ONE MARK QUESTIONS (BOOK BACK)
UNIT 1 (NATURE OF PHYSICAL WORLD AND MEASUREMENT)

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
(a) 4% (b) 5% (c) 6% (d) 7%

4. The length of a body is measured as 3.51 m, if the accuracy is 0.01m, 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 m^2 (b) 2.64×10^{24} kg (c) 0.0006032m^2 (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. Round of the following number 19.95 into three significant figures.
(a) 19.9 (b) 20.0 (c) 20.1 (d) 19.5

8. 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

9. The dimensional formula of Planck's constant h is
(a) $[ML^2T^{-1}]$ (b) $[ML^2T^{-3}]$ (c) $[MLT^{-1}]$ (d) $[ML^3T^{-3}]$

10. 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) $[LT^{-3}]$

11. The dimensional formula for gravitational constant G is
(a) $[ML^3T^{-2}]$ (b) $[M^{-1}L^3T^{-2}]$ (c) $[M^{-1}L^{-3}T^{-2}]$ (d) $[ML^{-3}T^2]$

12. 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

13. If the force is proportional to square of velocity, then the dimension of proportionality constant is
(a) $[MLT^0]$ (b) $[MLT^{-1}]$ (c) $[ML^{-2}T]$ (d) $[ML^{-1}T^0]$

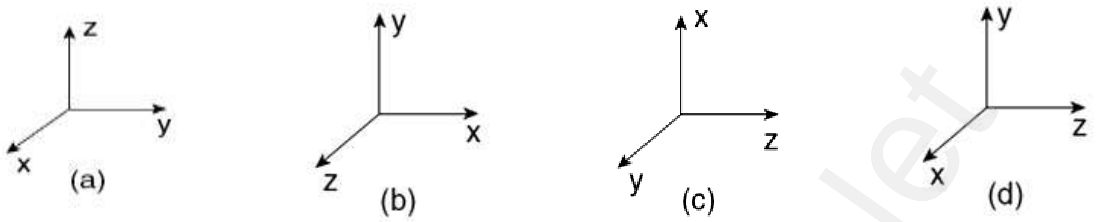
14. The dimension of $(\mu_0\varepsilon_0)^{\frac{1}{2}}$ is
(a) length (b) time (c) velocity (d) force

15. 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?

(a) $\frac{\sqrt{hG}}{c^{\frac{3}{2}}}$ (b) $\frac{\sqrt{hG}}{c^{\frac{5}{2}}}$ (c) $\sqrt{\frac{hc}{G}}$ (d) $\sqrt{\frac{Gc}{h^{\frac{3}{2}}}}$

UNIT 2 (KINETICS)

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



17. Identify the unit vector in the following

(a) $\hat{\imath}+\hat{\jmath}$ (b) $\frac{\hat{\imath}}{\sqrt{2}}$ (c) $\hat{k}-\frac{\hat{\imath}}{\sqrt{2}}$ (d) $\frac{\hat{\imath}+\hat{\jmath}}{\sqrt{2}}$

18. Which one of the following physical quantities cannot be represented by a scalar?

(a) Mass (b) length
(c) momentum (d) magnitude of acceleration

19. Two objects of masses m1 and m2 fall from the heights h_1 and h_2 respectively. The ratio of the magnitude of their momenta when they hit the ground is

(a) $\sqrt{\frac{h_1}{h_2}}$ (b) $\sqrt{\frac{m_1h_1}{m_2h_2}}$ **(c)** $\frac{m_1}{m_2}\sqrt{\frac{h_1}{h_2}}$ (d) $\frac{m_1}{m_2}$

20. If a particle has negative velocity and negative acceleration, its speed

(a) increases (b) decreases (c) remains same (d) zero

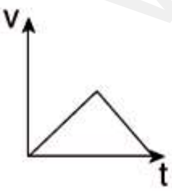
21. If the velocity is $\vec{v}=2\hat{\imath}+t^2\hat{\jmath}-9\hat{k}$, then the magnitude of acceleration at t = 0.5 s is

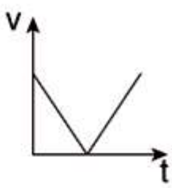
(a) 1m s^{-2} (b) 2 m s^{-2} (c) zero (d) -1 m s^{-2}

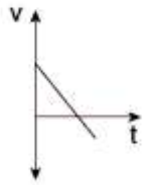
22. If an object is dropped from the top of a building and it reaches the ground at t = 4 s then the height of the building is (ignoring air resistance) (g = 9.8 ms^{-2})

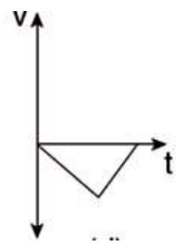
(a) 77.3 m (b) 78.4 m (c) 80.5 m (d) 79.2 m

23. A ball is projected vertically upwards with a velocity v. It comes back to ground in time t. Which v-t graph shows the motion correctly?

(a) 

(b) 

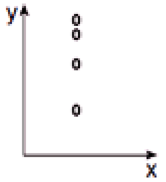
(c) 

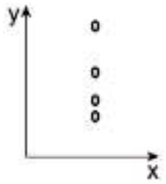
(d) 

24. 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

25. A ball is dropped from some height towards the ground. Which one of the following represents the correct motion of the ball?



(a)


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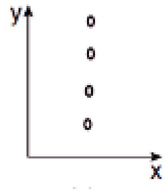

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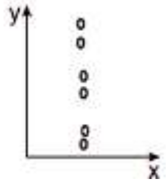


(d)

26. 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

27. If a particle executes uniform circular motion, choose the correct statement

(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.

