capillary tube and stays there without overflowing.
65. A rectangular film of liquid is extended from (4cm × 2cm) to (5cm to 4 cm). If the work done is 3×10^{-4} J. The value of the surface tension of the liquid is
    a) 0.250 Nm^{-1} b) 0.125 Nm^{-1} c) 0.2 Nm^{-1} d) 8.0 Nm^{-1}
66. A rectangular of densities P_1,P_2 and P_3(with $P_1 > P_2 > P_3$)having the same value of surface tension T, rise to the same height in three identical capillaries. The angle of contact Q_1 ,Q_2 and Q_3 obey
    a) $\frac{\pi}{2} > Q_1 > Q_2 > Q_3 \geq 0$ b) $0 \leq Q_1 < Q_2 < Q_3 < \frac{\pi}{2}$
    c) $\frac{\pi}{2} < Q_1 < Q_2 < Q_3 < \frac{\pi}{2}$ d) $\pi > Q_1 > Q_2 > Q_3 > \frac{\pi}{2}$
67. A certain number of spherical drops of a liquid of radius r coalesce to form a single drop of radius r and volume. If Tis the surface Tension of the liquid then
    a) Energy = $4VT(\frac{1}{r} - \frac{1}{R})$is released b) energy =3 VT $(\frac{1}{r} + \frac{1}{R})$ is absorbed
    c) Energy = $3VT(\frac{1}{r} - \frac{1}{R})$ is released d) energy is neither released nor absorbed)
68. The surface tension of a soap solution is 2×10 -2 NM-1 .To blow a bubble of radius 1 cm. The work done is
    a) $4\pi \times 10^{-6}$ J b) $8\pi \times 10^{-6}$ J c) $12\pi \times 10^{-6}$ J d) $16\pi \times 10^{-6}$ J
69. A liquid wets a solid completely. The meniscus of the liquid in a sufficiently long tube is
    a) Flat b) Concave c) Convex d) Cylindrical
70. A body measure 5N in air and 2N when put in water. The buyant force is
    a) 7N b) 9N c) 3N d) None of these.
71. On mixing the salt in water, the surface tension of water
    a) increase b) decrease c) remain unchanged d) None
72. A liquid rises in a vertical tube. The relation between the weight of the liquid in the tube, surface tension on of the liquid T and radius of the tube r is given by, if the angle of contact is zero
    a) $W=\pi r^2 T$ b) $W=2\pi rT$ c) $W=2r^2\pi T$ d) $W=\frac{3}{4}\pi r^3 T$

73. Assuming that the atmosphere has the same density any where as at a sea level (P=1.3 Kgm^{-3}) and g to be constant (g=10 ms^{-2}). What should be the approximate height of atmosphere? (P=1.01 ×10 5NM^{-2})
    a) 6 Km b) 8 Km c) 12 Km d)18 Km.
74. Water rises in plant fibres due to
    a) capillarity b) Viscosity c) Fluid pressure d) Osmosis
75. Water is flowing in a pipe of diameter 4 cm with a velocity 3 ms -1.The water then enters into a tube of diameter 2 cm .The velocity of water in the other pipe is
    a) 3 ms^{-1} b) 6 ms^{-1} c) 12 ms^{-1} d) 8 ms^{-1}
76. A liquid is flowing in a horizontal uniform capillary tube under a constant pressure differences P. The value of pressure for which the rate of flow of the liquid is doubled) When the radius and length both are doubled is
    a) P b) $\frac{3P}{4}$ c) $\frac{P}{2}$ d) $\frac{P}{4}$
77. Water flows along horizontal pipe of uniform cross section. The pressure is 1 cm of Hg when the velocity is 35 cm s^{-1}.At a point where the velocityis65 cms^{-1}, the pressure will be
    a) 0.89 cm of Hg b) 0.62 cm of Hg c) 0.5 cm of Hg d) 1 cm of Hg
78. A vessel, whose bottom has round holes with diameter of 1.0mm is filled with water. The maximum height to which the water can be filled without leakage is (T=75 dyne cm^{-1} g=1000cms^{-2})
    a) 100 cm b) 75 cm c) 50 cm d) 30 cm
79. Air stream flows horizontally past an aeroplane wing of surface area 4 m^2 .The speed of air over the top surface is 60 ms^{-1} and under the bottom surface is 40 ms-1.The force of lift on the wing is (P=1 kgm^{-3})
    a) 800 N b) 1000 N c) 4000 N d) 3200 N
80. Water from a tap emerges vertically down with an initial speed of 1.0 ms^{-1}.The cross-sectional area of tap is 10^{-4} m^2.Assume that the pressure is constant throughout the stream of water, and that the constant throughout the stream of water, and that the flow is steady. The cross-sectional area of the stream 0.15m below the tap is
    a) 5.0×10^{-4} m^2 b) 1.0×10^{-5} m^2 c) 5.0×10^{-5} m^2 d) 2.0×10^{-5} m^2
81. If T is the surface tension of a liquid, the energy needed to break a liquid drop of radius R into 64 drops is
    a) $6\pi R^2 T$ b) $12\pi R^2T$ c) πR^2T d) $4\pi R^2T$
82. Viscosity is the property of liquids by virtue of which
    a) Liquid pushes neighboring molecules b) Liquid attracts other molecules
    c) Liquid becomes conducting d) Liquid becomes conducting
83. With the rise in temperature, the co-efficient of viscosity of a gas
    a) increases b) decreases c) does not change d) may increase
84. 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
85. Streamline flow is more likely for liquids with
    a) High density and low viscosity. b) Low density and high viscosity
    c) High density and high viscosity d) Low density and low viscosity
86. With increase in temperature, the viscosity of
    a) gases decreases and liquid increases b) gases increases and liquid decreases
    c) both gases and liquid increases d) both gases and liquid decreases.

87. The clouds float in the atmosphere because of
a) their low temperature b) their low viscocity
c) their low density d) air current in atmosphere
88. The viscosity of falling raindrop attains limiting value because of
a) upthrust of air b) viscous force exerted by air
c) surface tension effects d) air current in atmosphere.
89. In milikan's oil drop experiment a small spherical oil drop of radius r is moving in a medium of density with a instantaneous speed V. The viscous force F is
a) $6\pi\eta rv$ b) ηrv c) $\frac{6\pi}{rv}$ d) $\frac{6\eta rv}{p}$
90. The working of automiser depends on
a) Bernoulli's principle b) Boyles's law
c) Archimede's principle d) Newton's law of motion
91. For Streamline flow of a liquid Bernoulli's theorem states that following remains constant
a) $\frac{1}{2}PV^2$ b) $P+\frac{1}{2}PV^2$ c) $P+\frac{1}{2}PV^2$ d) $P+PV^2+Pg$
92. The flow of fluid is laminar or streamline is determined by
a) Rate of flow of fluid b) Density of fluid
c) Radius of tube d) Co-efficient of viscosity of liquid
93. Viscosity in fluid motion is analogous to
a) Friction in the motion of solids. b) Random motion of the gas molecules.
c) Non-uniform motion of solids d) internal motion
94. The viscous force between two liquid layers is
a) Radial b) Normal c) the liquid surface d) Tangential
95. A small spherical liquid drop is moving in a viscous medium. The viscous force does not depend
a) Nature of the medium b) Density of the medium
c) The instantaneous speed of the spherical drop d) The radius of the spherical drop.
96. Venturi meteris used to
a) Measure liquid pressure. b) Measure liquid density
c) Measure rate of flow of liquids d) Measure surface tension.
97. The ratio of inertial force to viscous force represents
a) Magnus effect b) Reynolds number c) Torricelli's law d) Bernoulli's principle
98. For turbulent flow, the value of Reynolds number is
a) $R < 2000$ b) $R > 2000$ c) $1000 < R$ d) $R=1000$
99. Reynold's number is low for
a) Low velocity b) low density c) high viscosity d) All of these.
100. In Bernoulli's Theorum which of the following is conserved
a) Mass b) Energy c) Linear momemtum d) Angular momentum

LEVEL – III (101 - 110 Questions)

101. When a fluid is in stream line flow, then the reason of viscous force acting between its two layer
a) Transport of energy from one layer to another
b) Transport of linear momentum from one layer to another
c) Same velocity of molecules.
d) The variable density along the length of the tube.
102. Maximum possibility of turbulent flow is in a fluid of
a) Low density and low viscosity b) high density and low viscosity
c) Low density and high viscosity d) high density and low viscosity

103. More liquid rises in a thin tube because of
a) Larger value of radius b) smaller value of radius
c) Larger value of radius d) smaller value of radius.

104. The list of an aeroplane is based on
a) Torricelli's Theorem b) Bernoulli's Theorem
c) Laws of gravitation d) coulomb's law

105.
A) Hydraulic list	i. Archimede's principle
B) Ship is floating on ocean water	ii. Pascal Law
C) Deep water runs slow	iii. Equation of continuity
D) Rate of flow of liquid through a horizontal tube	iv. Bernoulli's Theorem

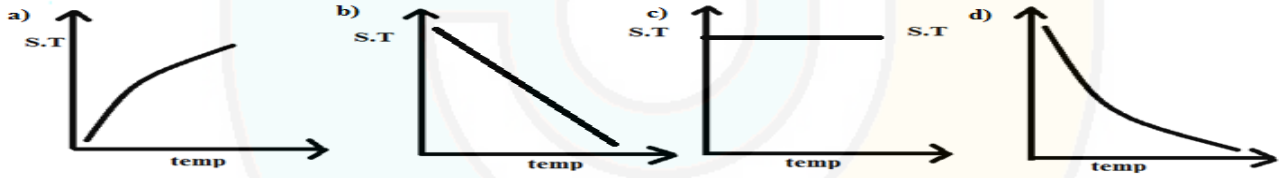
a) A-ii, B - I, C - iii, D - iv b) A - I, B - ii, C - iii, D - iv
c) A - iii, B - ii, C - iv, D - i d) A - iv, B-iii, C - ii, D - i

106. If capillary experiment is performed in vacuum then for a liquid there
a) It will rise b) it will remain same c) it will fall d) Rise to top

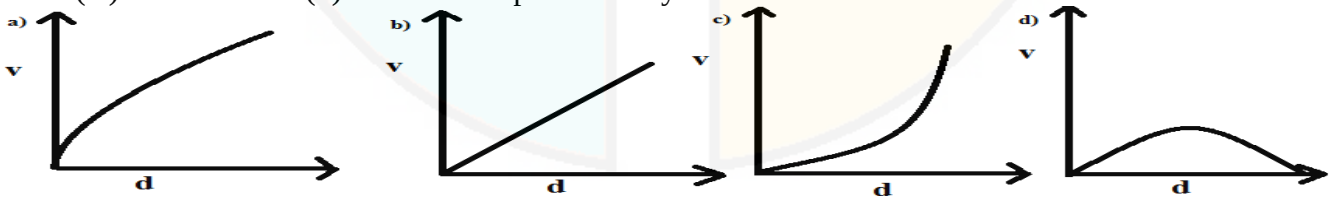
107. for different capillarities of radi (r) , the condition of liquid rise (h) due to surface tension is
a) rh: constant b) $\frac{h}{r}$ = Constant c) H+r = Constant d) h-r = Constant

108. During capillary rise of a liquid in a capillary tube the surface of contact that remains constant is of
a) Glass and liquid b) Air and glass c) Air and liquid d) None

109. Which graph represents the variation of surface tension with temperature over small temperature ranges for water



110. A lead shot or 1mm diameter falls through a long column glycerine. The variation of its velocity (V) with distance (d) covered is represented by



UNIT – VIII

HEAT AND THERMODYNAMICS

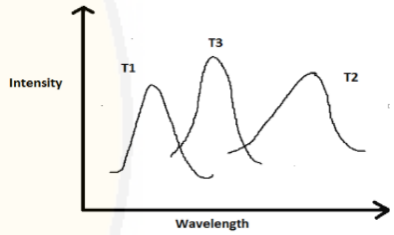
TRY AND TEST YOURSELF

LEVEL – I (1 - 50 Questions)

