PHYSICS

41. A stone falls freely from rest and the total distance covered by it in the last second of its motion is equal to the distance covered by it in the first three seconds of motion. The height from which the particle is released from surface of earth is

(a) 100 m (b) 150 m (c) 125 m (d) 175 m

42. The horizontal and vertical displacement of a projectile at a time t are, $x = 36\,t$ and $y = 48t - 4.9\,t^2$ respectively, where x and y are in metre and t is in second. The angle made by initial velocity of projectile with x-axis is

(a) 37^0 (b) 53^0 (c) 30^0 (d) 60^0

43. A balloon of mass M is rising up with an acceleration a. At any instant a mass m is removed from the balloon its acceleration becomes

(a) $(Ma+mg)(M+m)$ (b) $\dfrac{(Ma+mg)}{M-m}$ (c) $\dfrac{(ma+Mg)}{M-m}$ (d) $\dfrac{(Ma+Mg)}{(M+m)}$

44. A box is moved along a straight line by a machine delivering constant power. The velocity of body at any time t is proportional to

(a) $t^{1/2}$ (b) t (c) $t^{3/2}$ (d) t^2

45. A circular disc of radius R is free to oscillate about an axis passing through a point on its rim and perpendicular to its plane. The disc is turned through an angle of 60^0 and released. The velocity of its centre of mass when it reaches the equilibrium position will be

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

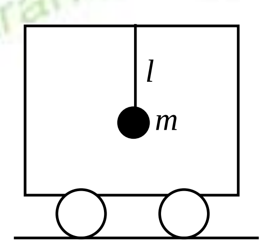
46. A uniform rod AB of mass m and length l is at rest on a smooth horizontal surface. An impulse is applied to the end B. The distance moved by centre of mass as the rod turn through a right angle is

(a) $\dfrac{\pi l}{12}$ (b) $\dfrac{\pi l}{24}$ (c) $\dfrac{\pi l}{6}$ (d) $\dfrac{\pi l}{3}$

47. A satellite moving on a circular path of radius r around earth has angular momentum L. If its radius slightly increases by Δr, the change in its angular momentum is

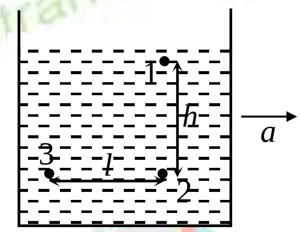
(a) $\dfrac{L\Delta r}{2r^2}$ (b) $\dfrac{L\Delta r}{2r^2}$ (c) $\dfrac{L\Delta r}{2r}$ (d) $\dfrac{Lr^2\Delta r}{2}$

48. A pendulum is suspended in a car. If car have a horizontal acceleration g, then time period is T_1 and if acceleration of car becomes $2g$ time period becomes T_2. Ratio of T_1 and T_2 (T_1/T_2) is



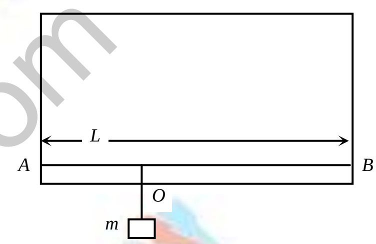
(a) $\left(\frac{5}{2}\right)^{1/2}$ (b) $\left(\frac{5}{2}\right)^{1/4}$ (c) $\left(\frac{2}{5}\right)^{1/2}$ (d) $\left(\frac{2}{5}\right)^{1/4}$

49. There is a liquid of density ρ inside a container. Points 1 and 2 are on same vertical line (at distance *h*) and points 2 and 3 are on same horizontal line (at distance *l*). Pressure difference between points 3 and 1 if the container is given acceleration *a* in right direction is



(a) $\rho(gl+ah)$ (b) $\rho(gl-ah)$ (c) $\rho(gh+la)$ (d) $\rho(gh-la)$

50. A massless rod *AB* of length *L* is hung from two identical wires of equal length. A block of mass *m* is attached at point *O* on the rod as shown in figure the value of *AO* so that a tuning fork excites the wire on the left in its fundamental tone and the wire on the right in its second harmonic is :

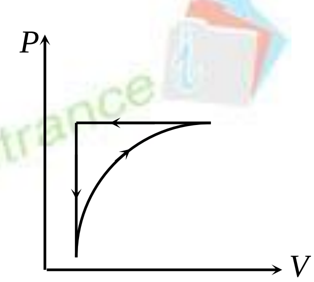


(a) $\frac{4L}{5}$ (b) $\frac{L}{4}$ (c) $\frac{3L}{4}$ (d) $\frac{L}{5}$.