28. 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) $\frac{2u}{g}$

29. Two objects are projected at angles 30^0 and 60^0 respectively with respect to the horizontal direction. The ranges 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) $R_{30^0} = 4R_{60^0}$ (c) $R_{30^0} = \frac{R_{60^0}}{2}$ (d) $R_{30^0} = 2R_{60^0}$

30. 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

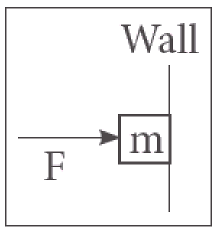
(a) $g = 20\ m\ s^{-2}$ (b) $g = 25\ m\ s^{-2}$ (c) $g = 15\ m\ s^{-2}$ (d) $g = 30\ m\ s^{-2}$

UNIT 3 (LAWS OF MOTION)

31. When a car takes a sudden left turn in the curved road, passengers are pushed towards the right due to

(a) inertia of direction (b) inertia of motion
(c) inertia of rest (d) absence of inertia

32. An object of mass m held against a vertical wall by applying horizontal force F as shown in the figure. The minimum value of the force F is



(a) Less than mg (b) Equal to mg
(c) Greater than mg (d) Cannot determine

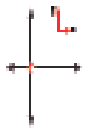
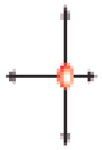
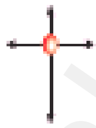
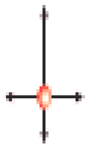
33. A vehicle is moving along the positive x direction, if sudden brake is applied, then

(a) frictional force acting on the vehicle is along positive x direction
(b) no frictional force acts on the vehicle
(c) frictional force acts in downward direction
(d) frictional force acting on the vehicle is along negative x direction

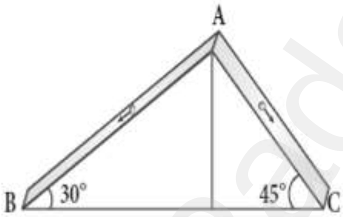
34. A book is at rest on the table which exerts a normal force on the book. If this force is considered as reaction force, what is the action force according to Newton's third law?
   (a) Gravitational force exerted by Earth on the book
   (b) Gravitational force exerted by the book on Earth
   (c) Normal force exerted by the book on the table
   (d) None of the above

35. Two masses m_1 and m_2 are experiencing the same force where $m_1 < m_2$. The ratio of their acceleration $\frac{a_1}{a_2}$ is
   (a) 1 (b) less than 1
   (c) greater than 1 (d) all the three cases

36. Choose appropriate free body diagram for the particle experiencing net acceleration along negative y direction. (Each arrow mark represents the force acting on the system).

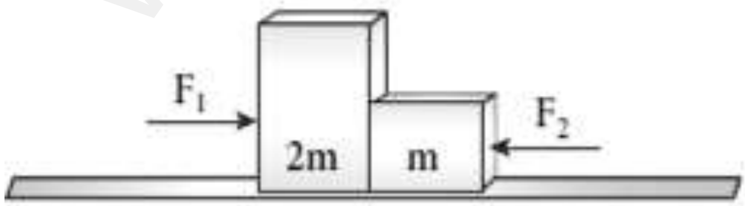
(a)  (b)  (c)  (d) 

37. A particle of mass m sliding on the smooth double inclined plane (shown in figure) will experience



   (a) greater acceleration along the path AB
   (b) greater acceleration along the path AC
   (c) same acceleration in both the paths
   (d) no acceleration in both the paths

38. Two blocks of masses m and 2m are placed on a smooth horizontal surface as shown. In the first case only a force F_1 is applied from the left. Later only a force F_2 is applied from the right. If the force acting at the interface of the two blocks in the two cases is same, then $F_1 : F_2$ is



   (a) 1:1 (b) 1:2 (c) 2:1 (d) 1:3

39. Force acting on the particle moving with constant speed is
   (a) always zero (b) need not be zero
   (c) always non zero (d) cannot be concluded

40. An object of mass m begins to move on the plane inclined at an angle θ. The coefficient of static friction of inclined surface is μ_s. The maximum static friction experienced by the mass is
(a) mg (b) $\mu_s$mg
(c) $\mu_s$mg sinθ (d) $\mu_s$mg cos θ

41. When the object is moving at constant velocity on the rough surface,
(a) no force acts on the object (b) net force on the object is zero
(c) only external force acts on the object
(d) only kinetic friction acts on the object

42. When an object is at rest on the inclined rough surface,
(a) static and kinetic frictions acting on the object is zero
(b) static friction is zero but kinetic friction is not zero
(c) static friction is not zero and kinetic friction is zero
(d) static and kinetic frictions are not zero

43. The centrifugal force appears to exist
(a) only in inertial frames (b) only in rotating frames
(c) in any accelerated frame
(d) both in inertial and non-inertial frames

44. Choose the correct statement from the following
(a) Centrifugal and centripetal forces are action reaction pairs
(b) Centripetal force acts towards the centre and centrifugal force appears to act away from the centre in a circular motion
(c) Centripetal forces is a natural force
(d) Centrifugal force arises from gravitational force

45. If a person moving from pole to equator, the centrifugal force acting on him
(a) increases (b) decreases
(c) remains the same (d) increases and then decreases

UNIT 4 (WORK, ENERGY AND POWER)

46. A uniform force of $(2\hat{\imath} + \hat{\jmath})$+ N acts on a particle of mass 1 kg. The particle displaces from position $(3\hat{\jmath} + \hat{k})$ m to $(5\hat{\imath} + 3\hat{\jmath})$.The work done by the force on the particle is
(a) 9 J (b) 6 J (c) 10 J (d) 12 J

47. A ball of mass 1 kg and another of mass 2 kg are dropped from a tall building whose height is 80 m. After, a fall of 40 m each towards Earth, their respective kinetic energies will be in the ratio of
(a) $\sqrt{2} : 1$ (b) $1 : \sqrt{2}$ (c) 2 : 1 (d) 1 : 2

48. A body of mass 1 kg is thrown upwards with a velocity 20 m s^{-1}. It momentarily comes to rest after attaining a height of 18 m. How much energy is lost due to air friction? (Take g = 10ms^{-2})
(a) 20 J (b) 30 J (c) 40 J (d) 10 J

49. An engine pumps water continuously through a hose. Water leaves the hose with a velocity v and m is the mass per unit length of the water of the jet. What is the rate at which kinetic energy is imparted to water?