1. At what temperature the centigrade (Celsius) and Fahrenheit readings are same.
   a) -40^0 b) $+40^0$ c) 36.6^0 d) -37^0
2. Absolute scale of temperature was given by
   a) Carrot b) Otto c) Kelvin d) Dewar
3. The equation of state for 5g of oxygen at a pressure P and temperature T, when occupying a volume V will be
   a) PV= $\left(\frac{5}{32}\right) RT$ b) PV=5RT c) PV= $\left(\frac{5}{2}\right) RT$ d) $\left(\frac{5}{16}\right) RT$
4. The unit of heat capacity is
   a) J kg^{-1} K^{-1} b) JK^{-1} c) J kg^{-1} d) None.
5. The unit of specific heat capacity is
   a) J kg^{-1} K^{-1} b) JK^{-1} c) J kg^{-1} d) None.
6. The S.I unit for molar specific heat capacity is
   a) J kg^{-1} K^{-1} b) JK^{-1} c) J kg^{-1} d) J mol^{-1} K^{-1}
7. The coefficient of volume expansion is
   a) Equal to the coefficient of linear expansion
   b) Thrice the co-efficient of linear expansion
   c) Twice the co-efficient of linear expansion
   d) None.
8. Which one of the following substances has highest specific heat capacity at room temperature and atmospheric pressure?
   a) Water b) Ice c) Aluminium d) Mercury
9. Heat capacity of a substance is infinite. It means
   a) Heat is given out
   b) heat is taken in
   c) No change in temperature whether heat is taken in or given out
   d) All of these
10. For cooking the food, which of the following type of utensil is most suitable.
    a) High specific heat and low conductivity
    b) High specific heat and high conductivity
    c) Low specific heat and low conductivity
    d) Low specific heat and high conductivity
11. In order that the heat flows from one part of a solid to another part, what is required?
    a) Uniform density b) Density gradient
    c) Temperature gradient d) Uniform Temperature
12. Mud houses are cooler in summer and warmer in winter because
    a) Mud is super conductor of heat b) Mud is good conductor
    c) Mud is bad conductor of heat d) None of these
13. In a closed room, heat transfer takes place by
    a) Conduction b) Convection c) Radiation d) All of these

14. The freezer in a refrigeration is located at the top section so that
    a) The entire of the refrigeration is cooled quickly due to convection.
    b) The motor is not heated
    c) The heat gained from environment is high
    d) The heat gained from the environment is low.
15. The layers of atmosphere are heated through
    a) Convection b) conduction c) Radiation d) b & c
16. The thermal conductivity of a rod depends on
    a) Length b) mass c) area of cross section d) material of the rod.
17. A compared to a person white skin another person with dark skin, will experience:
    a) Less heat and more cold b) More heat and more cold
    c) More heat and less cold d) less heat and less cold
18. The speediest mode of heat transfer is
    a) Conduction b) convection c) radiation d) combustion
19. While measuring the thermal conductivity of a liquid we keep the upper part hot and lower cool so that
    a) Convection may be stopped b) radiation may be stopped
    c) Heat conduction is easier downwards d) None
20. If a liquid is heated in space under no gravity, the transfer of heat will take place by process of
    a) Conduction b) Convection c) Radiation d) None
21. If the pressure of the surrounding is increased is increased, then the latent heat of steam
    a) Remains unchanged b) increases c) decreases d) None
22. During melting process the heat given to a body is utilized in
    a) Increasing the temperature
    b) Increasing the density
    c) Increasing the average distance between the molecules.
    d) Decreasing the mass of the body.
23. Newton's law of cooling is used in laboratory for the determination of the
    a) Stefan's law b) Kirchhoff's law c) Wien's law d) Planck's law
24. Newton's law of cooling is used in laboratory for the determination of the
    a) specific heat of gases b) The latent heat of gases
    c) Specific heat of liquids d) Latent heat of liquids
25. According to "Newton law of cooling" the rate of cooling of a body is proportional to
    a) Temperature of the body b) Temperature of surrounding
    c) Fourth power of the temperature of the body.
    d) Difference of the temperature of the body and the surrounding.
26. Good absorbers of heat are
    a) Poor emitters b) Non-emitters c) Good emitters d) None
27. For a perfect black body, its absorptive power is
    a) 1 b) 0.5 c) 0 d) infinity
28. The earth radiates in the infra-red region of the spectrum .The spectrum is correctly given by
    a) Wien's law b) Rayleigh jeans law
    c) Planck's law of radiation d) Stefan's law of radiation
29. The thermal radiation from a hot body travels with a velocity of
    a) $3 \times 10^8 ms^{-1}$ b) 330 ms^{-1} c) $2 \times 10^8 ms^{-1}$ d) None
30. According to Wien's law
    a) λm T =constant b) $\frac{\lambda m}{T}$ =constant c) $\frac{T}{\lambda m}$ =constant d) None

31. Relation between the colour and the temperature of a star is given by
    a) Wien's displacement law b) Planck's law
    c) Hubble's law d) Fraunhoffer diffraction law
32. If wavelengths of maximum intensity of radiations emitted by the sun and moon are $\times\ 10^{-6}\ m$ and $10^{-4}\ m$ respectively, the ratio of their temperature is 0.5
    a) $\frac{1}{100}$ b) $\frac{1}{200}$ c) 100 d) 200
33. A particular star has a surface temperature of about $5 \times\ 10^{4}\ k$.The wavelength of its Radiation is (b=2.9 $\times\ 10^{-3}\ mk$)
    a) 48nm b) 58 nm c) 60 nm d) 70 nm
34. The maximum energy in thermal radiation from a source occurs at the wavelength 4000 A^0.The effective temperature of the source is
    a) 7250K b) 80000K c) $10^4\ K$ d) $10^6\ K$
35. A perfectly black body is that which:
    a) Is totally black in colour b) can radiate all its energy
    c) Is made of ideal gas d) absorbs all the radiations incident
36. According to Stefan-Boltzmann's law:
    a) $E = \sigma To^4$ b) $E = \sigma\ T^2$ c) $E = \sigma\ (T^2 - T0^2)$ d) $E = \sigma\ (T^4 - T_0^4)$
37. Plots of intensity verses wavelength for three bodies at temperatures T_1, T_2, T_3 respectively are shown in fig. Their temperatures are such that



    a) $T_1 > T_2 > T_3$
    b) $T_1 > T_3 > T_2$
    c) $T_2 > T_3 > T_1$
    d) $T_3 > T_2 > T_1$
38. The absolute temperature of a perfectly black is increased to twice its value. The rate of emission of energy per unit area will be
    a) 2 times b) 4 times c) 8 times d) 16 times.
39. Specific heat of water is
    a) 4.2 J Kg^{-1} K^{-1} b) 420 J Kg^{-1} K^{-1} c) 1 cal Kg^{-1} K^{-1} d) 4200 J Kg^{-1} K^{-1}
40. Which law of cooling holds for really large temperature differences?
    a) Newton's law of cooling b) Wien's law
    c) Stefan's law d) Stefan Boltzmann law
41. Newton's law of cooling is valid when difference in temperature of liquid and surroundings is the order of
    a) 30^0C b) 300^0C c) 3000^0C d) 0.3^0C
42. The variation of temperature of a liquid with time is represented correctly by fig.

    Ans: d
43. Electromagnetic radiation is emitted by
    a) All bodies at all temperature b) all bodies at 1000C
    c) All bodies at absolute zero d) only a few bodies at all temperature
44. Unit of Stefan's constant is
    a) $Wm^{-2}k^{-4}$ b) $Wm^{-1}\ K^{-4}$ c) $Wm\ k^{-4}$ d) Wk^{-4}

45. Unit of Wien's constant is
a) K b) m c) mK d) mK^{-1}
46. The value of Wien's constant is
a) $2.898 \times 10^{-3}\ mk$ b) $28.98 \times 10^{-4}\ mk$ c) $0.2898 \times 10^{-2}\ mk$ d) All of these
47. The value of Stefan's constant is
a) $5.67 \times 10^{-8}\ wm^{-2}k^{-4}$ b) $5.67 \times 10^{8}\ wm^{-2}k^{-4}$
c) $5.67 \times 10^{-7}\ wm^{-2}k^{-4}$ d) $5.67 \times 10^{-8}\ wm^{-1}k^{-4}$
48. Our eye is sensitive to only visible wavelength range is
a) 4×10^{-7} m -7×10^{-7} m b) 400nm-700nm
c) 4×10^{-5} m -7×10^{-6} m d) both a and b
49. Compare the radiant emittance of a black body at 200k and 2000k ($\sigma = 5.672\ 10^{-8}$)
a) 10^{-4} b) 10^{-2} c) 10^{-8} d) 10^{-6}
50. When the body has same temperature as that as surrounding
a) It does not radiate heat
b) It radiates the same quantity as it receives from surroundings.
c) It radiates more quantity of heat as it receives from surroundings.
d) It radiates more quantity of heat as it receives heat from surroundings.

LEVEL – II (51 - 100 Questions)

51. Calculate the radiant emittance of a black body at a temperature of 400k
a) 1452 Watts/m^2 b) 1852 watts/m^2 c) 1800 watts/m^2 d) None
52. Zeroth law of thermodynamics is
a) Kinetic energy of molecule of a gas is zero
b) Ideal gas does not contain molecules
c) If two systems are separated in thermal equilibrium with a third system then they themselves are in thermal equilibrium with each other.
d) Absolute zero temperature can not be attained.
53. Thermodynamics mostly deals with
a) Measurement of quantity of heat b) Transfer of heat
c) Conversion of heat to other forms of energy d) Change of state
54. Triple point of water is
a) 273.16^0F b) 273.16 K c) 273.16^0C d) 273.16R
55. Water has maximum density at
a) 0^0C b) 32^0C c) -4 ^{0}C d) 4 ^{0}C
56. When a bimetallic strip is heated, it
a) Does not bend at all b) Gets twisted in the form of 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.
57. Water is used to cool radiators of engine, because,
a) Of its lower density b) It is easily available
c) It is cheap d) It has high specific heat.
58. The unit of latent heat capacity is
a) J kg^{-1} b) J^{-1} kg c) Jkg d) None
59. At Latent heat
a) Temperature increase b) Temperature decrease c) Temperature is constant d) None
60. At Latent heat
a) Energy is used to raise the temperature. b) Energy is used to change the state.
c) Both a and b d) None

61. Concept of temperature is
a) Zeroth law b) First law c) second law d) None

62. The physical quantity that determines whether or not a given system A is ij thermal equilibrium with another system B is called
a) Pressure b) Volume c) temperature d) none of these

63. Match the following

A. Cyclic process	i) dq=du
B. Adiabatic process	ii) du=mL
C. Melting point	iii) du=-dw
D. Isochoric process	iv) dq=dw

a. A-iii, B-iv, C-ii, D-i b. A.i, B-ii, C-iii, D-iv
c. A-ii, B-I, C-iv, D-iii d. A-iv, B-iii, C-ii, D-i

64. Match the following.

A. Isothermal expansion	i) Work done=0
B. Isobaric expansion	ii) Internal energy decreases
C. Adiabatic expansion	iii) Internal energy increases
D. Isochoric process	iv) Internal energy=constant

a) A-iii, B-ii, C-i, D-iv b) A-I, B-ii, C- iii, D-iv
c) A-iv, B-iii, C-ii, D-i d) A-iv, B-iii, C-ii, D-i

65. First law of thermodynamics is conservation of
a) Energy b) Work c) heat d) None

66. According to first law of thermodynamics
a) dq=du+dw b) dq=dw-du c) dw=dq+du d) None

67. 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) equal in all cases c) isothermal d) Isobaric

68. If Q, E and W denotes respectively the heat added change in internal energy and the work done in a closed cycle process, then
a) E=0 b) Q=0 c) W=0 d) Q=W=0

69. 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) Isochoric b) Isothermal c) Adiabatic d) Isobaric

70. A gas is compressed isothermally to half its initial volume. The same gas is compressed separately through an adiabatic process until its volume is again reduced to half. Then
a) Compressing the gas isothermally or adiabatically will require the same amount of work.
b) Which of the case (whether compression through isothermal or through adiabatic process) requires more work will depend upon the atomicity of the gas.
c) Compressing the gas isothermally will require more work to be done.
d) Compressing the gas through adiabatic process will require more work to be done

71. 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

72. The internal energy u is a unique function of any state because change in u
a) Does not depend upon path b) depends upon path
c) Corresponds to an adiabatic process. d) Corresponds to an isothermal process.

