



JEE Main Online Exam 2019

Questions & Solutions

10th April 2019 | Shift - II

Physics

Q.1 In the formula $X = 5YZ^2$, X and Z have dimensions of capacitance and magnetic field, respectively. What are the dimensions of Y in SI units?

- (1) $[M^{-3} L^{-2} T^8 A^4]$ (2) $[M^{-2} L^{-2} T^6 A^3]$ (3) $[M^{-1} L^{-2} T^4 A^2]$ (4) $[M^{-2} L^0 T^{-4} A^{-2}]$

Ans. [1]

Sol. $X = 5Y Z^2$

$$X = \text{capacitance} = \frac{Q}{V}$$

$$= \frac{Q^2}{\omega} = \frac{Q^2}{F.L}$$

$$= \frac{A^2 T^2}{M^1 L^1 T^{-2} \times L}$$

$$= A^2 M^{-1} L^{-2} T^4$$

$$= M^{-1} L^{-2} T^4 A^2$$

$$Z = B = \frac{F}{i\ell} = \frac{M^1 L^1 T^{-2}}{A^1 L^1} = M^1 L^0 T^{-2} A^{-1}$$

$$Z^2 = M^2 T^{-4} A^{-2}$$

$$Y = \frac{X}{Z^2} = \frac{M^{-1} L^{-2} T^4 A^2}{M^2 T^{-4} A^{-2}}$$

$$= M^{-3} L^{-2} T^8 A^4$$

Q.2 In free space, a particle A of charge $1\mu\text{C}$ is held fixed at a point P. Another particle B of the same charge and mass $4\mu\text{g}$ is kept at a distance of 1 mm from P. If B is released, then its velocity at a distance of 9 mm from P is :

$$\left[\text{Take } \frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2 \text{C}^{-2} \right]$$

- (1) 1.0 m/s (2) 3.0×10^4 m/s (3) 2.0×10^3 m/s (4) 1.5×10^2 m/s

Ans. [3]

Sol. By conservation of energy

$$\frac{1}{2} mv^2 = kq_1 q_2 \left[\frac{1}{d_1} - \frac{1}{d_2} \right]$$

$$= k \times 10^{-12} \left[1 - \frac{1}{9} \right] \times 10^3$$

$$= 9 \times 10^9 \times 10^{-9} \left[\frac{8}{9} \right] = 8$$

$$\frac{1}{2} mv^2 = 8$$

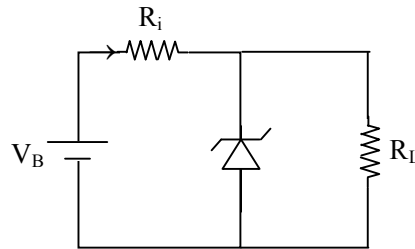
$$v = \sqrt{\frac{16}{m}} = \sqrt{\frac{16}{4 \times 10^{-9}}}$$

$$= 2 \times 10^4 \times \sqrt{10}$$

$$\approx 6 \times 10^4 \text{ m/s}$$

Of mass is considered as $m = 4 \times 10^{-6} \text{ kg}$ then $v = 2 \times 10^3 \text{ m/s}$

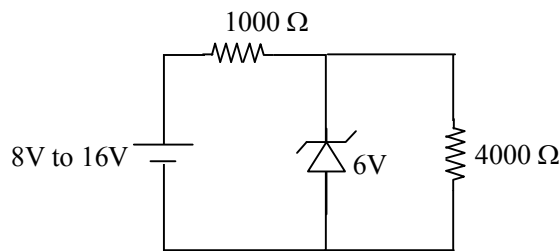
- Q.3** The figure represents a voltage regulator circuit using a Zener diode. The breakdown voltage of the Zener diode is 6 V and the load resistance is, $R_L = 4\text{k}\Omega$. The series resistance of the circuit is $R_i = 1 \text{ k}\Omega$. If the battery voltage V_B varies from 8 V to 16 V, what are the minimum and maximum values of the current through Zener diode?



- (1) 0.5 mA; 8.5 mA (2) 1.5 mA; 8.5 mA (3) 1 mA; 8.5 mA (4) 0.5 mA; 6 mA

Ans. [1]

Sol.



