1. Which of the following quantities have dimensions of $\frac{\pi Pr^4}{3Q\ell}$ : (Q = Volume flow rate in $m^3/s$ and P = pressure) :–
(1) Surface tension
(2) Coefficient of viscosity
(3) Energy
(4) Power

2. If a vector $2\hat{i}+3\hat{j}+2\hat{k}$ is perpendicular to the vector $4\hat{i}-4\hat{j}+\propto\hat{k}$, then the value of $\alpha$ is :–
(1) $\frac{1}{2}$ (2) $-\frac{1}{2}$ (3) –2 (4) 2

3. The hour hand of a clock is 6 cm long. The magnitude of the displacement of the tip of hour between 1:00 PM to 5:00 PM is :–
(1) 6 cm (2) $6\sqrt{3}$ cm
(3) 12 cm (4) $3\sqrt{3}$ cm

4. The maximum horizontal range of a projectile is 16 km when the projectile is thrown at an elevation of 30° from the horizontal, it will reach to the maximum height of :–
(1) 2 km (2) 4 km
(3) 8 km (4) 16 km

5. A block of mass 2 kg is at rest on a floor. The coefficient of static friction between block and the floor is 0.54. A horizontal force of 2.8N is applied to the block. What should be the frictional force between the block and the floor ($g = 10\ m/s^2$) :–
(1) 8.8 N (2) 5.8 N
(3) 2.8 N (4) 10.8 N

6. In order to raise a mass of 100 kg a man of mass 60 kg fastens a rope to it and passes the rope over a smooth pulley. He climbs the rope with an acceleration 5g/4 relative to the rope. The tension in the rope is : ($g = 10\ m/s^2$)
(1) 1432 N (2) 928 N
(3) 1218 N (4) 642 N

7. A body of mass 1 kg is rotating in a vertical circle of radius 1m. What will be the difference in its kinetic energy at the top and bottom of the circle : ($g = 10\ m/s^2$)
(1) 10 J (2) 20 J
(3) 30 J (4) 50 J

8. Work equal to 25 J is done on a mass of 2 kg to set it in motion. If whole of it is used to increase the kinetic energy then velocity acquired by the mass is :–
(1) 5 m/s (2) 12.5 m/s
(3) 25 m/s (4) 50 m/s

9. A body of mass 5 kg strikes another body of mass 2.5 kg initially at rest. The bodies after collision coalesce and begin to move as a whole with a kinetic energy of 5 J. The kinetic energy of the first body before collision is :–
(1) 7.5 J (2) 5 J
(3) 2.5 J (4) 10 J

10. Two bodies of masses 2kg and 4kg are moving with velocities 2m/s and 10m/s respectively towards each other due to mutual gravitational attraction. What is the velocity of their centre of mass (Bodies are at rest initially) :–
(1) 5.3 m/s (2) 6.4 m/s
(3) Zero (4) 8.1 m/s

11. In an electromagnetic wave the energy density associated with magnetic field will be
(1) $\frac{1}{2}LI^2$ (2) $\frac{B^2}{2\mu_0}$ (3) $\frac{1}{2}\mu_0 B^2$ (4) $\frac{1}{2}\frac{\mu_0}{B^2}$

12. The ratio of the magnetic field at the centre of a current carrying circular wire and the magnetic field at the centre of a square coil made from the same length of wire will be
(1) $\frac{\pi^2}{4\sqrt{2}}$ (2) $\frac{\pi^2}{8\sqrt{2}}$ (3) $\frac{\pi}{2\sqrt{2}}$ (4) $\frac{\pi}{4\sqrt{2}}$

13. The current in the windings of a toroid is 2.0A. There are 400 turns and the mean circumferential length is 40cm. If the inside magnetic field is 1.0T, the relative permeability is near to
(1) 100 (2) 200
(3) 300 (4) 400

**14.** A particle of mass m and charge q moves with a constant velocity v along the positive x direction. It enters a region containing a uniform magnetic field B directed along the negative z direction, extending from x = a to x = b. The minimum value of v required so that the particle can just enter the region x > b is

(1) qb B/m

(2) q(b–a)B/m

(3) qa B/m

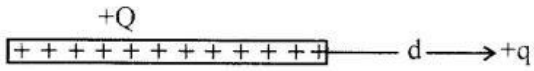
(4) q(b+a)B/2m

**15.** Two identically charged pith balls are suspended from the some point by two massless identical threads density of each ball is ρ. If system is immersed in a medium of density σ, balls remain undeflected, then the dielectric constant of medium is :-