73. A point on P-V diagram represents
a) The condition of a system b) Work done or by the system
c) Work done in a cyclic process d) A thermodynamics process

74. A curve drawn between two points on P-V diagram represents
    a) The state of s system
    b) Work done on or by the process.
    c) Work done in a cyclic process.
    d) A thermodynamics process.
75. $C_p > C_v$, 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 internal work.
76. A gas has
    a. One specific heat only
    b) two specific heats only
    c. infinite number of specific heats.
    d) No specific heat.
77. γ for a gas is always
    a. negative
    b) zero
    c. between zero and one
    d) more than one
78. The work done in an adiabatic change in a particular gas depends only upon
    a. change in volume
    b) change in temperature
    c. change in pressure
    d) none.
79. The slopes of isothermal and adiabatic curves are related as:
    a. isothermal curve slope = adiabatic curve slope
    b. isothermal curve slope = γ ×adiabatic curve slope
    c. adiabatic curve slope = γ ×isothermal curve slope
    d. adiabatic curve slope = $\frac{1}{2}$ ×isothermal curve slope
80. Work done on or by a gas, in general depends upon the
    a. initial state only
    b) final state only
    c. both
    d) initial state, final state f the path.
81. Specific heat of an ideal gas is
    a. Proportional to T
    b) Proportional to T^2
    c. Proportional to T^3
    d) independent of T
82. In all natural processes, the entropy of universe
    a. remains constant
    b) always decreases
    c. always increases
    d) may increase or decrease.
83. For an adiabatic change in a gas
    a) $TV^{\gamma-1}$ =constant
    b) $TV^{\gamma} + 1 =$ constant
    c) $TV^{\gamma+1} =$ Constant
    d) TV^{-1} = constant
84. A cycle tyre bursts suddenly. This represents an
    a) Isothermal process
    b) Isobaric process
    c) Isochoric process
    d) Adiabatic process.
85. Match the following

Process	Constant
A. Isothermal	i) Temperature
B. Adiabatic	ii) Heat
C. Isobaric	iii) Pressure
D. Isochoric	iv) volume.

    a) A-i, B-ii, C-iii, D-iv
    b) A-ii, B-iii, C-iv, D-i
    c) A-i, B-iii, C-ii, D-iv
    d) A-iii, B-ii, C-i, D-iv
86. In an isothermal expansion
    a) Internal energy of the gas increases
    b) Internal energy of the gas decreases.
    c) Internal energy remains unchanged.
    d) Average kinetic energy of gas molecule decreases

87. The gas law $\frac{PV}{T}$ =constant is true for
a) Isothermal changes only b) Adiabatic changes only
c) Both a and b d) Neither a and b
88. Work done in an isothermal change of a gas depends
a) Only on temperature b) Only on volume expansion ratio.
c. Both a and b d) only on initial and final pressure.
89. Work done per mol in an isothermal change is
a) RT $\log_{10} \frac{V_2}{V_1}$ b) RT $\log_{10} \frac{V_1}{V_2}$
c) RT $\log_e \frac{V_2}{V_1}$ d) RT $\log_e \frac{V_1}{V_2}$
90. A container that suits the occurrence of an isothermal process should be made of
a) Copper b) Glass c) Wood d) cloth
91. During isothermal expansion of an ideal gas
a) Its internal energy decreases b) its internal energy does not change
c) Both a and b correct d) None.
92. If an ideal gas is compressed isothermally then
a) No work is done against gas b) Heat is released by the gas.
c) The internal energy of gas will increase d) Pressure does not change.
93. In an isothermal process the volume of an ideal gas is halved. One can say that
a) Internal energy of the system decreases. b) Work done by the gas is negative.
c) Work done by the gas is negative. d) Internal energy of the system increases.
94. The specific heat of a gas in an isothermal process is
a) Infinite b) Zero c) Negative d) Remains constant
95. If heat is supplied to an ideal gas in an isothermal process
a) The internal energy of the gas will increase b) The gas will do positive work
c) The gas will do negative work d) The said process is not possible.
96. An ideal gas undergoes isothermal process from some initial state I to final state f. Choose the correct alternatives
a) $d_u=0$ b) $d_q=dw$ c) $d_q=0$ d) both a and b
97. A latent heat of vaporization of water is 2240 J/g. If the work done in the process of expansion of 1g is 168 J then increase in internal energy is
a) 2408 J b) 2240 J c) 2072 J d) 1904 J
98. Out of the following which quantity does not depend on path?
a) Temperature b) energy c) Work d) None of these
99. During an isothermal expansion, a confined ideal gas does -150J of work against it surrounding. This implies that
a) 150 J of heat has been added to 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
100. A monoatomic gas ($\gamma = \frac{5}{3}$) is suddenly compressed to $\frac{1}{8}$ of its original volume adiabatically. Then the pressure of the gas will change to
a) $\frac{24}{5}$ b) 8 c) $\frac{40}{3}$ d) 32 times its initial pressure

LEVEL – III (101 - 137 Questions)

101. Which of the following is a slow process
a) Isothermal b) Adiabatic c) Isobaric d) None

102. If the temperature of 1 mole of ideal gas is changed from 0^0C to 100^0c at constant pressure, then work done in the process (R=8.3 J/mol/Kelvin)
a) 8.3×10^{-3}J b) 8.3×10^{-2}J c) 8.3×10^{2}J d) 8.3×10^{3}J

103. Even Carnot engine cannot give 100 % efficiency because we can not
a) Prevent radiation b) Find ideal source
c) Reach absolute zero temperature d) Eliminate friction

104. Initial pressure and volume of a gas are P and V respectively. First it is expanded isothermally to volume 4V and then compressed adiabatically to volume V. The final pressure of gas will be ($\gamma = \frac{3}{2}$)
a) 1P b) 2P c) 4P d) 8P

105. Which of these is intensive variable?
a) Area b) entropy c) temperature d) volume

106. Unit of entropy is
a) Joule/kelvin b) cal/kelvin c) both a and b d) None

107. Entropy is a measure of
a) Perfect order b) available energy c) disorder d) None

108. Entropy is maximum in which state
a) Solid b) liquid c) gas d) can be any

109. In a reversible adiabatic process, entropy
a) Increases b) remains unchanged c) decrease d) None

110. Entropy remains constant in
a) Adiabatic b) isothermal c) isochoric d) None

111. In a reversible process, the entropy of the system
a) Increases b) decreases c) remains zero d) remains constant

112. The entropy of a system in an irreversible process
a) Increases b) decreases c) remains constant d) None.

113. Choose the correct statement
a) All quasi-static processes are quasi-static b) All reversible processes are quasi-static
c) Adiabatic process is quasi-static d) None

114. A piece of ice is added to water in a cup-The entropy
a) Is increased b) decreased
c) Undergo no change d) sometimes increases, sometimes not

115. When water vapour condenses into water, its entropy
a) Increases b) decreases
c) Remains unchanged d) first decreases and then increases.

116. Net entropy change of a system in Carnot's cycle
a) Zero b) Positive c) Negative d) More than 1

117. Which of the following represents a reversible process?
a) ds>0 b) ds=0 c) ds>0 d) None of these.

118. In the two gases at the same temperature
a) The average kinetic energy per molecule is equal. b) The internal energy is equal
c) The entropy is equal d) None

119. An ideal Carnot engine, whose efficiency is 40% receives heat at 500K. If its efficiency is 50% then the intake temperature for the same exhaust temperature is
a) 800k b) 900 k c) 600 k d) 700 k

120. The efficiency of a Carnot engine operating with reservoir temperature of 100^0C and -23^0C will be
a) $\frac{373+250}{373}$ b) $\frac{373-250}{373}$ c) $\frac{100+23}{100}$ d) $\frac{100\pm23}{100}$

121. The (W/Q) of a Carnot engine is $^1/_6$, now the temperature of sink is reduced by 62^0C.then this ratio become twice therefore the initial temperature of the sink and source are respectively.
a) 33^0C, 67^0C b) 37^0C, 99^0C c) 67^0C, 33^0C d) 97K, 37 K

122. A scientist says that the efficiency of his heat engine which work at source temperature 127^0C and sink temperature 270C is 26% then
a) It is impossible b) it is possible but less probable
c) It is quite probable. d) Data are incomplete

123. The efficiency of Carnot engine is 50% and temperature of sink is 500k. If temperature of source is kept constant and its efficiency raised to 60% then the required temperature of sink will be
a) 100K b) 600K c) 400K d) 500K

124. An ideal gas heat engine operates in a Carnot cycle between 227^0C and 127^0C.It absorbs 6 K cal at the higher temperature. The amount of heat (in K cal) converted into work is equal to
a) 4.8 b) 3.5 c) 1.6 d) 1.2

125. An ideal gas heat engine operates in Carnot cycle between 227^0C and 127^0C.It absorbs 6×10^4 cal of heat at higher temperature. Amount of het converted to work is
a) 4.8×10^4 cal b) 6×10^4 cal c) 2.4×10^4 cal d) 1.2×10^4 cal

126. A Carnot engine working between 300K and 600K has work output of 800J per cycle. What is amount of heat energy supplied to the engine from source per cycle?
a) 1800 J/cycle b) 1000 J/cycle c) 2000 J/cycle d) 1600 J/cycle

127. A refrigerator works between 40C and 300C.It is required to remove 600 calories of heat every second in order to keep the temperature of the refrigerated space constant. The power is (1 cal=4.2 J)
a) 2.365 W b) 23.65 W c) 236.5 W d) 2365 W

128. Transfer of heat from a body at low temperature to a body at high temperature
a) It is impossible
b) It is possible by keeping /both the bodies in contact
c) is possible by doing some external work
d) None

129. In Carnot cycle, the first step is
a) Isothermal expansion b) Isothermal compression
c) Adiabatic expansion d) adiabatic compression.

130. The efficiency of a reversible Carnot's engine working between temperatures T_1 and T_2 ($T_1 > T_2$) is 1
a) $\frac{T_2}{T_1}$ b) $\frac{T_1}{T_2}$ c) $(1-\frac{T_2}{T_1})$ d) $(\frac{T_1}{T_2} - 1)$

131. A refrigerator is a:
a) Heat engine b) an electric motor
c) Heat engine working in a backward direction d) air cooler

132. The door of running refrigeration inside a room is left open Mark the correct statement
a) The room temperature will be cooled slightly
b) The room will be warmed up gradually
c) The room will be cooled to the temperature inside the refrigerator.
d) The temperature of the room will remain unaffected.

133. The complete conversion of a given quantity of heat into useful mechanical work occurs
a) Often b) seldom c) never d) depends on the device.

134. In an ideal gas, the energy is
a) Wholly kinetic b) Wholly potential c) sum of the two d) all are true.

135. Efficiency of Carnot engine working between ice point and steam point is
a) 73.2% b) 100% c) 26.8% d) None of these.