When Battery = 8 V

total current = 2mA

$$I_z = 2 - 1.5 = 0.5 \text{ mA}$$

Battery = 16 V

total current = 10 mA

$$I_z = 10 - 1.5 = 8.5 \text{ mA}$$

\therefore 0.5 mA, 8.5 mA

- Q.4** A bullet of mass 20 g has an initial speed of 1 ms^{-1} , just before it starts penetrating a mud wall of thickness 20 cm. If the wall offers a mean resistance of $2.5 \times 10^{-2} \text{ N}$, the speed of the bullet after emerging from the other side of the wall is close to :

- (1) 0.3 ms^{-1} (2) 0.1 ms^{-1} (3) 0.7 ms^{-1} (4) 0.4 ms^{-1}

Ans. [3]

Sol. $M = 20 \text{ g}$ $u = 1 \text{ m/s}$ $v = ?$

$$v^2 = u^2 + 2as$$

$$s = 20 \times 10^{-2} \text{ m}$$

$$a = -\frac{2.5 \times 10^{-2}}{2 \times 10^{-2}} = -1.25 \text{ m/s}^2$$

$$v^2 = 1 - 2 \times 1.25 \times 0.2$$

$$v^2 = 0.5 = \frac{1}{2}$$

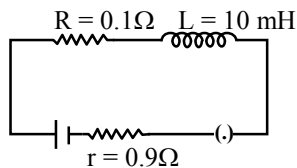
$$v = \frac{1}{\sqrt{2}} = 0.7 \text{ m/s}$$

Q.5 A coil of self inductance 10 mH and resistance 0.1 Ω is connected through a switch to a battery of internal resistance 0.9 Ω . After the switch is closed, the time taken for the current to attain 80% of the saturation value is: [take $\ln 5 = 1.6$]

- (1) 0.324 s (2) 0.002 s (3) 0.103 s (4) 0.016 s

Ans. [4]

Sol.



$$i = i_0 \left[1 - e^{-\frac{Rt}{L}} \right]$$

$$0.8i_0 = i_0 \left[1 - e^{-\frac{Rt}{L}} \right]$$

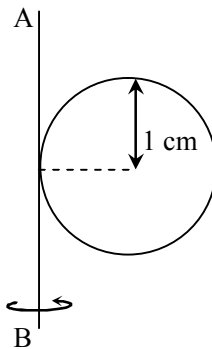
$$e^{-\frac{Rt}{L}} = 0.2 = \frac{1}{5}$$

$$-\frac{Rt}{L} = \ln(5)$$

$$t = \frac{L}{R} \ln(5)$$

$$= 0.016 \text{ sec}$$

Q.6 A metal coin of mass 5 g and radius 1 cm is fixed to a thin stick AB of negligible mass as shown in the figure. The system is initially at rest. The constant torque, that will make the system rotate about AB at 25 rotations per second in 5s, is close to :



- (1) $7.9 \times 10^{-6} \text{ Nm}$ (2) $4.0 \times 10^{-6} \text{ Nm}$ (3) $2.0 \times 10^{-5} \text{ Nm}$ (4) $1.6 \times 10^{-5} \text{ Nm}$

Ans. [3]

Sol. $\alpha = \frac{d\omega}{dt} = 10\pi$

$$\tau = I\alpha$$

$$= \frac{5}{4} (MR^2) \alpha$$

$$= 2 \times 10^{-5} \text{ N-m}$$

Q.7 Space between two concentric conducting spheres of radii a and b ($b > a$) is filled with a medium of resistivity ρ . The resistance between the two spheres will be :

(1) $\frac{\rho}{2\pi} \left(\frac{1}{a} + \frac{1}{b} \right)$ (2) $\frac{\rho}{4\pi} \left(\frac{1}{a} + \frac{1}{b} \right)$ (3) $\frac{\rho}{2\pi} \left(\frac{1}{a} - \frac{1}{b} \right)$ (4) $\frac{\rho}{4\pi} \left(\frac{1}{a} - \frac{1}{b} \right)$

Ans. [4]

Sol. Resistance of spherical shell is $R = \frac{\rho}{4\pi} \left[\frac{b-a}{ab} \right]$