(1) $\frac{\rho}{\rho-\sigma}$ (2) $\frac{\rho-\sigma}{\rho}$

(3) $\frac{\sigma}{\rho-\sigma}$ (4) $\frac{\rho-\sigma}{\sigma}$

**16.** The electrostatic force of interaction between an uniformly charged rod having total charge Q and length L and a point charge q as shown in figure is




(1) $\frac{1}{4\pi\epsilon_0}\frac{qQ}{d(d+L)}$

(2) $\frac{1}{4\pi\epsilon_0}\frac{4qQ}{(2d+L)^2}$

(3) $\frac{1}{4\pi\epsilon_0}\frac{Qq}{d^2}$

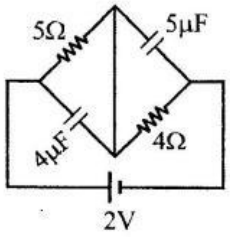
(4) $\frac{1}{4\pi\epsilon_0}\frac{qQ}{(d+L)^2}$

**17.** The maximum value of electric field on the axis of a charged ring having charge Q and radius R is :

(1) $\frac{1}{4\pi\epsilon_0}\frac{Q}{R^2}$ (2) $\frac{1}{4\pi\epsilon_0}\frac{2Q}{3\sqrt{3}R^2}$

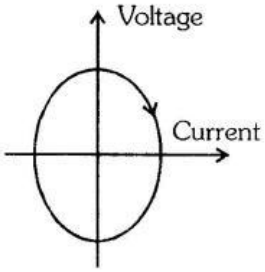
(3) $\frac{1}{4\pi\epsilon_0}\frac{2\sqrt{2}Q}{3R^2}$ (4) $\frac{1}{4\pi\epsilon_0}\frac{Q}{3R^2}$

**18.** Find the ratio of energy stored in 5μF and 4μF capacitor in the given circuit in steady state :-



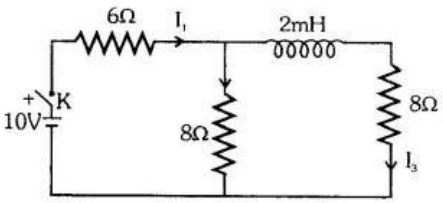

(1) 0.6 (2) 0.7 (3) 0.8 (4) 0.9

**19.** The graph shows current v/s voltage in a series RLC A.C. circuit. The arrow indicates the direction that this curve is drawn as time progresses. In this plot, the




(1) Current lags the voltage by about 90°
(2) Current leads the voltage by about 90°
(3) Current and voltage are in phase
(4) Current and voltage are 180 degree out of phase

**20.** In the circuit shown in figure what is the value of $I_1$ just after pressing the key K ?



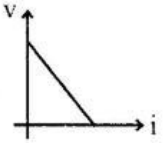

(1) $\frac{5}{7}$ A (2) $\frac{5}{11}$ A

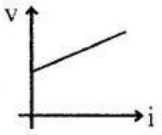
(3) 1A (4) None of the above

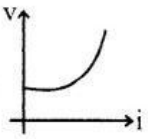
**21.** In a wire of cross section radius r, free electrons travel with drift velocity v when a current I flows through the wire. What is the current in another wire of half the radius and of the same material when the drift velocity is 2v ?

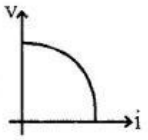
(1) 2 I (2) I (3) I/2 (4) I/4

**22.** if internal resistance of a cell is proportional to current drawn from the cell. Then the best representation of terminal potential difference of a cell with current drawn from cell will be :-

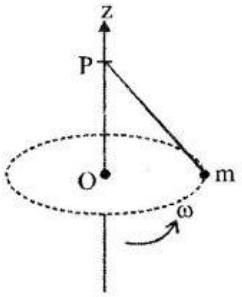
(1) 


(2) 


(3) 


(4) 


**23.** A small mass m is attached to a massless string whose other end is fixed at P as shown in figure. The mass is undergoing circular motion in x-y plane with centre O and constant angular speed ω. If the angular momentum of the system, calculated about O and P and denoted by $\vec{L}_O$ and $\vec{L}_P$ respectively, then:-




(1) $\vec{L}_O$ and $\vec{L}_P$ do not vary with time

(2) $\vec{L}_O$ varies with time while $\vec{L}_P$ remains constant

(3) $\vec{L}_O$ remains constant while $\vec{L}_P$ varies with time.