136. The temperature inside a refrigeration is $t_2{}^0C$ and the room temperature is $t_1{}^0C$.The amount of heat delivered to the room for each joule of electrical energy consumed ideally will be
a) $\frac{t_{1+}\ t_2}{t_1+273}$ b) $\frac{t_1}{t_1-t_2}$ c) $\frac{t_{1+}\ 273}{t_1-t_2}$ d) $\frac{t_2+273}{t_1-\ t_2}$

137. What is the value of sink temperature when efficiency of engine is 100 %?
a) 0 K b) 300 K c) 273 K d) 400 K

UNIT – IX

KINETIC THEORY OF GASES

TRY AND TEST YOURSELF

LEVEL – I (1 - 50 Questions)

1. The molecule of an ideal gas have
   a) Only kinetic energy b) only potential energy
   c) Both K.E and P.E d) None of them
2. Molecules of a gas behave like
   a) In elastic rigid sphere b) Perfectly elastic non-rigid sphere
   c) Perfectly elastic rigid sphere d) In elastic non rigid sphere.
3. Which of the following statements about kinetic theory of gases is wron
   a) The molecules of a gas are in continuous random motion
   b) The molecules continuously undergo inelastic collisions
   c) The molecules do not interact with each other except during collisions.
   d) The collisions amongst the molecules are of short duration.
4. Which one of the following is not 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.
5. According to the kinetic theory of gases, at absolute temperature
   a) Water freezes b) Liquid helium freezes
   c) Molecular motion stops. d) None of them
6. At 0 k which of the following properties of a gas will be zero
   a) Vibrational energy b) density
   c) Kinetic energy d) Potential energy.
7. A real gas behave 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.
8. Molecular motion shows itself as
   a) Temperature b) Internal energy c) Friction d) Viscosity
9. Cooking gas containers are kept in a lorry moving with uniform speed. The temperature of the gas molecules inside will
   a) Increase b) decrease c) Remains same d) None of them
10. Volume, pressure and temperature of an ideal gas are V, P and T respectively. If mass of its molecule is m then its density. (K- Boltzmann's constant)
    a) mKT b) $\frac{P}{KT}$ c) $\frac{P}{KTV}$ d. $\frac{Pm}{KT}$
11. S.I.Unit of universal gas constant is
    a) $\frac{cal}{C^0}$ b) $\frac{J}{mol}$ c) J mol $^{-1}$ K^{-1} d) $\frac{J}{Kg}$
12. Kinetic energy of gases provide a base for
    a) Charle's law b) Boyles law c) Both a and b d) None

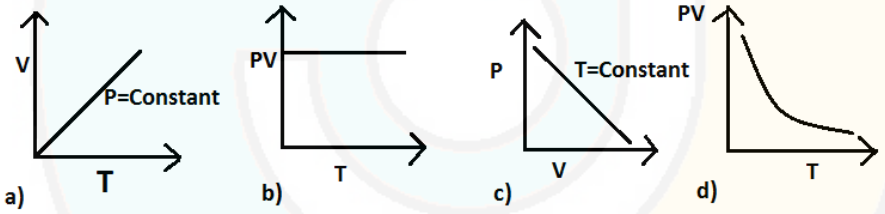
13. In the relation n = $\frac{PV}{RT}$, n is
    a) Number of molecules
    b) Atomic number
    c) Mass number
    d) Number of moles.
14. The value of Boltzmann's constant is
    a) $1.38 \times 10^{-16} JK^{-1}$ b) $1.38\, JK^{-1}$ c) $1.38 \times 10^{-23} JK^{-1}$ d) $8.314\, JK^{-1}$
15. Avogadro's number N_A is
    a) 6.02×10^{-23} b) 6.02×10^{23} c) 8.31×10^{23} d) None of these.
16. The value of universal gas constant is
    a) 8.31 J mol $^{-1}$ K $^{-1}$ b) 1.38 J mol $^{-1}$ K $^{-1}$ c) 6.02 J mol $^{-1}$ K $^{-1}$ d) None
17. In an isotropic gas, with no preferred direction of motion of molecules
    a) $V_x = V_y = V_z$ b) $V_x^2 = V_y^2 = V_z^2$ c) $\overline{V_x^2} = \overline{V_y^2} = \overline{V_z^2}$ d) None
18. According to kinetic theory of gases the relation between pressure P density ρ and mean square velocity is
    a) P = $\frac{1}{2}\rho\overline{V}^2$ b) P = $\frac{1}{3}\rho\overline{V}^2$ c) P = $\frac{1}{2}\rho\,\overline{V}$ d) $\frac{1}{3}\rho\,\overline{V}$
19. The kinetic energy per unit volume of a perfect gas is equal to (P is pressure)
    a) $\frac{2}{3}$ P b) $\frac{3}{2}$ P c) $\frac{P}{3}$ d) $\frac{1}{2}$ P
20. The average velocity of the molecules in a gas in equilibrium is proportional to
    a) $\sqrt{T}$ b) T^2 c) T d) equal to zero
21. Average kinetic energy of translation of a molecule of gas varies with temperature T of gas is proportional to
    a) T b) T^{-1} c) T^0 d) T^2
22. At constant volume temperature is increases then
    a) Collision on walls will be less.
    b) Number of collisions per unit time will increase
    c) Collisions will be in straight line
    d) Collisions will not change.
23. 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.

24. According to the kinetic energy of gases the pressure exerted by a gas on the walls is measured as.
    a) Rate of change of momentum imparted to the walls per second per unit area
    b) Momentum imparted to the walls per unit area
    c) Change of momentum imparted to the walls per unit area
    d) Change in momentum per unit volume.
25. We write the relation for Boyle's law in the form. PV=constant. When the temperature remains constant. In this relation, the magnitude of constant depends upon.
    a) The nature of the gas used in the experiment b) The atmospheric pressure
    c) The quantity of the gas enclosed d) None of these
26. In the equation PV=RT, V stands for the volume of
    a) Any amount of gas b) one gram of gas
    c) One gram molecule of gas d) one litre of gas.

27. A surface it hit elastically and normally by n balls per unit time. All the balls having the same mass m and moving with the same velocity V, the force on surface is
    a) mnV^2 b) $2mnV$ c) $\frac{1}{2}mnV^2$ d) $2mnV^2$
28. Gas exerts pressure on the walls of the container because
    a) Gas has weight
    b) gas molecules have momentum
    c) Gas molecules collide with each other
    d) Gas molecules collide with the walls of the container.
29. The absolute temperature of a gas is determined by
    a) The average momentum of the molecule
    b) The velocity of sound in the gas.
    c) The number of molecules in the gas.
    d) The mean square velocity of the molecules.
30. The temperature of a gas is a measure of
    a) The average kinetic energy of the gaseous molecules.
    b) The average potential energy of the gaseous molecules.
    c) The average distance between the molecules of the gas.
    d) The size of the molecules of the gas.
31. The kinetic theory of gases breaks down most at
    a) Low pressure and high temperature. b) High pressure and low temperature.
    c) Low pressure and low temperature. d) High pressure and low temperature.
32. Which of the following provide "direct evidence" in support of the kinetic theory of gases?
    a) Conduction and radiation b) Convection and evaporation.
    c) Diffusion and Brownian movement d) None.
33. If temperature of gas increases from 27^0C to 927 ^{0}C the kinetic energy will be
    a) Double b) Half c) One fourth d) Four times
34. At what temperature is the kinetic energy of a gas molecule double that of its value of 27^0C
    a) 54^0C b) 300K c) 327^0C d) 108^0C
35. The mean kinetic energy of a gas at 300K is 100J.The mean energy of the gas at 450 K is equal to
    a) 100J b) 3000J c) 450 J d) 150J
36. On colliding in a closed container the gas molecules
    a) Transfer momentum to the walls. b) Momentum become zero
    c) Move in opposite directions. d) Perform Brownian motion.

37. Two gases are at 300K and 350K respectively Ratio of average kinetic energy of their molecule is
    a) 7:6 b) 6:7 c) 36:49 d) 49:36
38. In a vessel, the gas is at pressure P. If the mass of all the molecules is halved and their speed is doubled, then the resultant pressure will be
    a) 2P b) P c) $\frac{P}{2}$ d) 4P
39. Which of the following parameters is the same for molecules of all gases at a given temperature?
    a) Mass b) Speed c) Momentum d) Kinetic energy
40. The pressure of an ideal gas is written as $P = \frac{2}{3}\frac{E}{V}$. Here E refers to
    a) Translational kinetic energy b) Rotational kinetic energy
    c) Vibrational kinetic energy d) Total kinetic energy

41. The energy of a given sample of an ideal gas depends only on its
    a) Volume b) pressure c) density d) temperature.
42. Which of the following quantities is zero on an average for the molecules of an ideal gas in equilibrium?
    a) Kinetic energy b) Momentum c) density d) Speed
43. The average momentum of a molecule in a sample of an ideal gas depends on
    a) Temperature b) Number of moles. c) Volume d) None of these
44. Which of the following quantities is the same for all ideal gases at the same temperature?
    a) The kinetic energy of 1 mole b) Kinetic energy of 1 g
    c) The number of molecules in 1 mole d) The number of molecules in 1 g
    e) both a and c
45. Keeping the number of moles, volume and temperature the same, which of the followings are the same for all ideal gas?
    a) RMS speed of a molecule b) Density c) Pressure d) None
46. Which of the following gases has maximum rms speed at a given temperature?
    a) Hydrogen b) Nitrogen c) Oxygen d) Carbon dioxide
47. Boyle's law is applicable for an
    a) Adiabatic process b) Isothermal process
    c) Isobaric process d) Isochoric process.
48. Which of the following graphs represent the behavior of an ideal gas?



49. If the pressure and the volume of certain quantity of ideal gas are halved, the temperature
    a) Is doubled b) becomes one-fourth
    c) Remains constant d) become four times
50. For a gas at a temperature T the root-mean. Square velocity V_{rms}, the most probable speed V_{mp} and the average speed V_{av} obey the relationship
    a) $V_{av} > V_{rms} > V_{mp}$ b) $V_{rms} > V_{av} > V_{mp}$ c) $V_{mp} > V_{av} > V_{r\,ms} >$ d) $V_{mp} > V_{rms} > V_{av}$

LEVEL – II (51 - 101 Questions)

51. Match the following according to Maxwell-Boltzmann distribution

a) Speed distribution i) $\sqrt{\frac{3KT}{m}}$

b) Mean speed ii) $\sqrt{\frac{2KT}{m}}$

c) Root mean square speed iii) $4\pi N \left(\frac{m}{2\pi KT}\right)^{\frac{3}{2}} V^2 e^{\frac{-mv^2}{2KT}}$

d) Most probable square speed iv) $\sqrt{\frac{8KT}{\pi m}}$

	a	b	c	d
A)	iii	iv	I	ii
B)	iii	I	ii	iv
C)	iii	ii	iv	i
D)	iii	i	iv	ii

52. For a gas at N.T.P which shall be maximum?
a) V_{av} b) V_{rms} c) V_{mp} d) None
53. The ratio of most probable speed and average speed of a gas enclosed in a vessel is
a) $\frac{\sqrt{\pi}}{4}$ b) 1 c) $\frac{\sqrt{\pi}}{2}$ d) $\frac{2}{\sqrt{\pi}}$
54. The most probable speed of molecules varies with temperature T as $V_{mp} \propto T^n$
a) 0 b) $\frac{1}{2}$ c) 2 d) $\frac{1}{3}$
55. The root mean square speed of a gas molecules of mass m at a given temperature T is Proportional to
a) m^0 b) m c) $m^{-1/2}$ d) $m^{1/2}$
56. RMS speed of an ideal gas is inversely proportional to the square-root of its
a) Mass b) temperature c) None of these d) Both of these
57. Most probable speed Vmp, average speed Vav and root mean square speed Vrms of gas molecules are related as
a) $\sqrt{3} : \sqrt{2} : \sqrt{\frac{8}{\pi}}$ b) $\sqrt{2} : \sqrt{3} : \sqrt{\frac{\pi}{8}}$ c) $\sqrt{2} : \sqrt{3} : \sqrt{\frac{8}{\pi}}$ d) $\sqrt{2} : \sqrt{\frac{8}{\pi}} : \sqrt{3}$
58. If mass of He atom is 4 times that of hydrogen atom then mean velocity of He is
a) 2 times of H. mean value b) $\frac{1}{2}$ times of H.mean value
c) 4 times of H mean value d) Same as H mean value
59. Four particles have speeds 1, 2, 3 and 4 cm/s respectively. Their rms speed is
a) 2.5 b) 10 c) $\frac{\sqrt{30}}{2}$ d) $\sqrt{30}$
60. The speeds of 10 particles in m/s are 0, 1.0, 2.0, 3.0, 3.0, 4.0, 4.0, 4.0, 5.0 and 6.0.The most probable speed is
a)3m/s b) 4m/s c) Zero d) None of these
61. Four particles have speeds 2, 3, 6 and 5 cm/s respectively. Their average speed is
a) 4 cm/s b) 2cm/s c) 0.25cm/s d) $\sqrt{2}$ cm/s
62. The average energy associated with each degree of freedom is
a) $\frac{3}{2}$ KT b) $\frac{1}{2}$ KT c) $\frac{5}{2}$ KT d) KT
63. Average K.E of translation of one mole of the gas is
a) $\frac{3}{2}$ KT b) $\frac{3}{2}$ RT c) $\frac{1}{2}$ KT `d) KT
64. Average K.E of translation of per molecule of the gas is
a) $\frac{3}{2}$ KT b) $\frac{3}{2}$ RT c) $\frac{1}{2}$ KT d) KT
65. A diameter molecule has how many degrees of freedom
a) 3 b) 4 c) 5 d) 6
66. A mono atomic molecule has how many degrees of freedom
a) 3 b) 5 c) 2 d) 7
67. General expression for degree of freedom is
a) N-q b) 3N-q c) 3N d) 2N-q
68. If N number of gas molecule in the container, then total number of degrees of freedom is
a) 2N b) 1N c) 3N d) None
69. Number of constraints in linear-triatomic molecule is (vibration also)
a) 1 b) 2 c) 3 d) 4
70. Number of constraints in Non-linear triatomic molecule (vibration also)
a) 1 b) 2 c) 3 d) 4

