AIPMT – 2014 TEST PAPER WITH SOLUTIONS
(HELD ON SUNDAY 04th MAY, 2014)

1. If force (F), velocity (V) and time (T) are taken as fundamental units, then the dimensions of mass are:-

(1) $[F\ V\ T^{-1}]$ (2) $[F\ V\ T^{-2}]$

(3) $[F\ V^{-1}\ T^{-1}]$ (4) $[F\ V^{-1}\ T]$

Ans. (4)

Sol. $[\text{mass}] = \left[\frac{\text{Force}}{\text{Acceleration}}\right] = \left[\frac{\text{Force}}{\text{Velocity / time}}\right]$

$= [F\ V^{-1}\ T]$

2. A projectile is fired from the surface of the earth with a velocity of 5 ms^{-1} and angle θ with the horizontal. Another projectile fired from another planet with a velocity of 3 ms^{-1} at the same angle follows a trajectory which is identical with the trajectory of the projectile fired from the earth. The value of the acceleration due to gravity on the planet is (in ms^{-2}) given $g = 9.8\ m/s^2$

(1) 3.5 (2) 5.9 (3) 16.3 (4) 110.8

Ans. (1)

Sol. As Range $= \frac{u^2 \sin 2\theta}{g}$ so $g \propto u^2$

Therefore $g_{planet} = \left(\frac{3}{5}\right)^2 (9.8\ m/s^2) = 3.5\ m/s^2$

3. A particle is moving such that its position coordinate (x, y) are

(2m, 3m) at time t = 0

(6m, 7m) at time t = 2 s and

(13m, 14m) at time t = 5s.

Average velocity vector $(\vec{V}_{av})$ from t = 0 to t = 5 s is :-

(1) $\frac{1}{5}(13\hat{i}+14\hat{j})$ (2) $\frac{7}{3}(\hat{i}+\hat{j})$

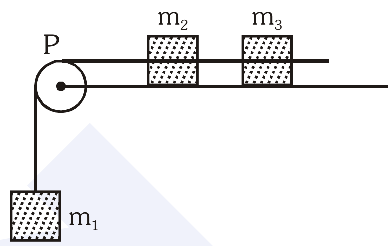
(3) $2(\hat{i}+\hat{j})$ (4) $\frac{11}{5}(\hat{i}+\hat{j})$

Ans. (4)

Sol. $\vec{v}_{av} = \frac{\Delta\vec{r}}{\Delta t} = \frac{(13-2)\hat{i}+(14-3)\hat{j}}{5-0} = \frac{11}{5}(\hat{i}+\hat{j})$

4. A system consists of three masses m_1, m_2 and m_3 connected by a string passing over a pulley P. The mass m_1 hangs freely and m_2 and m_3 are on a rough horizontal table (the coefficient of friction = μ). The pulley is frictionless and of negligible mass. The downward acceleration of mass m_1 is :

(Assume $m_1 = m_2 = m_3 = m$)



(1) $\frac{g(1-g\mu)}{9}$ (2) $\frac{2g\mu}{3}$

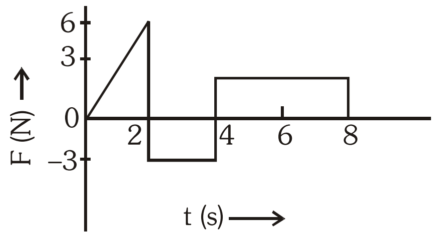
(3) $\frac{g(1-2\mu)}{3}$ (4) $\frac{g(1-2\mu)}{2}$

Ans. (3)

Sol. Acceleration $= \frac{\text{Net force in the direction of motion}}{\text{Total mass of system}}$

$= \frac{m_1 g - \mu(m_2+m_3)g}{m_1+m_2+m_3} = \frac{g}{3}(1-2\mu)$

5. The force 'F' acting on a particle of mass 'm' is indicated by the force-time graph shown below. The change in momentum of the particle over the time interval from zero to 8 s is :-



(1) 24 Ns (2) 20 Ns (3) 12 Ns (4) 6 Ns

Ans. (3)

Sol. Change in momentum,

$\Delta p = \int F dt$

= Area of F-t graph

$= \frac{1}{2} \times 2 \times 6 - 3 \times 2 + 4 \times 3$

= 12 N-s

6. A balloon with mass 'm' is descending down with an acceleration 'a' (where a < g). How much mass should be removed from it so that it starts moving up with an acceleration 'a' ?