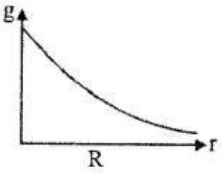
(4) $\vec{L}_O$ and $\vec{L}_P$ both vary with time

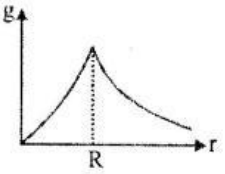
**24.** Two discs of moments of inertia $I_1$ and $I_2$ about their respective axes (normal to the disc and passing through the centre), and rotating with angular speed $\omega_1$ and $\omega_2$ are brought into contact face to face with their axes of rotation coincident. What is the loss in kinetic energy of the system in the process?

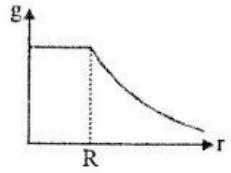
(1) $\frac{I_1 I_2(\omega_1-\omega_2)^2}{2(I_1+I_2)}$ (2) $\frac{I_1 I_2(\omega_1-\omega_2)^2}{(I_1+I_2)}$

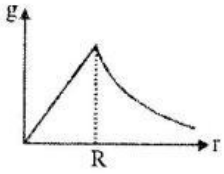
(3) $\frac{I_1 I_2(\omega_1+\omega_2)^2}{(I_1-I_2)}$ (4) $\frac{I_1 I_2(\omega_1+\omega_2)^2}{2(I_1-I_2)}$

**25.** The dependence of acceleration due to gravity g on the distance r from the centre of the earth assumed to be a sphere of radius R of uniform density is as shown figure below:-

(i) 


(ii) 


(iii) 


(iv) 


The correct figure is

(1) (i) (2) (ii)

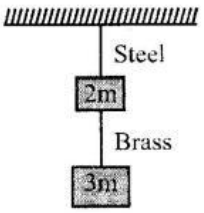
(3) (iii) (4) (iv)

**26.** If $v_e$ is escape velocity and $v_0$ is orbital velocity of satellite for orbit close to the earth's surface. Then these are related by:-

(1) $v_0=\sqrt{2}v_e$ (2) $v_0=v_e$

(3) $v_0=\frac{v_0}{2}$ (4) $v_e=\sqrt{2}v_0$

**27.** If the ratio of diameters, lengths and Young's moduli of steel and brass wires shown in the figure are p, q and r respectively. Then the corresponding ratio of increase in their lengths would be:-




(1) $\frac{3q}{5p^2r}$ (2) $\frac{5q}{3p^2r}$

(3) $\frac{3q}{5pr}$ (4) $\frac{5q}{3pr}$

**28.** The radii of the two columns in U tube are $r_1$ and $r_2$. When a liquid of density $\rho$ (angle of contact is 0°) is filled in it the level difference of liquid in two arms is h. The surface tension of liquid is (g = acceleration due to gravity):-

(1) $\frac{\rho g h r_1 r_2}{2(r_2 - r_1)}$ (2) $\frac{\rho g h (r_1 - r_2)}{2 r_2 r_1}$

(3) $\frac{2(r_2 - r_1)}{\rho g h r_1 r_2}$ (4) $\frac{\rho g h}{2(r_2 - r_1)}$

**29.** Two liquids A and B are at 32°C and 24°C. When mixed in equal masses the temperature of the mixture is found to be 28°C. Their specific heats are in the ratio of

(1) 3 : 2 (2) 2 : 3

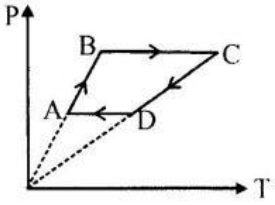
(3) 1 : 1 (4) 4 : 3

**30.** Two containers of equal volume contain the same gas at pressure $P_1$ and $P_2$ and absolute temperature $T_1$ and $T_2$ respectively. On joining the vessles, the gas reaches a common pressure P and common temperature T. The ratio P/T is equal to

(1) $\frac{P_1}{T_1} + \frac{P_2}{T_2}$ (2) $\frac{P_1T_1 + P_2T_2}{(T_1 + T_2)^2}$

(3) $\frac{P_1T_2 + P_2T_1}{(T_1 + T_2)^2}$ (4) $\frac{P_1}{2T_1} + \frac{P_2}{2T_2}$

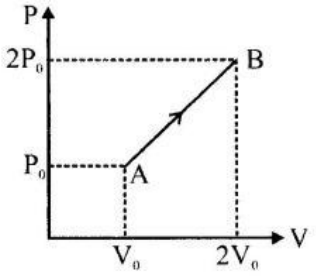
**31.** Six moles of an ideal gas performs a cycle shown in figure. If the temperature are $T_A$ = 600 K, $T_B$ = 800 K, $T_C$ = 2200 K and $T_D$ = 1200 K, the work done per cycle is