Q.8 One mole of ideal gas passes through a process where pressure and volume obey the relation

$$P = P_0 \left[1 - \frac{1}{2} \left(\frac{V_0}{V} \right)^2 \right].$$
 Here P_0 and V_0 are constants. Calculate the change in the temperature of the gas if its

volume changes from V_0 to $2V_0$

(1) $\frac{3 P_0 V_0}{4 R}$ (2) $\frac{1 P_0 V_0}{2 R}$ (3) $\frac{5 P_0 V_0}{4 R}$ (4) $\frac{1 P_0 V_0}{4 R}$

Ans. [3]

Sol. $P = P_0 \left[1 - 2 \left(\frac{V_0}{V} \right)^2 \right]$

When $V_1 = V_0$ $P_1 = \frac{P_0}{2}$

$V_2 = 2V_0$ $P_2 = \frac{7}{8} P_0$

$$\Delta T = T_2 - T_1 = (P_2 V_2 - V_1 P_1) \frac{1}{nR}$$

$$= \left(\frac{7}{4} - \frac{1}{2} \right) \frac{P_0 V_0}{R}$$

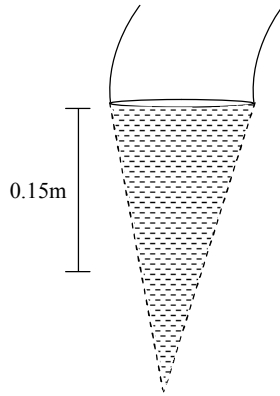
$$= \frac{5 P_0 V_0}{4 R}$$

Q.9 Water from a tap emerges vertically downwards with an initial speed of 1.0 ms^{-1} . The cross-sectional area of the tap is 10^{-4} m^2 . Assume that the pressure is constant throughout the stream of water and that the flow is streamlined. The cross-sectional area of the stream, 0.15 m below the tap would be : (Take $g = 10 \text{ ms}^{-2}$)

(1) $5 \times 10^{-4} \text{ m}^2$ (2) $2 \times 10^{-5} \text{ m}^2$ (3) $5 \times 10^{-5} \text{ m}^2$ (4) $1 \times 10^{-5} \text{ m}^2$

Ans. [3]

Sol.



$$A_1 V_1 = A_2 V_2$$

$$10^{-4} \times 1 = A_2 V_2$$

$$A_2 V_2 = 10^{-4}$$

Bernoulli's theorem

$$\frac{1}{2} \rho (V_1^2 - V_2^2) + \rho gh = 0$$

$$V_2^2 = V_1^2 + 2gh$$

$$V_2 = 2$$

$$\therefore A_2 = \frac{10^{-4}}{2} = 5 \times 10^{-5} \text{ m}^2$$

Q.10 A square loop is carrying a steady current I and the magnitude of its magnetic dipole moment is m . If this square loop is changed to a circular loop and it carries the same current, the magnitude of the magnetic dipole moment of circular loop will be:

(1) $\frac{4m}{\pi}$

(2) $\frac{3m}{\pi}$

(3) $\frac{2m}{\pi}$

(4) $\frac{m}{\pi}$

Ans. [1]

Sol. $m = nIA = 1 \times I \times \pi a^2$

a = side of square

$$\therefore 4a = 2\pi r$$

$$r = \frac{4a}{2\pi} = \frac{2a}{\pi}$$

$$\therefore m' = I \pi \left[\frac{2a}{\pi} \right]^2 \text{ For circular loop}$$

$$m' = \frac{4m}{\pi}$$

Q.11 A submarine experiences a pressure of 5.05×10^6 Pa at a depth of d_1 in a sea. When it goes further to a depth of d_2 , it experiences a pressure of 8.08×10^6 Pa. Then $d_2 - d_1$ is approximately (density of water = 10^3 kg/m³ and acceleration due to gravity = 10 ms⁻²):

(1) 600 m

(2) 400 m

(3) 300 m

(4) 500 m

Ans. [3]

Sol. $P_1 = P_0 + \rho g d_1$
 $P_2 = P_0 + \rho g d_2$
 $\therefore \Delta P = \rho g [d_2 - d_1] = 3.03 \times 10^6$
 $d_2 - d_1 = 303 \text{ m}$
 $= 300 \text{ m}$