(a) $\frac{1}{2}mv^3$ (b) mv^3 (c) $\frac{3}{2}mv^2$ (d) $\frac{5}{2}mv^2$

50. A body of mass 4 m is lying in xy-plane at rest. It suddenly explodes into three pieces. Two pieces each of mass m move perpendicular to each other with equal speed *v*. The total kinetic energy generated due to explosion is

(a) mv^2 (b) $\frac{3}{2}mv^2$ (c) $2mv^2$ (d) $4mv^2$

51. The potential energy of a system increases, if work is done

(a) by the system against a conservative force
(b) by the system against a non-conservative force
(c) upon the system by a conservative force
(d) upon the system by a non-conservative force

52. What is the minimum velocity with which a body of mass m must enter a vertical loop of radius R so that it can complete the loop?

(a) $\sqrt{2gR}$ (b) $\sqrt{3gR}$ (c) $\sqrt{5gR}$ (d) $\sqrt{gR}$

53. The work done by the conservative force for a closed path is

(a) always negative (b) zero
(c) always positive (d) not defined

54. If the linear momentum of the object is increased by 0.1%, then the kinetic energy is increased by

(a) 0.1 % (b) 0.2% (c) 0.4% (d) 0.01%

55. If the potential energy of the particle is $\alpha - \frac{\beta}{2}x^2$, then force experienced by the particle is

(a) $F = \frac{\beta}{2}x^2$ (b) $F = \beta x$ (c) $F = -\beta x$ (d) $F = -\frac{\beta}{2}x^2$

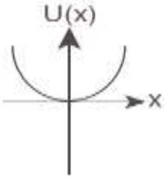
56. A wind-powered generator converts wind energy into electric energy. Assume that the generator converts a fixed fraction of the wind energy intercepted by its blades into electrical energy. For wind speed *v*, the electrical power output will be proportional to

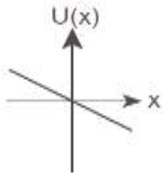
(a) v (b) v^2 (c) v^3 (d) v^4

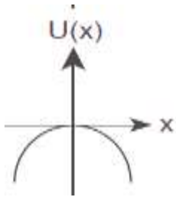
57. Two equal masses m_1 and m_2 are moving along the same straight line with velocities 5 ms^{-1} and -9ms^{-1} respectively. If the collision is elastic, then calculate the velocities after the collision of m_1 and m_2, respectively

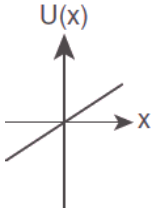
(a) -4ms^{-1} and 10 ms^{-1} (b) 10ms^{-1} and 0 ms^{-1}
(c) -9ms^{-1} and 5 ms^{-1} (d) 5 ms^{-1} and 1 ms^{-1}

58. A particle is placed at the origin and a force $F = kx$ is acting on it (where *k* is a positive constant). If U(0) = 0 , the graph of U *(x)* versus x will be (where U is the potential energy function)

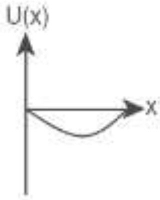
(a) 

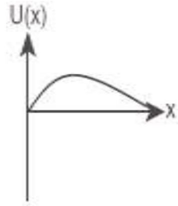
(b) 

(c) 

(d) 

59. A particle which is constrained to move along *x*-axis, is subjected to a force in the same direction which varies with the distance *x* of the particle from the origin as $F(x) = -kx + ax^3$. Here, *k* and a are positive constants. For $x \geq 0$, the functional form of the potential energy *U*(*x*) of the particle is

(a) 

(b) 

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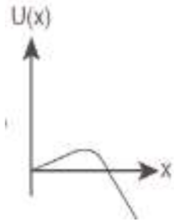
(d) 

60. A spring of force constant *k* is cut into two pieces such that one piece is double the length of the other. Then, the long piece will have a force constant of

(a) $\frac{2}{3}k$ (b) $\frac{3}{2}k$ (c) 3k (d) 6k

UNIT 5 (MOTION OF SYSTEM OF PARTICLES AND RIGID BODIES)

61. The centre of mass of a system of particles does not depend upon,
(a) position of particles (b) relative distance between particles
(c) masses of particles (d) force acting on particle

62. A couple produces,
(a) pure rotation (b) pure translation
(c) rotation and translation (d) no motion

63. 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,
(a) zero (b) increasing with x
(c) decreasing with x (d) remaining constant

64. 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 30 N?
(a) 0.25 rad s^{-2} (b) 25 rad s^{-2} (c) 5 m s s^{-2} (d) 25ms^{-2}

65. A closed cylindrical container is partially filled with water. As the container rotates in a horizontal plane about a perpendicular bisector, its moment of inertia,
(a) increases (b) decreases
(c) remains constant (d) depends on direction of rotation

66. A rigid body rotates with an angular momentum L. If its kinetic energy is halved, the angular momentum becomes,
(a) L (b) $\frac{L}{2}$ (c) 2L (d) $\frac{L}{\sqrt{2}}$

67. A particle undergoes uniform circular motion. The angular momentum of the particle remains conserved about,
   (a) the centre 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.