51. Through a stretched wire transverse wave passes from one end to other end in times *t*. If the tension is increased four times then time taken will be

(a) *t* (b) 2*t* (c) *t*/2 (d) 4*t*

52. For one complete cycle of a thermodynamic process on a gas as shown in the P-V diagram, which of the following is correct



(a) $\Delta U > 0$, $\Delta Q < 0$ (b) $\Delta U < 0$, $\Delta Q > 0$

(c) $\Delta U = 0$, $\Delta Q > 0$ (d) $\Delta U = 0$, $\Delta Q < 0$

53. A train is moving with a constant speed along a circular track. The engine of the train emits a sound of frequency *f*. The frequency heard by the guard at rear end of the train

(a) is less than *f*

(b) is greater than *f*

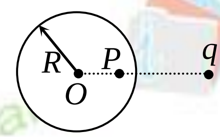
(c) is equal to *f*

(d) may be greater than, less than or equal to *f* depending on the factors like speed of train, length of train and radius of circular track

54. The ratio of thermal conductivities of two identical containers is 2 : 3. The ratio of times in which the equal quantity of ice will melt completely in these container is

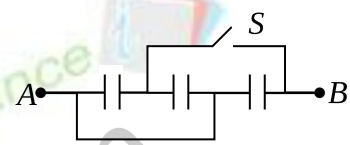
(a) 2 : 3 (b) 3 : 2 (c) 1 : 2 (d) 2 : 1

55. In the given figure a point charge q is placed at a distance $2R$ from centre O of a metallic sphere. The electric field due to the metallic sphere at the point P at distance $R/2$ from centre O will be



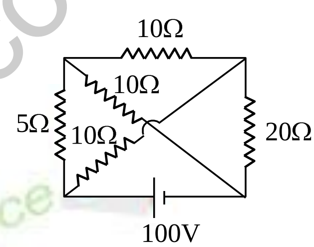
(a) $\frac{Q}{\pi\varepsilon_0 R^2}$ (b) $\frac{q}{\pi\varepsilon_0 R^2}$ (c) $\frac{Q}{9\pi\varepsilon_0 R^2}$ (d) $\frac{q}{9\pi\varepsilon_0 R^2}$

56. Three capacitors each of capacitance C is connected as shown in the figure. Ratio of capacitance between points AB where switch S if open and closed respectively is



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

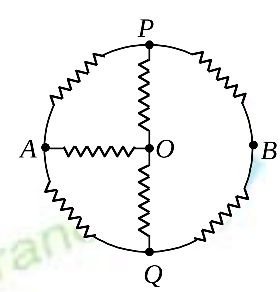
57. Four resistances are connected through a cell as shown in the figure. Current supplied through the cell is



(a) 10 A (b) 20 A

(c) 30 A (d) 40 A

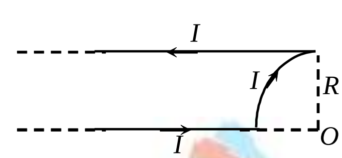
58. In the circuit as shown in the figure value of each resistance is R. Equivalent resistance between points A and O is



(a) R (b) $R/2$

(c) $2R$ (d) $3R$

59. In the figure shown, the value of magnetic field at centre is



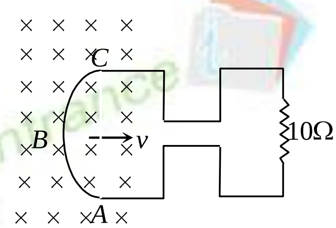
(a) $\frac{\mu_0 I}{4\pi R}+\frac{\mu_0 I}{8R}$ (outwards) (b) $\frac{\mu_0 I}{4\pi R}-\frac{\mu_0 I}{4R}$ (outwards)