71. Number of constraints in Mono atomic gas is
a) 0 b) 2 c) 3 d) 4

72. Number of constraints in di-atomic molecule is
a) 1 b) 2 c) 3 d) 4

73. Number of constraints for free particle is
a) 1 b) 2 c) 0 d) 3

74. Number of degrees of freedom for linear Triatomic molecule is
a) 5 b) 6 c) 7 d) None

75. Number of degrees of freedom for Non-linear Triatomic molecule is
a) 5 b) 6 c) 7 d) None

76. The molecules in an ideal gas at 27^0C have a certain mean velocity. At what approximate temperature will the mean velocity be doubled
a) 54^0C b) $327\ ^0$ C c) 1200^0 C d) 927^0C

77. Gas at a pressure P_0 in contained is a Vessel. If the masses of all the molecules are halved and their speeds are doubled. The resulting pressure P will be equal to
a) $4\ P_0$ b) $2\ P_0$ c) P_0 d) $\frac{P0}{2}$

78. At what temperature is the root mean square velocity of gaseous hydrogen molecules equal to that of oxygen molecules at 47 ^{0}C.
a) 20K b) 80 K c) -73K d) 3K

79. Mean free path of a gas molecule is
a) Inversely proportional to number of molecules per unit volume
b) Inversely proportional to diameter of the molecule
c) Independent of temperature
d) Directly proportional to the molecular mass.

80. Average thermal energy of one mole of helium at this temperature is (1gram mole = 8.31 J mol^{-1} K^{-1})
a) 3.74×10^3 J b) 3.74×10^{-3}J c) 3.47×10^6J d) 3.47×10^{-6} J

81. Average thermal energy of a helium atom at book would be
a) 6.21×10^{-21} J b) 1.24×10^{-20} J c) 1.24×10^{-21} J d) 1.24×10^{21} J

82. Meyer's relation is
a) C_V-C_P=R b) Cp - Cv=R c) Cp + Cv=R d) None

83. If the degree of freedom of a gas are 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) $1-\frac{1}{f}$

84. The ratio of the specific heats $\frac{C_p}{C_v}=\gamma$ in terms of degrees of freedom (f) is given by
a) $\left(1+\frac{f}{3}\right)$ b) $\left(1+\frac{2}{f}\right)$ c) $\left(1+\frac{f}{2}\right)$ d) $\left(1+\frac{1}{f}\right)$

85. For a gas $\frac{R}{C_v}$ =0.67.This gas is made up of molecules which are
a) Diatomic b) Mixture of diatomic and polyatomic molecules.
c) Mono atomic d) Polyatomic

86. 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

87. The molar specific heat at constant pressure of an ideal gas is $\frac{7}{2}$ R. The ratio of specific heat at constant pressure to that at constant volume is
a) $\frac{5}{7}$ b) $\frac{9}{7}$ c) $\frac{7}{5}$ d) $\frac{8}{7}$

88. For a gas if ratio of specific heats at constant pressure and volume is γ then value of degree of freedom is

a) $\frac{3\gamma-1}{2\gamma-1}$ b) $\frac{2}{\gamma-1}$ c) $\frac{9}{2}(\gamma-1)$ d) $\frac{25}{2}(\gamma-1)$

89. The molar specific heat at constant pressure for a mono atomic gas is

a) $\frac{3}{2}$ R b) $\frac{5}{2}$ R c) $\frac{7}{2}$ R d) 4R

90. Which of the following formula is wrong

a) $C_V = \frac{R}{\gamma-1}$ b) $C_V = \frac{\gamma_R}{\gamma-1}$ c) $\frac{C_P}{C_V} = \gamma$ d) $C_P - C_V = 2R$

91. What is the ratio of specific heats of constant pressure and constant volume for NH_3

a) 1.33 b) 1.44 c) 1.28 d) 1.67

92. The mean free path of a gas molecule is inversely proportional to

a) Square of the diameter of the molecule
b) Square root of the diameter of the molecule.
c) Molecular diameter
d) Fourth power of the molecular diameter.

93. If the mean free path of atoms is doubled then the Pressure of gas will become

a) $\frac{P}{4}$ b) $\frac{P}{2}$ c) $\frac{P}{8}$ d) P

94. The molecular density in a gas is n and the diameter of its molecule is d, then the mean free path of molecule is

a) $\frac{\pi}{nd^2}$ b) $\frac{1}{\pi nd}$ c) $\frac{1}{\sqrt{2}\pi nd^2}$ d) $\frac{1}{3\sqrt{2}\pi nd^3}$

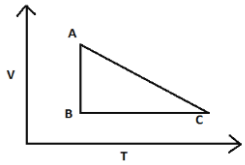
95. Calculate the values of the molar heat capacities C_P and C_V of a gas. If the ratio of heat capacities is 1.33.

a) 25.18, 33.39 b) 33.49, 25.18 c) 15.18, 33.49 d) None

96. If the ratio of the heat capacities is 1.33.Then the number of degrees of freedom is

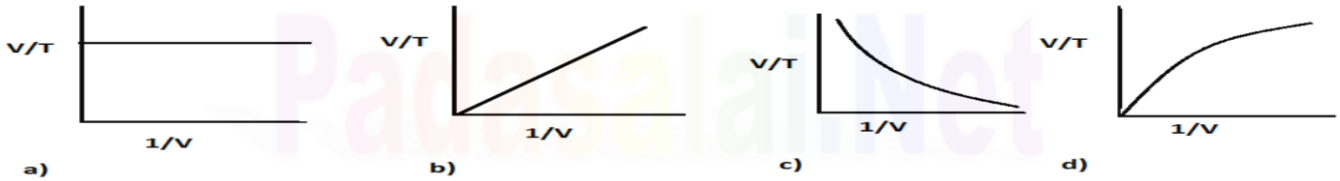
a) 6 b) 5 c) 4 d) 2

97. One mole of an ideal gas is taken from A to B, from B to C and then back to A) The variation of its volume with temperature for that change is as shown. Its pressure at A is P0, Volume is V_0, then the internal energy

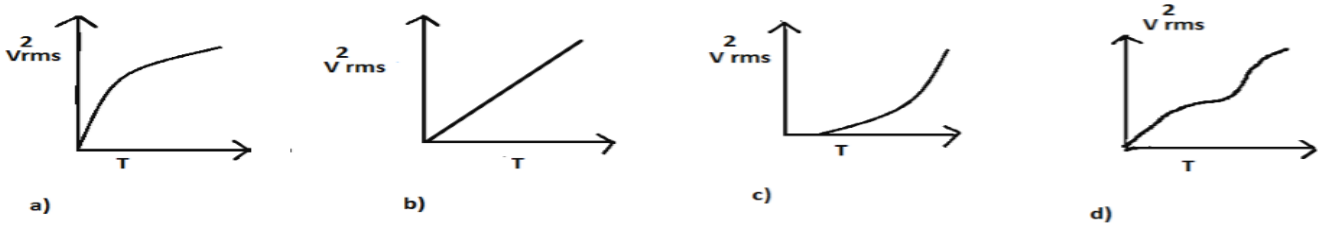


a) at A is more than at B b) at C is less than at B
c) at B is more than at A d) at A and B are equal.

98. Which one of the following graph is correct at constant pressure?

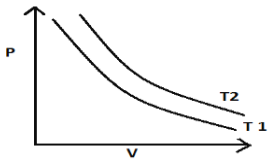


99. The curve between absolute temperature and V^2rms is



Ans: (b)

100. The adjoining figure sows graph of pressure and volume of a gas at two temperature T_1 and T_2. which of the following inferences is correct?



a) $T_1 > T_2$ b) $T_1 = T_2$

c) $T_1 < T_2$ d) None

101. Match the following

A) Mono atomic	i) He, Ne, Ar
B) Di-atomic	ii) H_2, N_2 ,O_2
C) Tri-atomic (Linear)	iii) CO_2, OCS
D) Tri-atomic (Non - Linear)	iv) H_2O

a) A- i, B-ii, C-iii, D-iv b) A-ii, B-iii, C-iv, d. i

c) A-iii, B-iv, C-i, D-ii d) A-i, B-iv, C-iii, D-ii

UNIT – X

OSCILLATIONS

TRY AND TEST YOURSELF

LEVEL – I (1 - 50 Questions)

1. The rotation of earth about its axis is
   a) Periodic motion b) Simple harmonic motion.
   c) Periodic but not simple harmonic motion. d) Both a and c
2. Motion of a ball bearing inside a smooth curved bowl when released from a point slightly above the lower point
   a) Simple harmonic motion b) Non-periodic motion
   c) Periodic motion d) Both a and c
3. Motion of an oscillating liquid column 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.
4. Choose he correct option
   a) Every simple harmonic motion is periodic.
   b) Every periodic motion is not simple harmonic.
   c) Every periodic motion is simple harmonic.
   d) Both a and b.
5. Which of the following equations does not represent a simple harmonic motion
   a) Y=a sinwt b) Y=a coswt c) Y=a sinwt + b coswt d) Y=tanwt
6. Which of the following is a necessary and sufficient condition for simple harmonic
   a) Constant period b) Constant acceleration
   c) Proportionality between acceleration and velocity.
   d) Proportionality between restoring force and displacement
7. A non-harmonic oscillation is expressed by
   a) Y=a sinwt b) Y=a coswt c) Y=a sinwt+b coswt d) None
8. The restoring force F acting on the body in SHM at the given instant is
   a) F= -Kx b) F=Kx c) F=x d) F=K
9. Differential equation of a SHM is
   a) $\frac{d^2x}{dt^2} = w^2x$ b) $\frac{d^2x}{dt^2} = wx$ c) $\frac{d^2x}{dt^2} = -w^2x$ d) None
10. Unit of force constant is (K)
    a) Nm b) N c) Nm^{-1} d) $N^{-1}m$
11. The restoring force of SHM is maximum when particle
    a) Diplacement is maximum b) is half way between the mean and extreme position
    c) Crosses mean position d) is at rest
12. What is constant in SHM?
    a) Restoring force b) Kinetic energy
    c) Potential energy d) Periodic time
13. The velocity of a particle performing simple harmonic motion, when it passes through its mean position is
    a) Infinity b) Zero c) Minimum d) Maximum