68. When a mass is rotating in a plane about a fixed point, its angular momentum is directed along,
   (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

69. Two discs of same moment of inertia rotating about their regular axis passing through centre and perpendicular to the plane of disc with angular velocities ω_1 and ω_2. They are brought in to contact face to face coinciding the axis of rotation. The expression for loss of energy during this process is,
   (a) $\frac{1}{4}\mathrm{I}(\omega_1 - \omega_2)^2$ (b $\mathrm{I}(\omega_1 - \omega_2)^2$
   (c) $\frac{1}{8}\mathrm{I}(\omega_1 - \omega_2)^2$ (d) $\frac{1}{2}\mathrm{I}(\omega_1 - \omega_2)^2$

70. 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,
   (a) 5:7 (b) 2:3 (c) 2:5 (d) 7:5

71. A disc of moment of inertia $\mathrm{I_a}$ is rotating in a horizontal plane about its symmetry axis with a constant angular speed ω. Another disc initially at rest of moment of inertia $\mathrm{I_b}$ 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,
   (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) $\frac{1}{2}\frac{I_b I_b}{(I_a+I_b)}\omega^2$

72. From a disc of radius R a 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 it
   (a) $\frac{15\,MR^2}{32}$ (b) $\frac{13\,\mathrm{MR}^2}{32}$ (c) $\frac{11\,\mathrm{MR}^2}{32}$ (d) $\frac{9\,\mathrm{MR}^2}{32}$

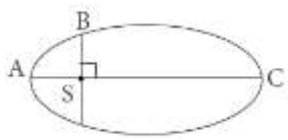
73. The speed of a solid sphere after rolling down from rest without sliding on an inclined plane of vertical height h is,
   (a) $\sqrt{\frac{4}{3}\mathrm{gh}}$ (b) $\sqrt{\frac{10}{7}\mathrm{gh}}$ (c) $\sqrt{2\mathrm{gh}}$ (d) $\sqrt{\frac{1}{2}\mathrm{gh}}$

74. The speed of the centre of a wheel rolling on a horizontal surface is v_0. A point on the rim in level with the centre will be moving at a speed of speed of,
   (a) zero (b) v_0 (c) $\sqrt{2}\ v_0$ (d) $2\ v_0$

75. A round object of mass M and radius R rolls down without slipping along an inclined plane. The frictional force,
   (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 – 6 (GRAVITATION)

76. 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
77. If the masses of the Earth and Sun suddenly double, the gravitational force between them will
   (a) remain the same (b) increase 2 times
   (c) increase 4 times (d) decrease 2 times
78. 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 $\frac{v_1}{v_2}$ is
   (a) $\frac{r_2}{r_1}$ (b) $\left(\frac{r_2}{r_1}\right)^2$ (c) $\frac{r_1}{r_2}$ (d) $\left(\frac{r_1}{r_2}\right)^2$
79. 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
80. 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
81. According to 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
82. 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
83. 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
   (a) $K_A > K_B > K_C$ (b) $K_B < K_A < K_C$
   (c) $K_A < K_B < K_C$ (d) $K_B > K_A > K_C$



84. 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

85. If the mass and radius of the Earth are both doubled, then the acceleration due to gravity g′
(a) remain s same (b) $\frac{g}{2}$ (c) 2 g (d) 4 g

86. 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

87. If a person moves from Chennai to Trichy, his weight
(a) increases (b) decreases
(c) remains same (d) increases and then decreases

88. 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

89. 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

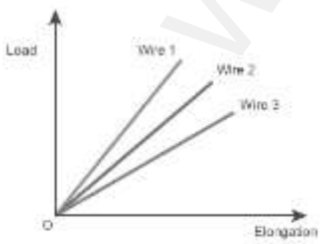
90. The kinetic energy of the satellite orbiting around the Earth is
(a) equal to potential energy (b) less than potential energy
(c) greater than kinetic energy (d) zero

UNIT – 7 (PROPERTIES OF MATTER)

91. Consider two wires X and Y. The radius of wire X is 3 times the radius of Y. If they are stretched by the same load, then the stress on Y is
(a) equal to that on X (b) thrice that on X
(c) nine times that on X (d) Half that on X

92. If a wire is stretched to double of its original length, then the strain in the wire is
(a) 1 (b) 2 (c) 3 (d) 4

93. The load – elongation graph of three wires of the same material are shown in figure. Which of the following wire is the thickest?



(a) wire 1 (b) wire 2
(c) wire 3 (d) all of them have same thickness

94. For a given material, the rigidity modulus is $\left(\frac{1}{3}\right)^{\text{rd}}$ of Young's modulus. Its Poisson's ratio is
(a) 0 (b) 0.25 (c) 0.3 (d) 0.5

95. A small sphere of radius 2cm falls from rest in a viscous liquid. Heat is produced due to viscous force. The rate of production of heat when the sphere attains its terminal velocity is proportional to
(a) 2^2 (b) 2^3 (c) 2^4 (d) 2^5

96. Two wires are made of the same material and have the same volume. The area of cross sections of the first and the second wires are A and 2A respectively. If the length of the first wire is increased by Δl on applying a force F, how much force is needed to stretch the second wire by the same amount?
(a) 2 F (b) 4 F (c) 8 F (d) 16 F

97. With an increase in temperature, the viscosity of liquid and gas, respectively will
(a) increase and increase (b) increase and decrease
(c) decrease and increase (d) decrease and decrease

98. The Young's modulus for a perfect rigid body is
(a) 0 (b) 1 (c) 0.5 (d) infinity

99. Which of the following is not a scalar?
(a) viscosity (b) surface tension
(c) pressure (d) stress

100. If the temperature of the wire is increased, then the Young's modulus will
(a) remain the same (b) decrease
(c) increase rapidly (d) increase by very a small amount