(c) $\frac{\mu_0 I}{8R}+\frac{\mu_0 I}{4\pi R}$ (inwards) (d) $\frac{\mu_0 I}{8R}-\frac{\mu_0 I}{4\pi R}$ (inwards)

60. An electron is projected at an angle θ with a uniform magnetic field. If the pitch of the helical path is equal to its radius, then the angle of projection is

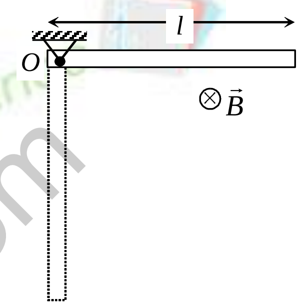
(a) $\tan^{-1}\pi$ (b) $\tan^{-1} 2\pi$ (c) $\text{cat}^{-1}\pi$ (d) $\text{cat}^{-1}2$

61. A semicircular loop *ABC* is moving with velocity *V* towards right in a magnetic field *B* = 4T. The loop is connected to a resistance 10 Ω through points *A* and *C*. If current I in loop is 2A and *AC* = 1m then find value of *V*



(a) 2.5 m/s (b) 5 m/s (c) 7.5 m/s (d) 10 m/s

62. A conducting rod of length is hinged at point *O*. It is free to rotate in a vertical plane. There exists a magnetic field $\vec{B}$ in horizontal direction. The rod is released from the position shown. The potential difference between the two ends of rod when rod becomes vertical is



(a) $\frac{1}{2}B\sqrt{gl}$ (b) $\frac{1}{2}B\sqrt{2gl}$ (c) $\frac{1}{2}Bl\sqrt{3gl}$ (d) $\frac{1}{2}B\sqrt{4gl}$

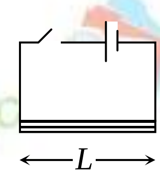
63. When 100 V dc is applied across a solenoid a current of 1A flows in it. When 100 V ac is applied across the same solenoid the current drops to 0.5A. If the frequency of the source is 50Hz, the impedance and inductance of the solenoid are

(a) 200 Ω and 0.55 H (b) 100 Ω and 0.86 H
(c) 200 Ω and 1.0 H (d) 1100 Ω and 0.93 H

64. The x-ray beam coming from an x-ray tube will be

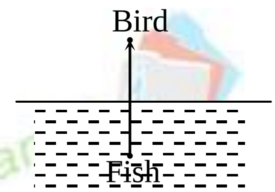
(a) monochromatic
(b) having all wavelengths smaller than a certain maximum wavelength
(c) having all wavelengths larger than a certain minimum wavelength
(d) having all wavelengths lying between a minimum and a maximum wavelength

65. A bar of mass *M* is suspended by two wires. Assume that a uniform magnetic field *B* is directed into the page. When the current through the bar is *I*, then the tension in each supporting wire is



(a) $\frac{Mg}{2}$ (b) $2BIL$ (c) $Mg - BIL$ (d) $\frac{Mg - BIL}{2}$

66. A fish rising vertically up towards the surface of water with speed 3 m/s observes a bird diving vertically down towards it with speed 9 m/s. The actual velocity of bird is



(a) 4.5 m/s (b) 5.4 m/s (c) 3.0 m/s (d) 3.4 m/s

67. The density of a cube is measured by measuring its mass and the length of its sides. If the maximum errors in the measurement of mass and length are 3% and 2% respectively, the maximum error in the measurement of density is

(a) 1% (b) 6% (c) 8% (d) 9%

68. Under the action of a force, a 2 kg body moves such that the position x as a function of time is given by $x = 2t^2$, where x is in metres and t is in seconds. The work done by the force in the first three seconds is