(1) $\frac{2ma}{g+a}$ (2) $\frac{2ma}{g-a}$

(3) $\frac{ma}{g+a}$ (4) $\frac{ma}{g-a}$

Ans. (1)

Sol. Let upthrust of air be F_a then

for downward motion

$mg - F_a = ma$

for upward motion

$F_a - (m - \Delta m) = (m - \Delta m)a$

Therefore $\Delta m = \frac{2ma}{g+a}$

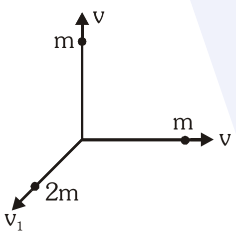
7. A body of mass (4m) is lying in x-y plane at rest. It suddenly explodes into three pieces. Two pieces, each of mass (m) move perpendicular to each other with equal speeds (v). The total kinetic energy generated due to explosion is :-

(1) mv^2 (2) $\frac{3}{2}mv^2$

(3) $2\ mv^2$ (4) $4\ mv^2$

Ans. (2)

Sol.



By conservation of linear momentum

$$2mv_1 = \sqrt{2}\,mv \Rightarrow v_1 = \frac{v}{\sqrt{2}}$$

$$\text{Total KE generated} = \frac{1}{2}mv^2 + \frac{1}{2}mv^2 + \frac{1}{2}(2m)v_1^2$$

$$= mv^2 + \frac{mv^2}{2} = \frac{3}{2}mv^2$$

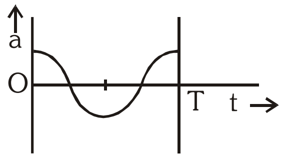
8. The oscillation of a body on a smooth horizontal surface is represented by the equation,

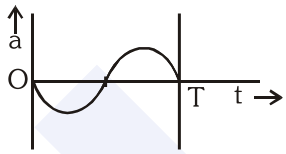
$X = A\cos(\omega t)$

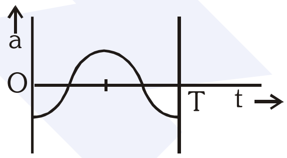
where X = displacement at time t

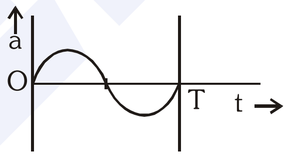
ω = frequency of oscillation

Which one of the following graphs shows correctly the variation 'a' with 't' ?

(1) 

(2) 

(3) 

(4) 

Ans. (3)

Sol. Displacement, $x = A\cos(\omega t)$

Velocity, $v = \frac{dx}{dt} = -A\omega\sin(\omega t)$

Acceleration, $a = \frac{dv}{dt} = -A\omega^2\cos(\omega t)$

9. A solid cylinder of mass 50 kg and radius 0.5 m is free to rotate about the horizontal axis. A massless string is wound round the cylinder with one end attached to it and other hanging freely. Tension in the string required to produce an angular acceleration of 2 revolutions s^{-2} is :-

(1) 25 N (2) 50 N (3) 78.5 N (4) 157 N

Ans. (4)

Sol. Here α = 2 revolutions/s^2 = 4π rad/s^2

$$I = \frac{1}{2}MR^2 = \frac{1}{2}(50)(0.5)^2 = \frac{25}{4}\ \text{Kg-m}^2$$

As $\tau = I\alpha$ so $TR = I\alpha$

$$\Rightarrow T = \frac{I\alpha}{R} = \frac{\left(\frac{25}{4}\right)(4\pi)}{(0.5)}N = 50\pi N = 157\ N$$