101. Copper of fixed volume V is drawn into a wire of length l. When this wire is subjected to a constant force F, the extension produced in the wire is Δl. If Y represents the Young's modulus, then which of the following graphs is a straight line?
(a) Δl versus V (b) Δl versus Y
(c) Δl versus F (d) Δl versus $\frac{1}{l}$

102. A certain number of spherical drops of a liquid of radius R coalesce to form a single drop of radius R and volume V. If T is the surface tension of the liquid, then
(a) energy = 4 V T $\left(\frac{1}{r}-\frac{1}{R}\right)$ is released
(b) energy = 3 V T $\left(\frac{1}{r}+\frac{1}{R}\right)$ is absorbed
(c) energy =3 V T $\left(\frac{1}{r}-\frac{1}{R}\right)$ is released
(d) energy is neither released nor absorbed

103. The following four wires are made of the same material. Which of these will have the largest extension when the same tension is applied?
(a) length = 200 cm, diameter = 0.5 mm
(b) length= 200 cm, diameter = 1 mm
(c) length = 200 cm, diameter = 2 mm
(d) length= 200 cm, diameter = 3 m

104. The wettability of a surface by a liquid depends primarily on
(a) viscosity (b) surface tension
(c) density
(d) angle of contact between the surface and the liquid

105. In a horizontal pipe of non-uniform cross section, water flows with a velocity of 1 ms^{-1} at a point where the diameter of the pipe is 20 cm. The velocity of water (1.5 m s^{-1}) at a point where the diameter of the pipe is (in cm)
(a) 8 (b) 16 (c) 24 (d) 32

UNIT – 8 (HEAT AND THERMODYNAMICS)

106. In hot summer after a bath, the body's
(a) internal energy decreases (b) internal energy increases
(c) heat decreases
(d) no change in internal energy and heat

107. The graph between volume and temperature in Charles' law is
(a) an ellipse (b) a circle
(c) a straight line (d) a parabola

108. When a cycle tyre suddenly bursts, the air inside the tyre expands. This process is
(a) isothermal (b) adiabatic
(c) isobaric (d) isochoric

109. An ideal gas passes from one equilibrium state (P_1, V_1, T_1, N) to another equilibrium state ($2P_1$, $3V_1$, T_2, N). Then
(a) $T_1 = T_2$ (b) $T_1 = \frac{T_2}{6}$ (c) $T_1 = 6T_2$ (d) $T_1 = 3T_2$

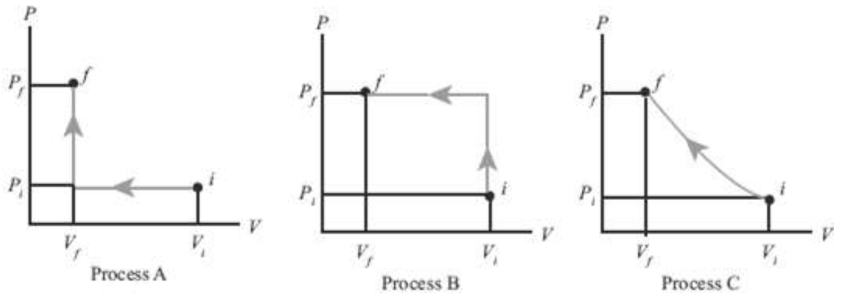
110. When a uniform rod is heated, which of the following quantity of the rod will increase
(a) mass (b) weight
(c) center of mass (d) moment of inertia

111. When food is cooked in a vessel by keeping the lid closed, after some time the steam pushes the lid outward. By considering the steam as a thermodynamic system, then in the cooking process
(a) $Q > 0$, $W > 0$ (b) $Q < 0$, $W > 0$
(c) $Q > 0$, $W < 0$ (d) $Q < 0$, $W < 0$

112. When you exercise in the morning, by considering your body as thermodynamic system, which of the following is true?
(a) $\Delta U > 0$, $W > 0$ (b) $\Delta U < 0$, $W > 0$
(c) $\Delta U < 0$, $W < 0$ (d) $\Delta U = 0$, $W > 0$

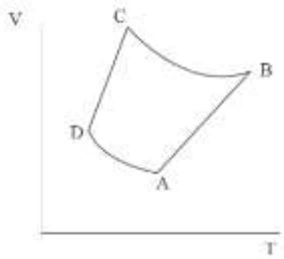
113. A hot cup of coffee is kept on the table. After some time, it attains a thermal equilibrium with the surroundings. By considering the air molecules in the room as a thermodynamic system, which of the following is true
(a) $\Delta U > 0$, $Q = 0$ (b) $\Delta U > 0$, $W < 0$
(c) $\Delta U > 0$, $Q > 0$ (d) $\Delta U = 0$, $Q > 0$

114. An ideal gas is taken from (P_i,V_i) to (P_f,V_f) in three different ways. Identify the process in which the work done on the gas the most.



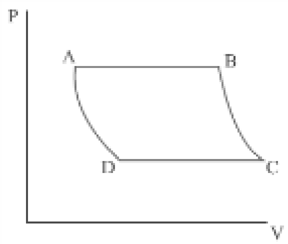
(a) Process A (b) Process B
(c) Process C (d) Equal work is done in Process A,B &C

115. The V-T diagram of an ideal gas which goes through a reversible cycle A⟶B⟶C⟶D is shown below. (Processes D⟶A and B⟶C are adiabatic)

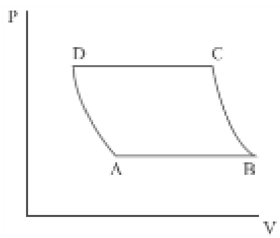


The corresponding PV diagram for the process is (all figures are schematic)

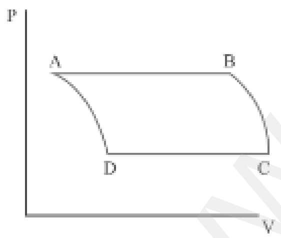
(a)