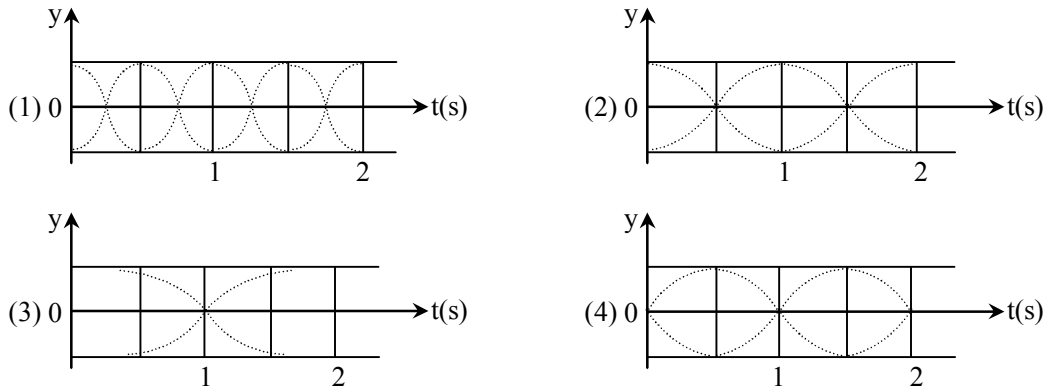
Q.12 Two radioactive substances A and B have decay constants 5λ and λ respectively. At $t = 0$, a sample has the same number of the two nuclei. The time taken for the ratio of the number of nuclei to become $\left(\frac{1}{e}\right)^2$ will be :

- (1) $\frac{2}{\lambda}$ (2) $\frac{1}{4\lambda}$ (3) $\frac{1}{2\lambda}$ (4) $\frac{1}{\lambda}$

Ans. [3]

Sol. $\frac{N_1}{N_2} = \frac{e^{-5\lambda t}}{e^{-\lambda t}} = e^{-4\lambda t} = e^{-2}$
 $\therefore t = \frac{1}{2\lambda}$

Q.13 The correct figure that shows, schematically, the wave pattern produced by superposition of two waves of frequencies 9 Hz and 11 Hz, is :



Ans. [1]

Sol. Beat frequency = 2 Beats/sec

Q.14 In a Young's double slit experiment, the ratio of the slit's width is 4 : 1. The ratio of the intensity of maxima to minima, close to the central fringe on the screen, will be :

- (1) 25 : 9 (2) 4 : 1 (3) $(\sqrt{3} + 1)^4 : 16$ (4) 9 : 1

Ans. [4]

Sol. $I_1 = 4I_0$ $I_2 = I_0$
 $I_{\max} = (\sqrt{I_1} + \sqrt{I_2})^2 = 9I_0$
 $I_{\min} = (\sqrt{I_1} - \sqrt{I_2})^2 = I_0$
 $\therefore \frac{I_{\max}}{I_{\min}} = \frac{9}{1}$

Q.15 A spaceship orbits around a planet at a height of 20 km from its surface. Assuming that only gravitational field of the planet acts on the spaceship, what will be the number of complete revolutions made by the spaceship in 24 hours around the planet?

[Given ; Mass of planet = 8×10^{22} kg, Radius of planet = 2×10^6 m, Gravitational constant $G = 6.67 \times 10^{-11}$ Nm²/kg²]

- (1) 13 (2) 9 (3) 17 (4) 11

Ans. [4]

Sol. $F_g = \frac{mv^2}{r} = \frac{GMm}{r^2}$

$$v = \sqrt{\frac{GM}{r}} = \sqrt{\frac{6.67 \times 10^{-11} \times 8 \times 10^{22}}{2.02 \times 10^6}}$$

$$v = 1.62 \times 10^3$$

$$T = \frac{2\pi r}{v}$$

$$n(T) = 24 \times 60 \times 60$$

$$n = \frac{24 \times 60 \times 60}{T}$$

Put the value of T

$$n = 11$$

Q.16 A source of sound S is moving with a velocity of 50 m/s towards a stationary observer. The observer measures the frequency of the source as 1000 Hz. What will be the apparent frequency of the source when it is moving away from the observer after crossing him? (Take velocity of sound in air is 350 m/s)

- (1) 750 Hz (2) 857 Hz (3) 807 Hz (4) 1143 Hz

Ans. [1]

Sol.



$$F' = \left(\frac{V - 0}{V - 50} \right) F_{\text{source}}$$

$$\therefore F_{\text{source}} = \frac{1000 \times 300}{350}$$

$$\text{Now if source moves away from observer } f'' = \left(\frac{V}{V + 50} \right) \cdot F_{\text{source}}$$

$$= \frac{300}{350} \times \frac{350}{400} \times 1000$$

$$= 750 \text{ Hz}$$

Q.17 In Li^{++} , electron in first Bohr orbit is excited to a level by a radiation of wavelength λ . When the ion gets deexcited to the ground state in all possible ways (including intermediate emissions), a total of six spectral lines are observed. What is the value of λ ?