10. The ratio of the accelerations for a soldi sphere (mass 'm' and radius 'R') rolling down an incline of angle 'θ' without slipping and slipping down the incline without rolling is :-

(1) 5 : 7 (2) 2 : 3

(3) 2 : 5 (4) 7 : 5

Ans. **(1)**

Sol. For rolling motion without slipping on inclined plane

$$a_1 = \frac{g\sin\theta}{1+\frac{K^2}{R^2}}$$

and for slipping motion on inclined plane

$a_2 = g\sin\theta$

$$\text{Required ratio} = \frac{a_1}{a_2} = \frac{1}{1+\frac{K^2}{R^2}} = \frac{1}{1+\frac{2}{5}} = \frac{5}{7}$$

11. A black hole is an object whose gravitational field is so strong that even light cannot escape from it. To what approximate radius would earth (mass = 5.98×10^{24} kg) have to be compressed to be a black hole ?

(1) 10^{-9} m (2) 10^{-6} m

(3) 10^{-2} m (4) 100 m

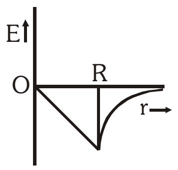
Ans. **(3)**

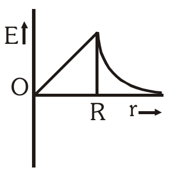
Sol. Escape velocity = $\sqrt{\frac{2GM}{R}}$ = c = speed of light

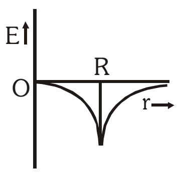
$$\Rightarrow R = \frac{2GM}{c^2} = \frac{2\times 6.6\times 10^{-11}\times 5.98\times 10^{24}}{(3\times 10^8)^2}\text{m}$$

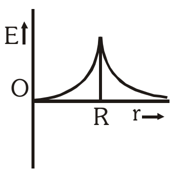
$= 10^{-2}$ m

12. Dependence of intensity of gravitational field (E) of earth with distance (r) from centre of earth is correctly represented by :-

(1) 

(2) 

(3) 

(4) 

Ans. **(1)**

13. Copper of fixed volume 'V; is drawn into wire of length 'l'. When this wire is subjected to a constant force 'F', the extension produced in the wire is 'Δl'. Which of the following graphs is a straight line ?

(1) Δl versus $\frac{1}{l}$ (2) Δl versus l^2

(3) Δl versus $\frac{1}{l^2}$ (4) Δl versus l

Ans. **(2)**

Sol. $Y = \dfrac{\frac{F}{A}}{\frac{\Delta\ell}{\ell}} \Rightarrow \Delta\ell = \dfrac{F\ell}{AY}$

But $V = A\ell$ so $A = \dfrac{V}{\ell}$

Therefore $\Delta\ell = \dfrac{F\ell^2}{VY} \propto \ell^2$

14. A certain number of sphereical 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 :

(1) energy = $4VT\left(\frac{1}{r}-\frac{1}{R}\right)$ is released

(2) energy = $3VT\left(\frac{1}{r}+\frac{1}{R}\right)$ is absorbed

(3) energy = $3VT\left(\frac{1}{r}-\frac{1}{R}\right)$ is released

(4) Energy is neither released nor absorbed

Ans. **(3)**

Sol. As surface area decreases so energy is released.