(a) 144 J (b) 12 J (c) 24 J (d) 44 J

69. A particle performs uniform circular motion with an angular momentum L. If the frequency of the particle's motion is doubled and kinetic energy halved, then the angular momentum becomes

(a) $2L$ (b) $4L$ (c) $L/2$ (d) $L/4$

70. The depth 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) $\frac{n}{R}$ (b) $\left(\frac{n}{n-1}\right)R$ (c) $\frac{R}{n-1}$ (d) $\left(\frac{n-1}{n}\right)R$

71. Two spherical black bodies of radii r_1 and r_2 with surface temperatures T_1 and T_2 respectively radiate the same power. Then r_1/r_2 must be equal to

(a) $\left(\frac{T_2}{T_1}\right)^2$ (b) $\left(\frac{T_2}{T_1}\right)^3$ (c) T_1T_2 (d) $\frac{T_1}{T_2}$

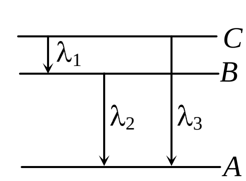
72. The average power dissipation in a pure capacitance in a.c., is

(a) $\frac{1}{2CV^2}$ (b) CV^2 (c) $\frac{1}{4CV^2}$ (d) zero

73. The distance between two slits is 0.03 cm. A screen is placed at a distance of 1.5 metre where an interference pattern is observed in which fourth bright fringe is at 1 cm from the central maximum. The wavelength of light used will be

(a) 7000 Å (b) 6000 Å (c) 5000 Å (d) 4500 Å

74. Energy levels A, B, C of a certain atom correspond to increasing values of energy i.e. $E_A < E_B < E_C$. If λ_1, λ_2, λ_3 are the wavelengths of radiations corresponding to the transitions C to B, B to A and C to A respectively, which of the following statements is correct?



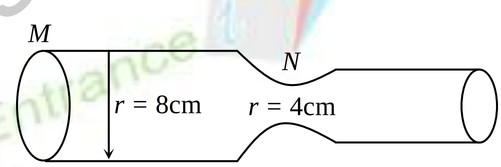
(a) $\lambda_3 = \lambda_1 + \lambda_2$ (b) $\lambda_3 = \frac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$ (c) $\lambda_1 + \lambda_2 + \lambda_3 = 0$ (d) $\lambda_3{}^2 = \lambda_1{}^2 + \lambda_2{}^2$

75. A hole in a p-type semiconductor is
(a) an excess electron (b) a missing electron
(c) a missing atom (d) a donor level

76. One of the refractive surfaces of a prism of angle 30° is silvered. A ray of light incident an angle of 60° retraces its path. The refractive index of the material of prism is
(a) $\sqrt{2}$ (b) $\sqrt{3}$ (c) 3/2 (d) 2

77. A particle of mass 3*m* at rest decays into two particles of masses *m* and 2*m* having non-zero velocities. The ratio of the de-Broglie wavelengths of the particles (λ_1/λ_2) is
(a) 1/2 (b) 1/4 (c) 2 (d) 1

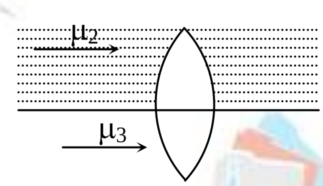
78. A horizontal pipe having a constriction is shown in figure. The radius at *M* and *N* are 8 *cm* and 4 *cm* respectively. If velocity of water at *M* is 16 cm/s then find velocity at *N*?



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

79. Two wires of same material and area of cross section are stretched by same force. If their length are in ratio 2 : 1, then compare ratio of the work done in stretching them.
(a) 2 : 1 (b) 1 : 2 (c) 4 : 1 (d) 1 : 8

80. A double convex lens made of material of refractive index μ_1 is placed inside two liquids refractive index μ_2 and μ_3 as shown in figure, where $\mu_2 > \mu_1 > \mu_3$. A wide parallel beam of light is incident on lens from left. The lens will give rise to



(a) single convergent beam
(b) two different convergent beam
(c) two different divergent beams
(d) two beams one convergent and one divergent