14. In SHM, the ratio of acceleration of the particle to its displacement at any time is a measure of
    a) Spring constant b) Angular frequency
    c) (Angular frequency)^2 d) Restoring force.
15. In simple harmonic motion, the particle is
    a) Always accelerated b) always retarded
    c) Alternately accelerated and retarded d) Neither accelerated nor retarded.
16. If a particle is executing SHM then acceleration of particle
    a) is uniform b) varies linearly with time
    c) is non-uniform d) Both b and c
17. A particle executes SHM. Then the graph of velocity as a function of displacement is
    a) Straight line b) a circle c) an ellipse d) a hyperbola
18. If a graph is drawn for acceleration versus displacement of SHM. It is a
    a) Straight lineb) circle c) ellipse d) a hyper bola
19. a particle performing SHM starts from mean position. The phase of that particle is $\frac{\pi}{2}$ when it has
    a) Maximum displacement b) Maximum velocity
    c) Maximum energy d) Maximum Kinetic energy
20. The amplitude and the time period in a SHM is 0.5 cm and 0.4 s respectively. If the initial phase is $\frac{\pi}{2}$ rad. Then the equation of SHM will be
    a) Y=0.5 sin 5πt b) Y=0.5sin 4πt c) Y=0.5sin 2.5πt d) Y=0.5 cos 5πt
21. A body is executing SHM with an amplitude 0.1m. Its velocity while passing through the mean position in 3ms -1 its frequency in Hz is
    a) 15π b) 15/π c) 30π d) 25π
22. The displacement of a simple harmonic motion is x=0.34 cos(3000t+0.74) Where x and t are in mm and second respectively. The frequency of the motion is
    a) $\frac{10}{\pi}$ b) $\frac{\pi}{10}$ c) $\frac{2\pi}{10}$ d) $\frac{10}{2\pi}$
23. The equation of a simple harmonic motion is x=0.34 cos (3000t+0.74). where x and t are in mm and second respectively. The frequency of the motion is
    a) 3000 b) $\frac{3000}{2\pi}$ c) $\frac{0.74}{2\pi}$ d) $\frac{3000}{\pi}$
24. The maximum velocity of a simple harmonic motion represented by Y = 3 sin (100t+$\frac{\pi}{2}$) is given by
    a) 300 units b) $\frac{3\pi}{6}$ units c) 100 units d) $\frac{\pi}{6}$ units
25. Velocity at mean position of a particle executing SHM is V velocity of the particle at a distance equal to half of the amplitude will be
    a) $\frac{V}{2}$ b) $\frac{V}{\sqrt{2}}$ c) $\frac{\sqrt{3}}{2}$ V d) $\frac{\sqrt{3}}{4}$ V
26. What is the maximum acceleration of the particle executing the SHM? Y= 2 sin $\left[\frac{\pi t}{2}+\phi\right]$ Where Y is in cm
    a) $\frac{\pi}{2}$ cms^{-2} b) $\frac{\pi^2}{2}$ cms^{-2} c) $\frac{\pi}{4}$ cms^{-2} d) $\frac{\pi^2}{2}$ cms^{-2}
27. The composition of two simple harmonic motions of equal periods at right angle to each other and with a phase different of π results in the displacement of the particle along
    a) Circle b) straight line c) Ellipse d) None

28. A body is executing SHM .When the displacement from the mean position of 4 cm and 5 cm, the corresponding velocities of the body is 10 cm/sec and 8cm/sec. Then the time period of the body is

a) 2π sec b) $\frac{\pi}{2}$ sec c) π sec d) $\frac{3\pi}{2}$ sec

29. If a simple harmonic oscillation has got a displacement of 0.02m and acceleration equal to 0.02 ms-2 at any time the angular frequency of the oscillation is equal to

a) 10 rad/s b) 0.1 rad/s c) 100 rad/s d) 1 rad/s

30. Two SHM's with same Amplitude and time periods, when acting together in perpendicular directions with a phase difference of $\frac{\pi}{2}$, give rise to

a) Straight motion b) Elliptical motion c) Circular motion d) None

31. Which one of the following statement is true for the speed 'V' and the acceleration 'a' of a particle executing simple harmonic motion?

a) V→ maximux, a→maximum b) V→ minimum, a→ minimum
c) V→ zero, a → zero d) V→ maximum.a → zero

32. A system exhibiting SHM must possess

a) Inertia only b) elasticity as well as inertia
c) Elasticity, inertia, and an external force d) Elasticity only

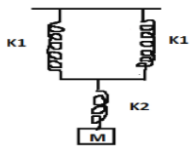
33. The ratio of maximum acceleration to maximum velocity of a particle performing SHM is equal to

a) Amplitude b) Angular velocity
c) Square of amplitude d) square of angular velocity

34. A spring-mass system oscillates with a frequency f, if it takes in an elevator slowly accelerating upwards, the frequency will

a) Increase b) decrease c) remain same d) become zero.

35. The total force constant of the springs shown in the figure will be



a) $\frac{K_1}{2} + K_2$ b) $\left(\frac{1}{2K_1} + \frac{1}{K_2}\right)^{-1}$
c) $\frac{1}{2K_1} + \frac{1}{K_2}$ d) $\left(2K_1 + \frac{1}{K_2}\right)$

36. A spring of force constant K is cut in to 3 equal parts .The force constant of each part will be

a) 3K b) K c) $\frac{K}{3}$ d) None

37. A mass m is suspended by means of two coiled springs which have the same length in upstretched conditions. Their force constants are K_1 and K_2 respectively. When set into vertical vibrations, the period will be

a) $2\pi\sqrt{\frac{m}{K_1K_2}}$ b) $2\pi\sqrt{m\left(\frac{K_1}{K_2}\right)}$ c) $2\pi\sqrt{\frac{m}{K_1-K_2}}$ d) $2\pi\sqrt{\frac{m}{K_1+K_2}}$

38. Two springs of spring constant K_1 and K_2 are joined in parallel. The effective spring constant of the combination is given by

a) $\sqrt{K_1K_2}$ b) $\frac{K_1+K_2}{2}$ c) $K_1 + K_2$ d) $\frac{K_1K_2}{K_1+K_2}$

39. Two springs of spring constant K_1 and K_2 are joined in parallel. The effective spring constant of the combination is given by

a) $\sqrt{K_1K_2}$ b) $\frac{K_1+K_2}{2}$ c) $K_1 + K_2$ d) $\frac{K_1K_2}{K_1+K_2}$

40. 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 will be

a) $T = 2\pi\sqrt{\frac{m}{K_1 - K_2}}$ b) $T = 2\pi\sqrt{\frac{m(K_1|K_2)}{K_1+K_2}}$ c) $T = 2\pi\sqrt{\frac{m(K_1K_2)}{K_1+K_2}}$ d) None

41. A body of mass 5 kg hangs from a spring and oscillates with a time period of 2 π seconds. If the ball is removed the length of the spring will decrease by

a) $\frac{g}{k}$ meters b) $\frac{k}{g}$ meters c) 2π meters d) g meters

42. To make the frequency double of a spring oscillator, we have to

a) Reduce the mass to one fourth b) Quadruples the mass
c) Double of mass d) Half of mass

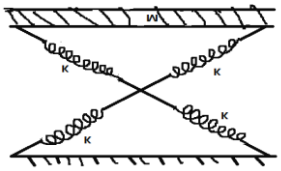
43. A body of mass 20 g connected to spring of constant K executes SHM with a frequency of $\frac{5}{\pi}$ Hz. The value of spring constant is

a) $4Nm^{-1}$ b) $3\ Nm^{-1}$ c) $2\ Nm^{-1}$ d) $5\ Nm^{-1}$

44. A body of mass 8 kg is suspended through two light springs X and Y connected in series. The readings in X and Y respectively are

a) 8Kg,Zero b) Zero,8 kg c) 8 kg, 8 kg d) 2 kg, 6 kg

45. As shown in figure, a simple harmonic motion oscillator having identical four springs has time period



a) $T=2\pi\sqrt{\frac{m}{4k}}$ b) $T=2\pi\sqrt{\frac{m}{2k}}$

c) $T=2\pi\sqrt{\frac{m}{k}}$ d) $T=2\pi\sqrt{\frac{2m}{k}}$

46. A spring having a spring constant 'K' is loaded with a mass 'm'. The spring is cut into two equal parts and one of these is loaded again with the same mass. The new spring constant is

a) $\frac{K}{2}$ b) K c) 2K d) K^2

47. The time period of a simple pendulum for small swings depends on

a) Mass of the body b) Its length
c) The size of its bob d) None

48. If the length of a simple pendulum for small depends on

a) is halved b) is doubled
c) becomes $\sqrt{2}$ times d) reduces by $\sqrt{2}$

49. The speed of the bob of an oscillating pendulum is maximum

a) At each of the extreme position b) Between the mean position and the right
c) Between the mean position and the left extreme position
d) At the mean position

50. What is the effect on the period of a simple pendulum if the mass of the bob is doubled?

a) Halved b) Doubled
c) Become 8 times d) No effect

LEVEL – II (51 - 78 Questions)

51. To show that a simple pendulum executing a simple harmonic motion it is necessary to assume that

a) Length of pendulum is smal b) Mass of the pendulum is small
c) Acceleration due to gravity is small d) Amplitude of the oscillation is small.

52. For a simple pendulum l-T graph is

a) Parabola b) Straight line c) Ellipse d) None

53. For a simple pendulum l-T_2 graph is
a) Parabola b) Straight linec) Ellipse d) None

54. In a simple pendulum, the period of oscillation (T) is related to length of the pendulum (l) is
a) $\frac{l}{T}$ =Constant b) $\frac{l^2}{T}$ = Constant c) $\frac{l}{T^2}$ =Constant d) $\frac{l^2}{T^2}$ =Constant

55. The period of oscillation of a simple pendulum of constant length at earth's surface is T. Its period inside a mine is
a) Greater than T b) Less than T c) Equal to T d) Cannot be compared

56. The period of a simple pendulum is doubled when
a) Its length is doubled b) The mass of the bob is doubled.
c) Its length is made four times d) None

57. A pendulum suspended from the ceiling of a train has a period T when the train is at rest. When the train is accelerating with a uniform acceleration a, the period of oscillation will
a) Increase b) Decrease c) remain unaffected d) become infinite

58. The work done by the string of a simple pendulum during one complete oscillation is equal to
a) Total energy of the pendulum b) Kinetic energy of the pendulum
c) Potential energy of the pendulum d) Zero

59. A simple pendulum is taken from the equation to the pole. Its period
a) Decreases b) Increases
c) Remains the same d) Decreases and then increases

60. The time period of a simple pendulum when it is made to oscillate on the surface of moon
a) Increases b) Decreases
c) Remains unchanged d) Become infinite

61. The ratio of frequencies of two pendulums are 2:3, then their length are in ratio
a) $\sqrt{\frac{2}{3}}$ b) $\sqrt{\frac{3}{2}}$ c) $\frac{4}{9}$ d) $\frac{9}{4}$

62. If the length of a simple pendulum is increased by 2% then the time period
a) Increases by 1% b) decreases by 1%
c) Increases by 2% d) Decreases by 2%

63. Time period of a simple pendulum is 2 sec. If its length is increased by 4 times, then its period becomes
a) 8 sec b) 12 sec c) 16 sec d) 4 sec

64. A body performs SHM with an amplitude A. At a distance $\frac{A}{\sqrt{2}}$ from the mean position, the correct relation between K.E and P.E is
a) K.E=$\frac{P.E}{2}$ b) K.E=$\sqrt{2}$ P.E c) K.E=P.E d) $\frac{P.E}{\sqrt{2}}$

65. When the kinetic energy of a body executing SHM is $\frac{1}{3}$ of the potential energy. The displacement of the body is x percent of the amplitude, where x is
a) 33 b) 87 c) 67 d) 50

66. The P.E of a particle executing SHM at a distance x from the equilibrium position is
a) $\frac{1}{2}$ m w^2x^2 b) $\frac{1}{2}$ mw^2a^2 c) $\frac{1}{2}$ $mw^2(a^2-x^2)$ d) Zero