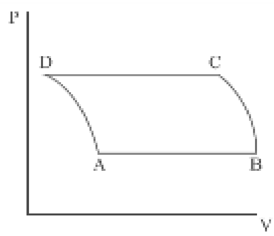
(b)



(c)



(d)



116. A distant star emits radiation with maximum intensity at 350 nm. The temperature of the star is
(a) 8280 K (b) 5000K (c) 7260 K (d) 9044 K

117. Identify the state variables given here?
(a) Q, T, W (b) P, T, U (c) Q, W (d) P, T, Q

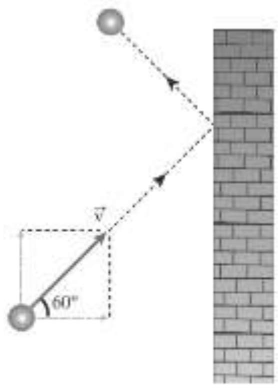
118. In an isochoric process, we have
(a) W = 0 (b) Q = 0 (c) ΔU = 0 (d) ΔT = 0

119. The efficiency of a heat engine working between the freezing point and boiling point of water is
(a) 6.25% (b) 20% (c) 26.8% (d) 12.5%

120. An ideal refrigerator has a freezer at temperature −12°C. The coefficient of performance of the engine is 5. The temperature of the air (to which the heat ejected) is
(a) 50°C (b) 45.2°C (c) 40.2°C (d) 37.5°C

UNIT – 9 (KINETIC THEORY OF GASES)

121. A particle of mass m is moving with speed u in a direction which makes 60° with respect to x axis. It undergoes elastic collision with the wall. What is the change in momentum in x and y direction?



(a) $\Delta p_x = -mu, \Delta p_y = 0$ (b) $\Delta p_x = -2mu, \Delta p_y = 0$
(c) $\Delta p_x = 0, \Delta p_y = mu$ (d) $\Delta p_x = mu, \Delta p_y = 0$

122. A sample of ideal gas is at equilibrium. Which of the following quantity is zero?
(a) rms speed (b) average speed
(c) average velocity (d) most probable speed

123. An ideal gas is maintained at constant pressure. If the temperature of an ideal gas increases from 100K to 10000K then the rms speed of the gas molecules
(a) increases by 5 times (b) increases by 10 times
(c) remains same (d) increases by 7 times

124. Two identically sized rooms A and B are connected by an open door. If the room A is air conditioned such that its temperature is 4°C lesser than room B, which room has more air in it?
(a) Room A (b) Room B
(c) Both room has same air (d) Cannot be determined

125. The average translational kinetic energy of gas molecules depends on
(a) number of moles and T (b) only on T
(c) P and T (d) P only

126. If the internal energy of an ideal gas U and volume V are doubled then the pressure
(a) doubles (b) remains same
(c) halves (d) quadruples

127. The ratio $\gamma = \frac{C_P}{C_V}$ for a gas mixture consisting of 8 g of helium and 16 g of oxygen is
(a) 23/15 (b) 15/23
(c) 27/17 (d) 17/2

128. A container has one mole of monoatomic ideal gas. Each molecule has f degrees of freedom. What is the ratio of $\gamma = \frac{C_p}{C_v}$

(a) f (b) $\frac{f}{2}$ (c) $\frac{f}{f+2}$ (d) $\frac{f+2}{f}$

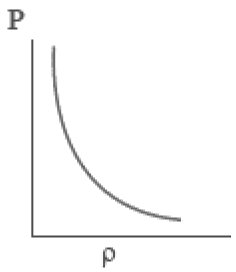
129. If the temperature and pressure of a gas is doubled the mean free path of the gas molecules

(a) remains same (b) doubled

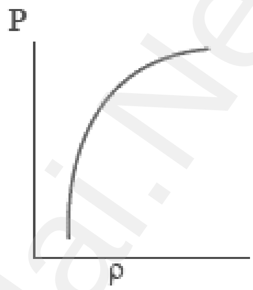
(c) tripled (d) quadrapoled

130. Which of the following shows the correct relationship between the pressure and density of an ideal gas at constant temperature?

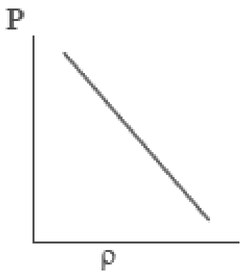
(a)



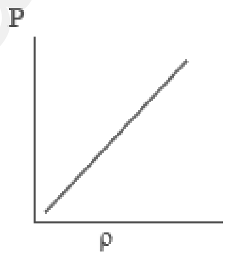
(b)



(c)



(d)



131. A sample of gas consists of μ_1 moles of monoatomic molecules, μ_2 moles of diatomic molecules and μ_3 moles of linear triatomic molecules. The gas is kept at high temperature. What is the total number of degrees of freedom?

(a) $[3\mu_1 + 7(\mu_2 + \mu_3)]\, N_A$ (b) $[3\mu_1 + 7\mu_2 + 6\mu_3]\, N_A$

(c) $[7\mu_1 + 3(\mu_2 + \mu_3)]\, N_A$ (d) $[3\mu_1 + 6(\mu_2 + \mu_3)]\, N_A$

132. If S_P and S_V denote the specific heats of nitrogen gas per unit mass at constant pressure and constant volume respectively, then