(Given : $h = 6.63 \times 10^{-34}$ Js; $c = 3 \times 10^8$ ms⁻¹)

- (1) 12.3 nm (2) 10.8 nm (3) 9.4 nm (4) 11.4 nm

Ans. [2]

Sol. $\Delta E = \frac{hc}{\lambda} = 13.6 \times 9 - 0.85 \times 9$

$$\lambda = \frac{1237}{9 \times 12.75} \text{ nm}$$

$$\approx 10.8 \text{ nm}$$

Q.18 A solid sphere of mass M and radius R is divided into two unequal parts. The first part has a mass of $\frac{7M}{8}$ and is converted into a uniform disc of radius $2R$. The second part is converted into a uniform solid sphere. Let I_1 be the moment of inertia of the disc about its axis and I_2 be the moment of inertia of the new sphere about its axis. The ratio I_1/I_2 is given by:

- (1) 65 (2) 140 (3) 185 (4) 285

Ans. [2]

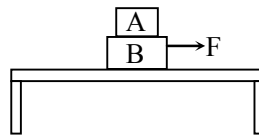
Sol. $I_1 = \frac{\left(\frac{7M}{8}\right)(2R)^2}{2} = \frac{7}{4}MR^2$

$$I_2 = \frac{2}{5}\left(\frac{M}{8}\right)R_1^2 = \frac{MR_1^2}{80}$$

$$R = 2R_1$$

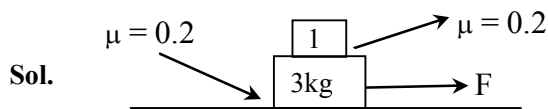
$$\frac{I_1}{I_2} = \frac{7}{4} \times 80 = 140$$

Q.19 Two blocks A and B of masses $m_A = 1 \text{ kg}$ and $m_B = 3 \text{ kg}$ are kept on the table as shown in figure. the coefficient of friction between A and B is 0.2 and between B and the surface of the table is also 0.2. The maximum force F that can be applied on B horizontally, so that the block A does not slide over the block B is : [Take $g = 10 \text{ m/s}^2$]



- (1) 8 N (2) 40 N (3) 16 N (4) 12 N

Ans. [3]



$$a_{\text{max}} = \mu g = 2$$

$$F - 8 = 4 \times 2$$

$$F = 16 \text{ N}$$

Q.20 Light is incident normally on a completely absorbing surface with an energy flux of 25 W cm^{-2} . If the surface has an area of 25 cm^2 , the momentum transferred to the surface in 40 min time duration will be :

- (1) $6.3 \times 10^{-4} \text{ Ns}$ (2) $5.0 \times 10^{-3} \text{ Ns}$ (3) $1.4 \times 10^{-6} \text{ Ns}$ (4) $3.5 \times 10^{-6} \text{ Ns}$

Ans. [2]

Sol. Pressure = $\frac{I}{C}$ where I = Intensity

$$\therefore \frac{F}{A} = \frac{I}{C}$$

$$F = \frac{IA}{C} = \frac{\Delta P}{\Delta t}$$

$$\Delta P = \frac{I}{C} A \Delta t$$

$$= \frac{25 \times 10^4}{3 \times 10^8} \times 25 \times 10^{-4} \times 40 \times 60$$

$$= 5 \times 10^{-3} \text{ N s}$$

Q.21 The magnitude of the magnetic field at the centre of an equilateral triangular loop of side 1 m which is carrying a current of 10 A is : [Take $\mu_0 = 4\pi \times 10^{-7} \text{ NA}^{-2}$]

- (1) $3 \mu\text{T}$ (2) $18 \mu\text{T}$ (3) $9 \mu\text{T}$ (4) $1 \mu\text{T}$