67. A body executes simple harmonic motion. The potential energy (P.E), the kinetic energy (K.E) and total energy (T.E) are measured as a function of displacement x. Which of the following statement is true
    a) P.E is maximum when x=0 b) K.E is maximum when x=0
    c) T.E is zero when x=o d) K.E is maximum when x is maximum
68. The angular velocity and the amplitude of a simple pendulum is w 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) $\frac{(a^2-x^2w^2)}{x^2w^2}$ b) $\frac{x^2w^2}{(a^2-x^2w^2)}$ c) $\frac{a^2-x^2}{x^2}$ d) $\frac{x^2}{a^2-x^2}$
69. The total energy of a simple harmonic oscillator is proportional to
    a) Velocity b) Frequency c) Amplitude d) Square of the Amplitude
70. The equation of motion of a particle is $\frac{d^2y}{dt^2}$ +Ky =0, where K -is positive constant. The time period of the motion is given by w =
    a) $\frac{2\pi}{K}$ b) $2\pi K$ c) $\frac{2\pi}{\sqrt{k}}$ d) $2\pi\sqrt{k}$
71. The acceleration of a particle performing S.H.M is 12 cm s^{-2} at a distance of 3 cm from the mean position. Its time period is
    a) 0.5 s b) 1.0 s c) 2.0 s d) 3.14 s
72. Frequency of variation of kinetic energy of a SHM of frequency f is
    a) 2f b) f c) $\frac{f}{2}$ d) 3f
73. A particle executing SHM with time period T. The time period with which its kinetic energy oscillation is
    a) T b) 2T c) 4T d) $\frac{T}{2}$
74. A particle oscillating under a force $\vec{F}$= -Kx-b$\vec{v}$ is a (K and b are constant)
    a) Simple harmonic oscillator b) Linear oscillator
    c) Damped oscillator d) Forced oscillator
75. A simple pendulum is set into vibration. The bob of the Pendulum comes to rest after some time due to
    a) Air friction b) Moment of inertia
    c) Weight of the bob d) None of these
76. A simple pendulum oscillates in air with time period t and amplitude A.As the time passes
    a) T and A both decrease b) T increases and A is constant.
    c) T remains same and A decreases d) T decreases and A is constant
77. Resonance is example of
    a) Tuning fork b) Forced vibration
    c) Free Vibration d) Damped vibration.
78. In case of a forced vibration, the resonance wave becomes very sharp when the
    a) Restoring force is small b) Applies periodic force is small
    c) Quality factor is small d) Damping force is small

UNIT – XI

WAVES

TRY AND TEST YOURSELF

LEVEL – I (1 - 50 Questions)

1. The relation between wave length, frequency and wave velocity is
   a) V=λf b) λ=vf c) f=vλ d) none of these
2. The reciprocal of frequency is
   a) Amplitude b) wave length c) time-period d) wave velocity
3. The product of time – period and frequency is
   a) Zero b) unity c) infinity d) none of these
4. Hz is the unit of
   a) Frequency b) period c) amplitude d) none of these
5. The frequency of sound waves can be expressed in
   a) Second b) cycle c) cycle per second d) metre per second
6. A medium can carry a longitudinal wave because it has the property of
   a) Mass b) density c) compressibility d) elasticity
7. In transverse waves, particles of the medium vibrate about their mean position
   a) Along the direction of propagation of wave
   b) perpendicular to the direction of propagation wave
   c) sometimes, along and sometimes normal to the propagation of wave
   d) none of the above
8. It is possible to distinguish between transverse and longitudinal waves by studying the property of
   a) Interference b) diffraction c) reflection d) polarization
9. The velocity of sound in air is not affected by change in
   a) Moisture content of air b) temperature of air
   c) Atmospheric pressure d) composition of air
10. Velocity of sound in air
    a) Decreases with increase in temperature
    b) Increases with decreases in temperature
    c) Decreases with decreases in temperature
    d) Does not depend on temperature
11. The velocity of sound is generally greater in solid that in gases because
    a) The density of solids is high but the elasticity is low
    b) Both the density and the elasticity of solids are high
    c) Both the density and the elasticity of solids are high
    d) The density of solids is low but the elasticity is high
12. Which of the following properties of sound is affected by change in air temperature
    a) Amplitude b) frequency c) wave length d) intensity
13. Which of the following is different from others
    a) Velocity b) wavelength c) frequency d) amplitude
14. Which of the following do not require medium for transmission
    a) Cathode ray b) Electromagnetic wave c) sound wave d) none
15. Velocity of sound is maximum in
    a) Air b) water c) vacuum d) steel

16. Sound wave transfer
    a) Only energy not momentum b) Energy
    c) Momentum d) both energy and momentum
17. The following phenomenon cannot be observed for sound waves
    a) Refraction b) Interference c) diffraction d) polarization
18. The nature of sound waves in gases is
    a) Transverse b) Longitudinal c) stationary d) electromagnetic
19. Water waves are
    a) Longitudinal b) Transverse
    c) Both longitudinal and transverse d) Neither longitudinal nor transverse
20. The phenomenon of sound propagation in air is
    a) Isothermal b) Isobaric c) Adiabatic d) none
21. Transverse waves can propagate in
    a) Liquids b) Solids c) gases d) none
22. Speed of sound at constant temperature depends on
    a) Pressure b) density of gas c) above both d) none
23. Which one of the following statement is true
    a) Both light and sound waves in air are longitudinal
    b) Both light and sound waves can travel in vacuum
    c) Both light and sound waves in air are transverse
    d) The sound waves in air are longitudinal while the light waves are transverse
24. Consider the following
    I. waves created on the surfaces of a water pond by vibrating sources
    II. Wave created by an oscillating electric field in air
    III. Sound waves travelling under water which of these can be polarized
    a) I and II b) II only c) II and III d) I, II and III
25. The Laplace's correction in the expression for the velocity of sound given by newton is needed because sound waves
    a) Are longitudinal b) propagate isothermally
    c) Propagate adiabatically d) are of long wave length
26. As a transverse wave strike against a wall
    a) Its phase changes by a180° but velocity does not change
    b) Its phase does not change but velocity change
    c) Its velocity changes and phase too changes by 180°
    d) None
27. The frequency of sound wave is $20H_z$ then time period is
    a) 0.5s b) 0.05s c) 0.005s d) 1s
28. If 20 waves are produced per second, then its frequency is
    a) $20H_z$ b) $2H_z$ c) $200H_z$ d) $10H_z$

29. A source of wave produces 40 crests and 40 troughs in 0.4 second. Find the frequency of the wave
    a) $50H_z$ b) $100H_z$ c) $10H_z$ d) none
30. A human heart, on an average, is found to beat 75 times a minute. Calculate its frequency
    a) $1.25H_z$ b) $45H_z$ c) $4500H_z$ d) none
31. A sound wave travels at a speed of $330ms^{-1}$. If its wave length is 1.5cm then the frequency is
    a) $22000H_z$ b) $220H_z$ c) $2200H_z$ d) none
32. The propagation constant of wave is also called its
    a) Wave length b) frequency c) wave number d) angular wave number

33. A uniform rope of length L and mass M, hangs vertically from a rigid support. A block of mass m_2 is attached to the free end of the rope. A transverse pulse of wave length λ_1 is produced at the lower end of the rope the wave length of the pulse when it reaches the top of the rope is λ_2 the ratio λ_2/λ_1 is

a) $\sqrt{\frac{m_2}{m_1}}$ b) $\sqrt{\frac{m_1+m_2}{m_1}}$ c) $\sqrt{\frac{m_1}{m_2}}$ d) $\sqrt{\frac{m_1+m_2}{m_2}}$

34. A 5.5 metre length of string has a mass of 0.035kg if the tension in the string in 77 N the speed of a wave on the string is

a) $110ms^{-1}$ b) $165\ ms^{-1}$ c) $77\ ms^{-1}$ d) $102ms^{-1}$

35. A string is producing transverse vibration whose equation is y=0.021 sin (x+30t). Where x and y are in meters and t is in seconds. If the linear density of the string is $1.3x10^{-4}$kg/m. then the tension in the string in N will be

a) 10 b) 0.5 c) 1 d) 0.117

36. A 10m long steel wire has mass 5g. if the wire is under a tension of 80N,the speed of transverse waves on the wire is

a)$100ms^{-1}$ b)$200ms^{-1}$ c)$400ms^{-1}$ d)$500ms^{-1}$

37. 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

38. The temperature at which the speed of sound becomes double as was at 27°c is

a) 273°c b) 0°c c) 927°c d) 1027°c

39. Two identical piano wires, kept under the same tension T have a fundamental frequency of $600H_z$. the fractional increases in the tension of one the wires which will lead to occurrence of 6 beats/s. when both the wires oscillate together would be

a) 0.01 b) 0.02 c) 0.03 d)0.04

40. Two stretched strings have length l to 2l while tensions are T and 4T respectively. If they are made of same material the ratio of their frequency is

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

41. A device used for investigating the vibration of a fixed string or wire is

a) Sonometer b) barometer c)hydrometer d) none of the these

42. The sound carried by air from a sitar to a listener is a wave of the following type

a) Longitudinal stationary b) longitudinal progressive
c) transverse stationary d) longitudinal progressive

43. Speed of sound in mercury at a certain temperature is $1450ms^{-1}$. Given the density of mercury as $13.6x10^3kgm^{-3}$ the bulk modulus for mercury is

a)$2.86x10^{10}NM^{-3}$ b) $3.86x10^{10}NM^{-3}$ c) $4.86x10^{10}NM^{-3}$ d)$5.86x10^{10}NM^{-3}$

44. A string is vibrating in n loops. The number of nodes and antinodes respectively are

a) n, n b) (n+1),n c) n,(n-1) d) (n-1),n

45. Which of the following equation represent a wave travelling along y-axis

a) y =A sin(kx-wt) b) x=A sin(ky-wt) c) x=Asin kycoscot d) none

46. A progressive wave y=A sin (kx - wt) is reflected by a rigid wall at x=0. Then the reflected wave can be represented by

a) y =A sin (kx+wt) b) y=A cos(kx+wt) c) y=-A sin (kx-wt) d) y=-A sin (kx+wt)

47. A sound wave $y=A_0 \sin(wt-kx)$ is reflected from a rigid wall with 64% of its amplitude. The equation of the reflected wave is
    a) $y=\frac{64}{100}A_0 \sin(wt+kx)$ b) $y= -\frac{64}{100}A_0 \sin(wt+kx)$
    c) $y=\frac{64}{100}A_0 \sin(wt-kx)$ d) $y= \frac{64}{100}A_0 \cos(wt-kx)$
48. Two waves are given by $y_1=a \sin(wt-kx)$ and $y_2=a \cos(wt-kx)$. The phase difference between the two ware is
    a) $\pi/4$ b) C c) $\pi/8$ d) $\pi/2$
49. A wave travelling in the +ve x direction having displacement along y direction as 1m, wave length 2π m and frequency of $\frac{1}{\pi}H_z$ is represented by
    a) $Y=\sin(10\pi x - 20\pi t)$ b) $y=\sin(2\pi x + 2\pi t)$
    c) $y =\sin(x-2t)$ d) $y=\sin(2\pi x - 2\pi t)$
50. A transverse wave propagating along x-axis is represented by $y(x, t) = 8.0\sin(0.5\pi x - 4\pi t - \frac{\pi}{4})$ where x is in metres and t in seconds. The speed of the wave is
    a) $8ms^{-1}$ b) $4\pi\ ms^{-1}$ c) $0.5\ \pi\ ms^{-1}$ d) $\pi/4\ ms^{-1}$

LEVEL – II (51 - 100 Questions)

51. The equation of a sound wave is $y=0.0015 \sin(62.4x+316t)$. The wave length of the wave is
    a) 0.3 unit b) 0.2 unit c) 0.1 unit d) cannot be calculated
52. The relation between phase difference $\Delta\phi$ and path difference Δx is
    a) $\Delta\phi=\frac{2\pi}{\lambda}\Delta x$ b) $\Delta\phi=2\pi\lambda\Delta x$ c) $\Delta\phi = \frac{2\pi\lambda}{\Delta x}$ d) $\Delta\phi = \frac{2\Delta x}{\lambda}$
53. The wave length of a wave in a medium is 0.5m. The phase difference between the oscillations at two points in the medium due to this wave is $\frac{\pi}{5}$. What is the minimum distance between these points?
    a) 0.05m b) 0.1m c) 0.25m d) 0.15m
54. The speed of sound in air is $332ms^{-1}$. The speed in air in units of km per hour will be
    a) 1.1952km/h b) 11.952km/h c) 119.52km/h d) 1195.2km/h
55. Two sound waves having a phase difference of 60° have path difference of
    a) 2λ b) $\lambda/2$ c) $\lambda/6$ d) $\lambda/3$
56. What is the phase difference between two successive crests in the ware
    a) π b) $\pi/2$ c) 2π d) 4π
57. The phase difference between two points separated by 0.8m in a wave of frequency is $120H_z$. the velocity of wave is
    a) $720ms^{-1}$ b) $384ms^{-1}$ c) $250ms^{-1}$ d) $1ms^{-1}$
58. The displacement y of a wave travelling in the x – direction is given by $y= {}^{10\text{-}4}\sin(600t - 2x+\pi/3)$ metres. Where x is expressed in metres and t in seconds the speed of the wave – motion in ms^{-1} is
    a) 200 b) 300 c) 600 d) 1200
59. If the equation of transverse wave is $y=2\sin(kx-2t)$ then the maximum particle velocity is
    a) 4 units b) 2 units c) 0 d) 6 units
60. A transverse wave is represented by the equation $y=y° \sin\frac{1\pi}{\lambda}(vt-x)$ for what value of λ is the particle velocity equal to times the wave velocity
    a) $\lambda=\pi y_0$ b) $\lambda = \frac{\pi y_0}{2}$ c) $\lambda = \frac{\pi y_0}{3}$ d) $\lambda =2\ piy_0$
61. If the phase difference between the two ware is 2π during superposition, then the resultant amplitude is
    a) Maximum b) minimum c) maximum on minimum d) none of the above