(a) $S_P - S_V = 28R$ (b) $S_P - S_V = R/28$

(c) $S_P - S_V = R/14$ (d) $S_P - S_V = R$

133. Which of the following gases will have least rms speed at a given temperature?

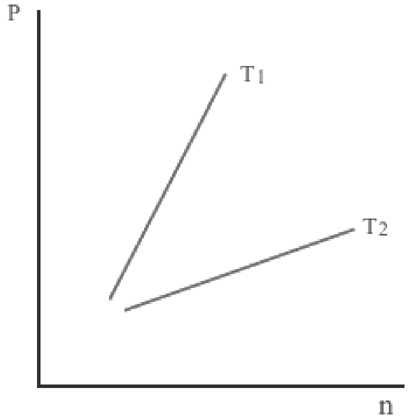
(a) Hydrogen (b) Nitrogen

(c) Oxygen (d) Carbon dioxide

134. For a given gas molecule at a fixed temperature, the area under the Maxwell-Boltzmann distribution curve is equal to

(a) $\frac{PV}{kT}$ (b) $\frac{kT}{PV}$ (c) $\frac{P}{NkT}$ (d) PV

135. The following graph represents the pressure versus number density for ideal gas at two different temperatures T_1 and T_2. The graph implies



(a) $T_1 = T_2$ (b) $T_1 > T_2$
(c) $T_1 < T_2$ (d) Cannot be determined

UNIT – 10 (KINETIC THEORY OF GASES)

136. In a simple harmonic oscillation, the acceleration against displacement for one complete oscillation will be
(a) an ellipse (b) a circle (c) a parabola (d) a straight line

137. A particle executing SHM crosses points A and B with the same velocity. Having taken 3 s in passing from A to B, it returns to B after another 3 s. The time period is
(a) 15 s (b) 6 s (c) 12 s (d) 9 s

138. The length of a second's pendulum on the surface of the Earth is 0.9 m. The length of the same pendulum on surface of planet X such that the acceleration of the planet X is n times greater than the Earth is
(a) 0.9n (b) $\frac{0.9}{n} m$ (c) 0.9 n^2m (d) $\frac{0.9}{n^2}$

139. A simple pendulum is suspended from the roof of a school bus which moves in a horizontal direction with an acceleration a, then the time period is
(a) $T \propto \frac{1}{g^2+a^2}$ (b) $T \propto \frac{1}{\sqrt{g^2+a^2}}$
(c) $T \propto \sqrt{g^2+a^2}$ (d) $T \propto (g^2+a^2)$

140. Two bodies A and B whose masses are in the ratio 1:2 are suspended from two separate massless springs of force constants k_A and k_B respectively. If the two bodies oscillate vertically such that their maximum velocities are in the ratio 1:2, the ratio of the amplitude A to that of B is
(a) $\sqrt{\frac{k_B}{2k_A}}$ (b) $\sqrt{\frac{k_B}{8k_A}}$ (c) $\sqrt{\frac{2k_B}{k_A}}$ (d) $\sqrt{\frac{8k_B}{k_A}}$

141. A spring is connected to a mass m suspended from it and its time period for vertical oscillation is T. The spring is now cut into two equal halves and the same mass is suspended from one of the halves. The period of vertical oscillation is
(a) $T' = \sqrt{2}\,T$ (b) $T' = \frac{T}{\sqrt{2}}$ (c) $T' = \sqrt{2T}$ (d) $T' = \sqrt{\frac{T}{2}}$

142. The displacement of a simple harmonic motion is given by $y(t) = A \sin(\omega t + \varphi)$ where A is amplitude of the oscillation, ω is the angular frequency and φ is the phase. Let the amplitude of the oscillation be 8 cm and the time period of the oscillation is 24 s. If the displacement at initial time (t = 0 s) is 4 cm, then the displacement at t = 6 s is

(a) 8 cm (b) 4 cm (c) $4\sqrt{3}$ cm (d) $8\sqrt{3}$ cm

143. A simple pendulum has a time period T_1. When its point of suspension is moved vertically upwards according as $y = k\,t^2$, where y is vertical distance covered and k = 1 ms^{-2}, its time period becomes T_2. Then, $\frac{T_1^2}{T_2^2}$ is (g = 10 ms^{-2})

(a) $\frac{5}{6}$ (b) $\frac{11}{10}$ (c) $\frac{6}{5}$ (d) $\frac{5}{4}$

144. An ideal spring of spring constant k, is suspended from the ceiling of a room and a block of mass M is fastened to its lower end. If the block is released when the spring is un-stretched, then the maximum extension in the spring is

(a) $4\frac{Mg}{k}$ (b) $\frac{Mg}{k}$ (c) $2\frac{Mg}{k}$ (d) $\frac{Mg}{2k}$

145. A pendulum is hung in a very high building oscillates to and fro motion freely like a simple harmonic oscillator. If the acceleration of the bob is 16 ms^{-2} at a distance of 4 m from the mean position, then the time period is

(a) 2 s (b) 1 s (c) 2πs (d) πs

146. A hollow sphere is filled with water. It is hung by a long thread. As the water flows out of a hole at the bottom, the period of oscillation will

(a) first increase and then decrease (b) first decrease and then increase

(c) increase continuously (d) decrease continuously

147. The damping force on an oscillator is directly proportional to the velocity. The units of the constant of proportionality are

(a) kg m s^{-1} (b) kg m s^{-2} (c) kg s^{-1} (d) kg s

148. Let the total energy of a particle executing simple harmonic motion with angular frequency is 1 rad s^{-1} is 0.256 J. If the displacement of the particle at time $t=\frac{\pi}{2}$ s is $8\sqrt{3}$ cm then the amplitude of motion is

(a) 8 cm (b) 16 cm (c) 32 cm (d) 64 cm

149. A particle executes simple harmonic motion and displacement y at time t_0, $2t_0$ and $3t_0$ are A, B and C, respectively. Then the value of $\left(\frac{A+C}{2B}\right)$ is

(a) $\cos \omega t_0$ (b) $\cos 2\omega t_0$ (c) $\cos 3\omega t_0$ (d) 1

150. A mass of 3 kg is attached at the end of a spring moves with simple harmonic motion on a horizontal frictionless table with time period 2π and with amplitude of 2m, then the maximum fore exerted on the spring is