Ans. [2]

Sol. $B = \frac{3\mu_0 i}{\pi a} \sin \frac{\pi}{3} \tan \frac{\pi}{3}$

$$= \frac{9\mu_0 i}{2\pi a}$$

$$= \frac{9 \times 4\pi \times 10^{-7} \times 10}{2\pi \times 1}$$

$$= 18 \times 10^{-6} \text{ T}$$

Q.22 The time dependence of the position of a particle of mass $m = 2$ is given by $\vec{r}(t) = 2t\hat{i} - 3t^2\hat{j}$. Its angular momentum, with respect to the origin, at time $t = 2$ is

- (1) $36 \hat{k}$ (2) $-48 \hat{k}$ (3) $-34 (\hat{k} - \hat{i})$ (4) $48 (\hat{i} + s \hat{j})$

Ans. [2]

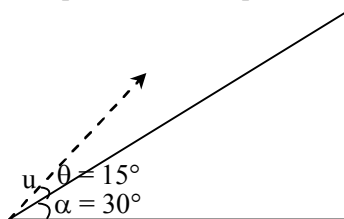
Sol. $\vec{L} = m \vec{v} \times \vec{r} \sin\theta \hat{n} = m(\hat{r} \times \vec{v})$

$$\vec{v} = \frac{d\vec{r}}{dt} = 2\hat{i} - 12\hat{j}$$

$$\vec{r} \times \vec{v} = -24 \hat{k}$$

$$\therefore \vec{L} = -48 \hat{k}$$

Q.23 A plane is inclined at an angle $\alpha = 30^\circ$ with respect to the horizontal. A particle is projected with a speed $u = 2 \text{ ms}^{-1}$, from the base of the plane, making an angle $\theta = 15^\circ$ with respect to the plane as shown in the figure. the distance from the base, at which the particle hits the plane is close to : (Take $g = 10 \text{ ms}^{-2}$)



- (1) 14 cm (2) 18 cm (3) 20 cm (4) 26 cm

Ans. [3]

Sol. $T = \frac{u \sin 15^\circ}{g \cos 30}$

$$S = t(2 \cos 15) - \frac{g \sin 30 t^2}{2}$$

$$S = 20 \text{ cm}$$

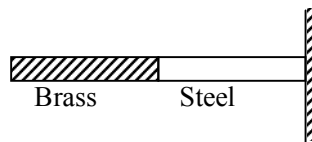
Q.24 In an experiment, brass and steel wires of length 1 m each with areas of cross section 1 mm^2 are used. The wires are connected in series and one end of the combined wire is connected to a rigid support and other end is subjected to elongation. The stress required to produce a net elongation of 0.2 mm is,

[Given, the Young's Modulus for steel and brass are, respectively, $120 \times 10^9 \text{ N/m}^2$ and $60 \times 10^9 \text{ N/m}^2$]

- (1) $4.0 \times 10^6 \text{ N/m}^2$ (2) $1.2 \times 10^6 \text{ N/m}^2$ (3) $1.8 \times 10^6 \text{ N/m}^2$ (4) $0.2 \times 10^6 \text{ N/m}^2$

Ans. [Bonus]

Sol.



$$k_1 = \frac{Y_1 A_1}{\ell_1} = \frac{120 \times 10^9 A}{\ell}$$

$$k_2 = 60 \times 10^9 \frac{A}{\ell}$$

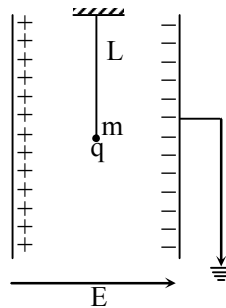
$$k_{\text{eq}} = \frac{k_1 k_2}{k_1 + k_2}$$

$$F = k_{\text{eq}}(x)$$

$$\frac{F}{A} = \frac{k_{\text{eq}}}{A}(x) = 8 \times 10^6$$

Solution gives this answer which is not matching with any option

Q.25 A simple pendulum of length L is placed between the plates of a parallel plate capacitor having electric field E , as shown in figure. Its bob has mass m and charge q . The time period of the pendulum is given by :



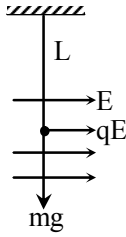
(1) $2\pi \sqrt{\frac{L}{\sqrt{g^2 - \frac{q^2 E^2}{m^2}}}}$