62. Law of superposition is applicable to only
a) light waves b) sound waves c) transverse waves d) all kinds of wave
63. Coherent sources are characterized by same
a) Phase, phase velocity b) amplitude and frequency
c) wave length, amplitude and frequency d) wave length, phase
64. Two waves of the opposite directions. If superposed give rise to
a) resonance b) beats c) standing wave d) harmonics
65. 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 wave length
66. The complete destructive interference of two sound waves takes place when 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
67. The phenomenon of beat is
a) A characteristic property of light waves
b) A characteristic property of water waves
c) A characteristic property of sound waves
d) A particular case of the phenomenon of interference
68. In a stationary wave
a) strain is maximum at nodes b) strain is maximum at antimodes
c) strain is minimum at nodes d) amplitude is zero at all points
69. Interference of sound can be demonstrated by
a) stethoscope b) tuning fork c) Quincke's tube d) organ pipe
70. In stationary wave at nodes
a) energy is maximum b) pressure and density changes
c) change in strain in maximum d) all the above
71. Two waves of amplitude A_1, A_2 are superimposed, then the common amplitude is
a) A_1+A_2 b) $A_1- A_2$ c) $\sqrt{A1 + A2^{\,2}}$ d) $\sqrt{A + A + 2AAcoso}$
72. Energy is not carried by
a)transverse progressive waves b) longitudinal progressive waves
c) stationary waves d) electromagnetic wave
73. 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) increasing by a factor of 2 b) decreasing by a factor of 2
c) decreasing by a factor of 4 d) unchanged
74. Two identical sinusoidal waves each of amplitude 5mm with phase difference of $\pi/2$ are travelling in the same direction in a string. The amplitude of the resultant wave is
a) Zero b) $\sqrt[5]{2}$ c) $5/\sqrt{2}$ d) 2.5

75. Beats are the result of
a) diffraction b) destructive interference
c) constructive and destructive interference
d) superposition of two waves of nearly equal of nearly equal frequency
76. When temperature increases, the frequency of a tuning fort
a) increases b) decreases
c) remain same d) increases on decreases depending on the material
77. When a tuning fork produces sound wave in air, which one of the following is same in the material of tuning fork as well as in the air
a) wave length b) frequency c) velocity d) amplitude
78. When a tuning fork vibrates, the wave produced in the fork are
a) longitudinal b) transverse c) progressive d) stationary
79. Two sound waves of slightly different frequencies propagating in the same direction produce beats due to
a) interference b) diffraction c) polarization d) refraction
80. 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) 4 beats per second with intensity ratio 25:16 between waxing and waning
b) 8 beats per second with intensity ratio 81:1 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
81. For production of beats the two sources must have
a) different frequencies and same amplitude
b) different frequencies
c) different frequencies and same amplitude and same phase
d) different frequencies and same phase
82. If the study the vibration of a pipe open at both ends then the following statement is not true
a) all harmonics of the fundamental frequency will be generated
b) pressure change will be maximum at both ends
c) open end will be antinode
d) odd harmonics of the fundamental frequency will be generated
83. 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) three nodes and three antinodes b) three nodes and four antinodes
c) four nodes and three antinodes d) four nodes and antinodes
84. A sono meter wire is generally mounted over a large hollow wooden sound bow. This increases
a) Frequency of sound b) velocity of sound
c) intensity of sound d) wave length of sound
85. The two nearest harmonics of a tube closed at one end and open at other end are $220H_z$ and $260H_z$ what is the fundamental frequency of the system
a) $20H_z$ b) $30H_z$ c)$40H_z$ d)$10H_z$
86. In open organ pipe, If fundamental frequency is f then the other frequencies are
a) f, 2f, 3f, 4f b) f, 3f, 5f c) f, 2f, 4f, 8f d) none
87. In a closed organ pipe the frequency fundamental note is $50H_z$ the note of which of the following frequencies will not be emitted by it
a) $50H_z$ b) $100H_z$ c) $150H_z$ d) None

88. If the velocity of sound in air is 336m/s. The maximum length of a closed pipe that would produce a just audible sound will be
a) 3.2cm b) 4.2cm c) 4.2cm d) 3.2cm
89. An open pipe of length L vibrates in fundamental mode the pressure variation is maximum at
a) ¼ from ends b) the middle of pipe
c) the ends of pipe d) at 1/8 from ends of pipe
90. The fundamental frequency of a closed organ pipe of length 20cm is equal to the sound overtone of an organ pipe open at both the ends. The length of organ pipe open at both the end is
a) 120cm b) 140cm c) 80cm d) 100cm
91. The intensity of sound produced by thunder is $0.1wm^{-2}$. Calculate the intensity level in decibel
a) 110db b) 100db c) 50db d) none
92. A spherical source of power 4w and frequency $800H_2$ is emitting sound wares. The intensity of ware at a distance 200m is
a) $8x10^{-6}wm^{-2}$ b) $2x10^{-4}wm^{-2}$ c) $1x10^{-4}wm^{-2}$ d) $4wm^{-2}$
93. How many times more intense is a 60db sound than 30db
a) 100 b) 4 c) 1000 d) 2
94.Doppler effect is applicable for
a) Moving bodies b) one is moving and other are stationary
c) for relative motion d) none of these
95. Doppler phenomena is related with
a) Pitch (frequency) b) loudness c) quality d) reflection
96. Doppler shift in frequency does not depend upon
a) The frequency of the wave produced b) the velocity of the source
c) the velocity of the observer d) distance from the source to the listener
97. A source emits a sound of frequency of $400H_z$ but the listener hears it to be $390H_z$ then
a) The listener is moving towards the source
b) the source is moving towards the listener
c) the listener is moving away from the source
d) the listener has a defective ear
98. An observer is moving towards the stationary source of sound, then
a) Apparent frequency will be less the real frequency
b) apparent frequency will be greater than the real frequency
c) apparent frequency will be equal to real frequency
d) only the quality of sound will change
99. When a source is going away from a stationary observer with a velocity equal to velocity of sound in air, then the frequency heard by the observer will be
a) Same b) double c) half d) one third
100. If source and observer both are relatively at rest and if speed of sound is increased then frequency heard by observer will
a) Increases b) decreases c) cannot be predicted d) will not change

LEVEL – III (101 - 119 Questions)

101. The Doppler shift in the frequency received by a stationary receiver when the source is moving towards. It was measured to be ΔV_{air} when both receiver and source are in air and it was measured to be ΔV_{water} when both are under water,then
a) $\Delta V_{air} > \Delta V_{water}$ b) $\Delta V_{air} < \Delta V_{water}$ c) $\Delta V_{air} = \Delta V_{water}$ d) $\Delta V_{water} = 0$, $\Delta V_{air} < 0$

102. Two cars moving in opposite directions approach each other with speed of $22ms^{-1}$ and $16.5ms^{-1}$ respectively. The driver of the first car blows a horn having a frequency $400H_z$. The frequency heard by the driver of the second car is (velocity of second is $340ms^{-1}$)
a) 361 H_z b) 411 H_z c) 448 H_z d) 350 H_z

103. A siren emitting a sound of frequency $800H_z$ moves away from an observer towards a (lift at a speed of $15ms^{-1}$ then the frequency of sound that the observer hears in the echo reflected from the (lift is velocity of sound in air $=330ms^{-1}$)
a) $838H_z$ b) $885H_z$ c) $765H_z$ d) $800H_z$

104. A train moving at a speed of $220ms^{-1}$ towards a stationary object, emits a sound of frequency $1000H_z$ 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 ($V= 330ms^{-1}$)
a) $3500H_z$ b) $4000H_z$ c) $5000H_z$ d) $3000H_z$

105. An observer moves towards a stationary source of sound with a speed $1/5^{th}$ of the speed of sound. The wave length and frequency of the source emitted are λ and f respectively. The apparent frequency and wave length recorded by the observer are respectively
a) 1.2f, 1.2 λ b) 1.2f, λ c) f, 1.2 λ d) 0.8f, 0.8 λ

106. Which of the following has high pitch in their sound
a) Lion b) mosquito c) man d) woman

107. Decibel is unit of
a) Intensity of light b) sound loudness c) energy d) none

108. Quality of a musical note depends on
a) Harmonics presents b) amplitude of the wave c) fundamental frequency

109. When we horn a sound, we can identify its source from
a) Amplitude of sound b) intensity of sound
c) wave length of sound d) overtone present in the sound

110. The loudness and pitch of a sound depends on
a) Intensity and velocity b) frequency and velocity
c) intensity and frequency d) frequency and number of harmonics

111. Quality depends on
a) Intensity b) loudness c) timbre d) frequency

112. If T is the reverberation time of an auditorium of volume V then
a) $T\alpha \frac{1}{V}$ b) $T\alpha \frac{1}{V^2}$ c) $T\alpha V^2$ d) $T\alpha V$

113. Match the following:

A) Transverse wave	i) crests and troughs
B) Longitudinal wave	ii) compression and rarefaction
C) Progressive wave	iii) energy propagated
D) stationary wave	iv) energy is not propagated

a) A-i, B-ii, C-iii, D-iv b) A-ii, B-iii, C-iv, D-i
c) A-iii, B-iv, C-i, D-ii d) A-iv, B-i, C-ii, D-iii

114. Match the following:

A) Newton	i) isothermal
B) Laplace	ii) adiabatic
C) Constructive interference	iii) $I= I_1+I_2+\sqrt{I_1 I_2}$
D) Destructive interference	iv) $I= I_1+I_2-\sqrt{I_1 I_2}$

a) A-i, B-ii, C-iii, D-iv b) A-ii, B-iii, C-iv, D-i
c) A-iii, B-iv, C-ii, D-I d) A-iv, B-iii, C-ii, D-i

115. A) In a progressive wave — i) vibration of particles are along the direction of wave propagation
B) In a transverse wave — ii) amplitude of vibration does not vary with time
C) In a stationary wave — iii) vibrations of particles are perpendicular to the direction of wave propagation
D) In a longitudinal wave — iv) Amplitude of vibration varies with position
a) A-iv, B-iii, C-ii, iv D-I, iii b) A-i, B-iii, C-iv, D-ii
c) A-iii, B-ii, C-i, D-iv d) A-I, ii, iii, B-i, ii C-iv, D-I,ii

116. Match the following:
A) Change in apparent frequency due to relative motion between source and listener is — i) Beats
B) Intensity of sound varies with time in — ii) transverse wave
C) Sound waves in air are — iii) Doppler's effect
D) Light waves are — iv) longitudinal wave
a) A-iii, B-i, C-iv, ii b) A-i, B-ii, C-iii, iv
c) A-ii, B-iii, C-iv, D-I d) A-iv, B-iii, C-ii, D-i

117. An electric generator operates at a sound intensity level of 80db then intensity is
a) 10^{-4}w/m^2 b) 10^{-8}w/m^2 c) 10^{-5}w/m^2 d) none

118. The maximum intensity with which an ear can tolerate is
a) 0.5 wm^{-2} b) 1 wm^{-2} c) 0.2 wm^{-2} d) None of these

119. The maximum intensity level in dB is
a) 120 dB b) 90 dB c) 40 dB d) None of these