(a) 1.5 N (b) 3 N (c) 6 N (d) 12 N

UNIT – 11 (WAVES)

151. A student tunes his guitar by striking a 120 Hertz with a tuning fork, and simultaneously plays the 4th string on his guitar. By keen observation, he hears the amplitude of the combined sound oscillating thrice per second. Which of the following frequencies is the most likely the frequency of the 4th string on his guitar?
(a) 130 (b) 117 (c) 110 (d) 120

152. A transverse wave moves from a medium A to a medium B. In medium A, the velocity of the transverse wave is 500 ms^{-1} and the wavelength is 5 m. The frequency and the wavelength of the wave in medium B when its velocity is 600 ms^{-1}, respectively are
(a) 120 Hz and 5 m (b) 100 Hz and 5 m
(c) 120 Hz and 6 m (d) 100 Hz and 6 m

153. For a particular tube, among six harmonic frequencies below 1000 Hz, only four harmonic frequencies are given: 300 Hz, 600 Hz, 750 Hz and 900 Hz. What are the two other frequencies missing from this list?
(a) 100 Hz, 150 Hz (b) 150 Hz, 450 Hz
(c) 450 Hz, 700 Hz (d) 700 Hz, 800 Hz

154. Which of the following options is correct?

A	B
(1) Quality	(A) Intensity
(2) Pitch	(B) Waveform
(3) Loudness	(C) Frequency

Options for (1), (2) and (3), respectively are
(a) (B),(C) and (A) (b) (C), (A) and (B)
(c) (A), (B) and (C) (d) (B), (A) and (C)

155. Equation of travelling wave on a stretched string of linear density 5 g/m is $y = 0.03 \sin(450t - 9x)$, where distance and time are measured in SI units. The tension in the string is
(a) 5 N (b) 12.5 N (c) 7.5 N (d) 10 N

156. A sound wave whose frequency is 5000 Hz travels in air and then hits the water surface. The ratio of its wavelengths in water and air is
(a) 4.30 (b) 0.23 (c) 5.30 (d) 1.23

157. A person standing between two parallel hills fi res a gun and hears the first echo after t_1 sec and the second echo after t_2 sec. The distance between the two hills is
(a) $\frac{v(t_1-t_2)}{2}$ (b) $\frac{v(t_1 t_2)}{2(t_1+t_2)}$
(c) $v(t_1+t_2)$ (d) $\frac{v(t_1+t_2)}{2}$

158. An air column in a pipe which is closed at one end, will be in resonance with the vibrating body of frequency 83Hz. Then the length of the air column is
(a) 1.5 m (b) 0.5 m (c) 1.0 m (d) 2.0 m

159. The displacement *y* of a wave travelling in the *x* direction is given by $y = (2\text{x}10^{-3})\sin\left(300t - 2x + \frac{\pi}{4}\right)$, where x and y are measured in metres and t in second. The speed of the wave is
(a) 150 ms^{-1} (b) 300 ms^{-1} (c) 450 ms^{-1} (d) 600 ms^{-1}

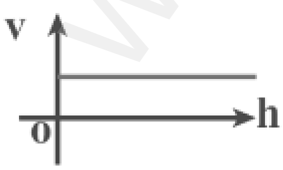
160. Consider two uniform wires vibrating simultaneously in their fundamental notes. The tensions, densities, lengths and diameter of the two wires are in the ratio 8: 1, 1: 2, x : y and 4 : 1 respectively. If the note of the higher pitch has a frequency of 360 Hz and the number of beats produced per second is 10, then the value of x : y is
(a) 36: 35 (b) 35: 36 (c) 1: 1 (d) 1: 2

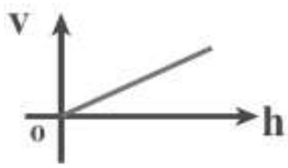
161. Which of the following represents a wave
(a) $(x - vt)^3$ (b) $x(x + vt)$ (c) $\frac{1}{(x + vt)}$ (d) $\sin(x + vt)$

162. A man sitting on a swing which is moving to an angle of 60^0 from the vertical is blowing a whistle which has a frequency of 2.0 k Hz. The whistle is 2.0 m from the fixed support point of the swing. A sound detector which detects the whistle sound is kept in front of the swing. The maximum frequency the sound detector detected is
(a) 2.027 kHz (b) 1.974 kHz (c) 9.74 kHz (d) 1.011 kHz

163. Let $y = \frac{1}{1+x^2}$ at t = 0 s be the amplitude of the wave propagating in the positive x-direction. At t = 2 s, the amplitude of the wave propagating becomes $y = \frac{1}{1 + (x-2)^2}$
Assume that the shape of the wave does not change during propagation. The velocity of the wave is
(a) 0.5m s^{-1} (b) 1.0m s^{-1} (c) 1.5m s^{-1} (d) 2.0m s^{-1}

164. A uniform rope having mass m hangs vertically from a rigid support. A transverse wave pulse is produced at the lower end. Which of the following plots shows the correct variation of speed *v* with height *h* from the lower end?

(a)


(b)


(c)


(d)


165. An organ pipe A closed at one end is allowed to vibrate in its first harmonic and another pipe B open at both ends is allowed to vibrate in its third harmonic. Both A and B are in resonance with a given tuning fork. The ratio of the length of A and B is

(a) $\frac{8}{3}$ (b) $\frac{3}{8}$ (c) $\frac{1}{6}$ (d) $\frac{1}{3}$

Prepared By
RAJENDRAN M, M.Sc., B.Ed., C.C.A.,
P.G. TEACHER IN PHYSICS,
DEPARTMENT OF PHYSICS,
SRMHSS, KAVERIYAMPOONDI,
TIRUVANNAMALAI DISTRICT – 606603.