Released energy

$= 4\pi R^2T[n^{1/3}-1]$ where $R = n^{1/3}r$

$= 4\pi R^3T\left[\frac{1}{r}-\frac{1}{R}\right]$

$= 3VT\left[\frac{1}{r}-\frac{1}{R}\right]$

15. Steam at 100°C is passed into 20 g of water at 10°C. When water acquires a temperature of 80°C, the mass of water present will be :
[Take specific heat of water = 1 cal g^{-1} $°C^{-1}$ and latent heat of steam = 540 cal g^{-1}]

(1) 24 g (2) 31.5 g
(3) 42.5 g (4) 22.5 g

Ans. (4)

Sol. Heat lost = Heat gained

$mL_v + ms_w\Delta\theta = m_W s_W \Delta\theta$

$\Rightarrow m \times 540 + m \times 1 \times (100 - 80)$

$= 20 \times 1 \times (80 - 10)$

$\Rightarrow m = 2.5$ g

Total mass of water = (20 + 2.5)g = 22.5g

16. Certain quantity of water cools from 70°C to 60°C in the first 5 minutes and to 54°C in the next 5 minutes. The temperature of the surroundings is:-

(1) 45°C (2) 20°C (3) 42°C (4) 10°C

Ans. (1)

Sol. By Newton's law of colling

$$\frac{\theta_1 - \theta_2}{t} = k\left[\frac{\theta_1 + \theta_2}{2} - \theta_0\right]$$

$$\Rightarrow \frac{70-60}{5} = k\left[\frac{70+60}{2} - \theta_0\right]$$

$\Rightarrow 2 = k[65 - \theta_0]$ .... (i)

and $$\frac{60-54}{5} = k\left[\frac{60+54}{2} - \theta_0\right]$$

$\Rightarrow \frac{6}{5} = k[57 - \theta_0]$ .... (ii)

By dividing (i) by (ii) we have

$$\frac{10}{5} = \frac{65-\theta_0}{37-\theta_0} \quad \Rightarrow \theta_0 = 45°$$

17. A monoatomic gas at a pressure P, having a volume V expands isothermally to a volume 2V and then adibatically to a volume 16V. The final pressure of the gas is : (take $\gamma = \frac{5}{3}$)

(1) 64P (2) 32P
(3) $\frac{P}{64}$ (4) 16P

Ans. (3)

Sol. For isothermal process $P_1V_1 = P_2V_2$

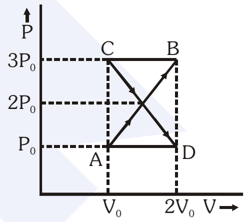
$\Rightarrow PV = P_2(2V) \Rightarrow P_2 = \frac{P}{2}$

For adiabatic process $P_2V_2^\gamma = P_3V_3^\gamma$

$$\Rightarrow \left(\frac{P}{2}\right)(2v)^\gamma = P_3(16v)^\gamma$$

$$\Rightarrow P_3 = \frac{3}{2}\left(\frac{1}{8}\right)^{5/3} = \frac{P}{64}$$

18. A thermodynamic system undergoes cyclic process ABCDA as shown in fig. The work done by the system in the cycle is :-



(1) P_0V_0 (2) $2P_0V_0$
(3) $\frac{P_0V_0}{2}$ (4) Zero

Ans. (4)

Sol. Work done by the system in the cycle
= Area under P–V curve & V-axis

$$= \frac{1}{2}(2P_0 - P_0)(2V_0 - V_0) +$$

$$\left[-\left(\frac{1}{2}\right)(3P_0 - 2P_0)(2V_0 - V_0)\right]$$

$$= \frac{P_0V_0}{2} - \frac{P_0V_0}{2} = 0$$

19. The mean free path of molecules of a gas, (radius 'r') is inversely proportional to :-

(1) r^3 (2) r^2 (3) r (4) $\sqrt{r}$

Ans. (2)

Sol. Mean free path $\lambda_m = \frac{1}{\sqrt{2}\pi d^2 n}$

where d = diameter of molecule

$\Rightarrow \lambda_m \propto \frac{1}{r^2}$

20. If n_1, n_2 and n_3 are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency n of the string is given by :-

(1) $\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$

(2) $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{n_1}} + \frac{1}{\sqrt{n_2}} + \frac{1}{\sqrt{n_3}}$

(3) $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$

(3) $n = n_1 + n_2 + n_3$

Ans. (1)