(2) $2\pi \sqrt{\frac{L}{\left(g + \frac{qE}{m}\right)}}$

(3) $2\pi \sqrt{\frac{L}{\left(g - \frac{qE}{m}\right)}}$

(4) $2\pi \sqrt{\frac{L}{\sqrt{g^2 + \left(\frac{qE}{m}\right)^2}}}$

Ans. [4]

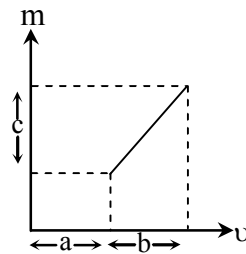
Sol.


$$T = 2\pi \sqrt{\frac{L}{a_{\text{eff}}}}$$

$$a_{\text{eff}} = \frac{\sqrt{(mg)^2 + (qE)^2}}{m}$$

$$\therefore T = 2\pi \sqrt{\frac{L}{g^2 + \left(\frac{qE}{m}\right)^2}}$$

Q.26 The graph shows how the magnification m produced by a thin lens varies with image distance v . What is the focal length of the lens used?



(1) $\frac{b^2 c}{a}$

(2) $\frac{b}{c}$

(3) $\frac{b^2}{ac}$

(4) $\frac{a}{c}$

Ans. [2]

Sol. $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$$1 - m = \frac{v}{f}$$

$$m = 1 - \frac{v}{f}$$

$$v = a, m = 1 - \frac{a}{f}$$

$$\text{at } v = a + b, m = 1 - \frac{a + b}{f}$$

$$m_2 - m_1 = c = \frac{b}{f}$$

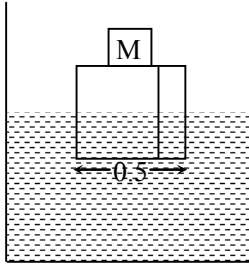
$$\therefore f = \frac{b}{c}$$

Q.27 A cubical block of side 0.5 m floats on water with 30% of its volume under water. What is the maximum weight that can be put on the block without fully submerging it under water? [Take, density of water = 10^3 kg/m^3]

- (1) 30.1 kg (2) 87.5 kg (3) 65.4 kg (4) 46.3 kg

Ans. [2]

Sol.



$$M = \rho_w [0.5 \times 0.5 \times 0.35]$$

$$M = 87.5 \text{ kg}$$

Q.28 A 2 mW laser operates at wavelength of 500 nm. The number of photons that will be emitted per second is :
[Given Planck's constant $h = 6.6 \times 10^{-34} \text{ Js}$, speed of light $c = 3.0 \times 10^8 \text{ m/s}$]

- (1) 5×10^{15} (2) 1.5×10^{16} (3) 1×10^{16} (4) 2×10^{16}

Ans. [1]

Sol.
$$p = \frac{nhc}{\lambda}$$

$$n = \frac{p\lambda}{hc} = \frac{2 \times 10^{-3} \times 5 \times 10^{-7}}{2 \times 10^{-25}}$$
$$\approx 5 \times 10^{15}$$

Q.29 When heat Q is supplied to a diatomic gas of rigid molecules, at constant volume its temperature increases by ΔT . the heat required to produce the same change in temperature, at a constant pressure is :

- (1) $\frac{7}{5}Q$ (2) $\frac{3}{2}Q$ (3) $\frac{2}{3}Q$ (4) $\frac{5}{3}Q$

Ans. [1]

Sol. $Q = mC_v dT$

$$Q^1 = nC_p dT$$

$$\frac{Q^1}{Q} = \frac{C_p}{C_v} = \gamma = \frac{7}{5}$$

Q.30 The elastic limit of brass is 379 MPa. What should be the minimum diameter of a brass rod if it is to support a 400 N load without exceeding its elastic limit?

- (1) 1.16 mm (2) 1.36 mm (3) 1.00 mm (4) 0.90 mm

Ans. [1]

Sol.
$$\text{Stress} = \frac{F}{A} = \frac{400 \times 4}{\pi d^2} = 379 \times 10^6$$

$$d = \sqrt{1.34} \times 10^{-3}$$
$$\approx 1.1 \times 10^{-3}$$