(1) 20 kJ (2) 30 kJ

(3) 40 kJ (4) 60 kJ

**32.** The P–V diagram of 2 g of helium gas for a certain process A → B is shown in the figure. What is the heat given to the gas during the process A → B




(1) $4\ P_0V_0$ (2) $6\ P_0V_0$

(3) $4.5\ P_0V_0$ (4) $2\ P_0V_0$

**33.** Two pendulums begins to swing simultaneously. The first pendulum makes 11 full oscillations when the other makes 9. The ratio of length of the two pendulums is :-

(1) 11/9 (2) 9/11

(3) 81/121 (4) 121/84

**34.** A particle performs SHM on x-axis with time period of 0.5 sec, such that it's velocity is zero at x = –3 cm and at x = 9 cm. It was located at x = 0 and moving in negative 'x' at t = 0. The equation of SHM of the particle is :-

(1) $x = -3 + 6 \sin(4\pi t + \pi/6)$

(2) $x = 3 + 6 \sin(4\pi t + 7\pi/6)$

(3) $x = 9 \sin(4\pi t + \pi/6)$

(4) $x = 9 \sin(4\pi t + 7\pi/6)$

**35.** A closed organ pipe and an open organ pipe have their first overtones identical in frequency. Their length are in the ratio :-

(1) 1 : 2 (2) 3 : 4 (3) 4 : 5 (4) 2 : 3

**36.** A wave travelling in the –ve z-direction having displacement along x-direction as 1m, wavelength $\pi$ m and frequency at $\frac{1}{\pi}$ $H_z$ is represented by:-

(1) $x = \sin(2t + 2z)$ (2) $z = \sin(2t + 2x)$

(3) $x = \sin(2\pi t - 2z)$ (4) $z = \sin(2t - 2x)$

**37.** A point object is kept in front of a plane mirror. The plane mirror is doing SHM of amplitude 2cm. The plane mirror moves along the x-axis and x-axis is normal to the mirror. The amplitude of the mirror is such that the object is always infront of the mirror. The amplitude of SHM of the image is:-

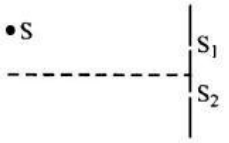
(1) zero (2) 2 cm

(3) 4 cm (4) 1 cm

**38.** A certain prism is found to produce a minimum deviation of 38°. It produces a deviation of 44° when the angle of incidence is either 42° or 62°. What is the angle of incidence when it is undergoing minimum deviation:-

(1) 45° (2) 49° (3) 40° (4) 55°

**39.** In YDSE, the source placed symmetrically with respect to the slit is now moved parallel to the plane of the slits so that it is closer to the upper slit, as shown. Then,




(1) the fringe width will increase and fringe pattern will shift down.

(2) the fringe width will remain same but fringe pattern will shift up.

(3) the fringe width will decrease and fringe pattern will shift down.

(4) the fringe width will remain same but fringe pattern will shift down.

**40.** At two points P and Q on screen in Young's double slit experiment, waves from slits $S_1$ and $S_2$ have a path difference of 0 and $\frac{\lambda}{4}$ respectively. the ratio of intensities at P and Q will be :

(1) 3 : 2 (2) 2 : 1

(3) $\sqrt{2}$ : 1 (4) 4 : 1

**41.** Which of the following support the quantum nature of the EM radiations-

(A) Photoelectric effect (B) Compton effect

(C) Doppler's effect (D) Field effect

(1) A and B (2) B and C

(3) C and D (4) D and A

**42.** Atomic weight of thorium is A = 232 and the atomic number is Z = 90. After disintergation to last element Pb is obtained which has A = 208 and Z = 82. In this process the number of emitted $\alpha$ and $\beta$ partilces are-

(1) 4 and 6 (2) 6 and 4

(3) 3 and 2 (4) 2 and 3

**43.** A 100 watt light source is emitting radiations of wavelength 5000Å. The rate of emission of photons is of the order of :-

(1) $10^{40}$ (2) $10^{20}$

(3) $10^{10}$ (4) $10^{5}$

**44.** A nucleus ${}_ZX^A$ emits an $\alpha$-particle with velocity v. The recoil speed of daughter nucleus is :-

(1) $\frac{A-4}{4v}$ (2) $\frac{4v}{A-4}$

(3) v (4) $\frac{v}{4}$

**45.** The Davisson-Germer experiment is the direct evidence of :-

(1) Particle nature of electron

(2) Wave nature of electron

(3) Wave nature of light

(4) Particle nature of light