Sol. Total length of string $\ell = \ell_1 + \ell_2 + \ell_3$

But frequency $\propto \frac{1}{\text{length}}$

so $\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$

21. The number of possible natural oscillation of air column in a pipe closed at one end of length 85 cm whose frequencies lie below 1250 Hz are : (velocity of sound = 340 ms^{-1})

(1) 4 (2) 5 (3) 7 (4) 6

Ans. (4)

Sol. Frequency COP, $f_n = (2n + 1)\frac{v}{4R}$

for $n = 0$, $f_0 = 100$ Hz
$n = 1$, $f_1 = 300$ Hz
$n = 2$, $f_2 = 500$ Hz
$n = 3$, $f_3 = 700$ Hz
$n = 4$, $f_4 = 900$ Hz
$n = 5$, $f_5 = 1100$ Hz

Which are less than 1250 Hz.

22. A speeding motorcyclist sees trafic jam ahead of him. He slows down to 36 km/hour. He finds that traffic has eased and a car moving ahead of him at 18 km/hour is honking at a frequency of 1392 Hz. If the speeds of sound is 343 m/s, the frequency of the honk as heard by him will be :-

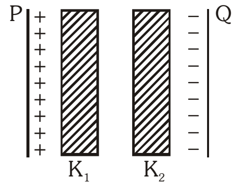
(1) 1332 Hz (2) 1372 Hz
(3) 1412 Hz (4) 1464 Hz

Ans. (3)

Sol. Apparent frequency

$$n' = n\left(\frac{v + v_0}{v + v_3}\right) = 1392\left(\frac{343+10}{343+5}\right) = 1412 \text{ Hz.}$$

23. Two thin dielectric slabs of dielectric constants K_1 and K_2 ($K_1 < K_2$) are inserted between plates of a parallel plate capacitor, as shown in the figure. The variation of electric field 'E' between the plates with distance 'd' as measured from plate P is correctly shown by :-



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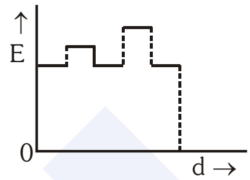

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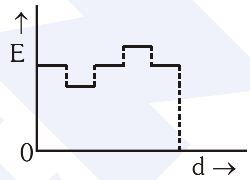

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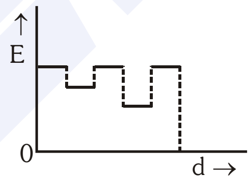

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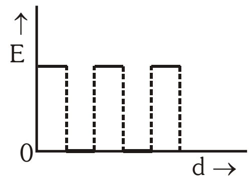


Ans. (3)

Sol. Electric field, $E \propto \frac{1}{K}$

As $K_1 < K_2$ so $E_1 > E_2$

24. A conducting sphere of radius R is given a charge Q. The electric potential and the electric field at the centre of the sphere respectively are :-

(1) Zero and $\frac{Q}{4\pi \epsilon_0 R^2}$

(2) $\frac{Q}{4\pi \epsilon_0 R}$ and Zero

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

(4) Both are zero

Ans. (2)

Sol. At centre, $E = 0$ & $V = \frac{Q}{4\pi \epsilon_0 R}$

25. In a region, the potential is represented by V(x, y, z) = 6x – 8xy – 8y + 6yz, where V is in volts and x, y, z are in metres. The electric force experienced by a charge of 2 coulomb situated at point (1, 1, 1) is :-

(1) $6\sqrt{5}$ N (2) 30 N

(3) 24 N (4) $4\sqrt{35}$ N

Ans. (4)

Sol. $\vec{E} = -\frac{\partial V}{\partial x}\hat{i} - \frac{\partial V}{\partial y}\hat{j} - \frac{\partial V}{\partial z}\hat{k}$

$= -[(6 - 8y)\hat{i} + (-8x - 8 + 6z)\hat{j} + (6y)\hat{k}]$

At (1, 1, 1), $\vec{E} = 2\hat{i} + 10\hat{j} - 6\hat{k}$

$\Rightarrow (\vec{E}) = \sqrt{2^2 + 10^2 + 6^2} = \sqrt{140} = 2\sqrt{35}$

26. Two cities are 150 km apart. Electric power is sent from one city to another city through copper wires. The fall of potential per km is 8 volt and the average resistance per km is 0.5 Ω. the power loss in the wires is :-

(1) 19.2 W (2) 19.2 kW

(3) 19.2 J (4) 12.2 kW

Ans. (2)

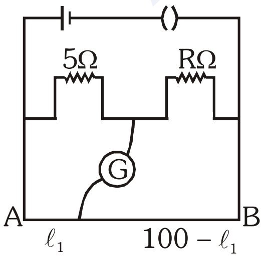
Sol. Resistance = (0.5Ω/km) (150 km) = 75Ω

Total voltage drop = (8 V/km) (150 km) = 1200V

Power loss = $\frac{(\Delta V)^2}{R} = \frac{(1200)^2}{75}$W

= 19200 W = 19.2 kW

27. The resistance in the two arms of the meter bridge are 5Ω and RΩ, respectively. When the resistance R is shunted with an equal resistance, the new balance point is at 1.6 ℓ_1. The resistance 'R' is :-



(1) 10Ω (2) 15Ω (3) 20Ω (4) 25Ω

Ans. (2)

Sol. $\frac{5}{R} = \frac{\ell_1}{100 - \ell_1}$ and $\frac{5}{R/2} = \frac{1.6\ell_1}{100 - 1.6\ell_1}$

$\Rightarrow$ R = 15Ω

28. A potentiometer circuit has been set up for finding the internal resistance of a given cell. The main battery used across the potentiometer wire, has an emf of 2.0 V and a negligible internal resistance. The potentiometer wire itself is 4m long, When the resistace R, connected across the given cell, has values of.

(i) infinity (ii) 9.5Ω

The balancing lengths', on the potentiometer wire are found to be 3 m and 2.85 m, respectively. The value of internal resistance of the cell is

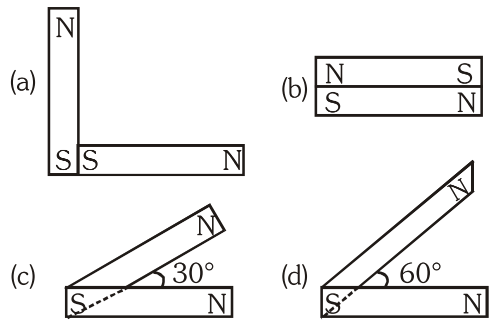
(1) 0.25Ω (2) 0.95Ω (3) 0.5Ω (4) 0.75Ω

Ans. (3)

Sol. Internal resistance, r = $\left(\frac{E - V}{V}\right)R = \left(\frac{\ell_1 - \ell_2}{\ell_2}\right)R$

$= \left(\frac{3 - 2.85}{2.85}\right)(9.5)\Omega = 0.5\Omega$

29. Following figures show the arrangement of bar magnets in different configurations. Each magnet has magnetic dipole moment $\vec{m}$. Which configuration has highest net magnetic diple moment ?



(1) (a) (2) (b) (3) (c) (4) (d)

Ans. (3)

Sol. Net magnetic moment = 2 Mcos$\frac{\theta}{2}$

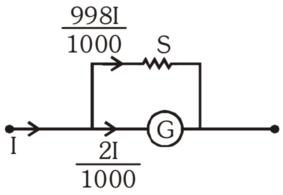
which is maximumfor option (3)

30. In an ammeter 0.2% of main current passes through the galvanometer. If resistance of galvanometer is G, the resistance of ammeter will be :-

(1) $\frac{1}{499}$G (2) $\frac{499}{500}$G (3) $\frac{1}{500}$G (4) $\frac{500}{499}$G

Ans. (3)

Sol.



$$\left(\frac{2I}{1000}\right)G = \left(\frac{998I}{1000}\right)S$$

$$\Rightarrow \; S = \frac{G}{499}$$

Total resistance of Ammeter

$$R = \frac{SG}{S+G} = \frac{\left(\frac{G}{499}\right)F}{\left(\frac{G}{499}\right)+G} = \frac{G}{500}$$

31. Two identical long conducting wires AOB and COD are placed at right angle to each other, with one above other such that 'O' is their common point for the two. The wires carry I_1 and I_2 currents respectively. Point 'P' is lying at distance 'd' from 'O' along a direction perpendicular to the plane containing the wires. The magnetic field at the point 'P' will be :-

(1) $\frac{\mu_0}{2\pi d}\left(\frac{I_1}{I_2}\right)$ (2) $\frac{\mu_0}{2\pi d}(I_1 + I_2)$

(3) $\frac{\mu_0}{2\pi d}(I_1^2 - I_2^2)$ (4) $\frac{\mu_0}{2\pi d}(I_1^2 + I_2^2)^{1/2}$

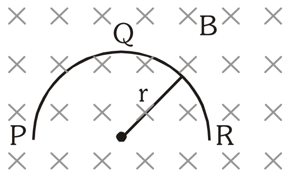
Ans. (4)

Sol. Net magnetic field, $B = \sqrt{B_1^2 + B_2^2}$

$$= \sqrt{\left(\frac{\mu_0 I_1}{2\pi d}\right)^2 + \left(\frac{\mu_0 I_2}{2\pi d}\right)^2}$$

$$= \frac{\mu_0}{2\pi d}\sqrt{I_1^2 + I_2^2}$$

32. A thin semicircular conducting ring (PQR) of radius 'r' is falling with its plane vertical in a horizontal magnetic field B, as shown in figure. The potential difference developed across the ring when its speed is v, is :-



(1) Zero

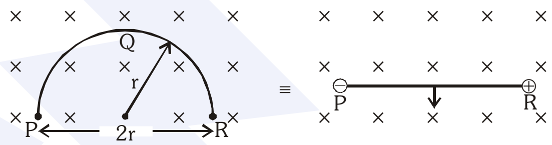
(2) $Bv\pi r^2/2$ and P is at higher potnetial

(3) πrBv and R is at higher potnetial

(4) 2rBv and R is at higher potential

Ans. (4)

Sol.



Induced emf = Bv(2r) = 2rBv

33. A transformer having efficiency of 90% is working on 200V and 3kW power supply. If the current in the secondary coil is 6A, the voltage across the secondary coil and the current in the primary coil respectively are :-

(1) 300 V, 15A (2) 450 V, 15A

(3) 450V, 13.5A (4) 600V, 15A

Ans. (2)

Sol. $\eta = \frac{V_S I_S}{V_P I_P} \Rightarrow 0.9 = \frac{V_S(6)}{3\times10^3} \Rightarrow V_S = 450V$

As $V_P I_P = 3000$ so $I_P = \frac{3000}{200}A = 15A$

34. Light with an energy flux of 25×10^4 Wm^{-2} falls on a perfectly reflecting surface at normal incidence. If the surface area is 15 cm^2, the average force exerted on the surface is :-

(1) 1.25×10^{-6} N (2) 2.50×10^{-6} N

(3) 1.20×10^{-6} N (4) 3.0×10^{-6} N

Ans. (2)

Sol. Average force $F_{av} = \frac{\Delta p}{\Delta t} = \frac{2IA}{c}$

$$= \frac{2\times25\times10^4\times15\times10^{-4}}{3\times10^8}$$

$$= 2.50\times10^{-6}\text{ N}$$

35. A beam of light of λ = 600 nm from a distant source falls on a single slit 1 mm wide and the resulting diffraction pattern is observed on a screen 2 m away. The distance between first dark fringes on either side of the central bright fringe is :-

(1) 1.2 cm (2) 1.2 mm

(3) 2.4 cm (4) 2.4 mm

Ans. **(4)**

Sol. Width of central bright fringe

$$= \frac{2\lambda D}{\lambda} = \frac{2\times 600\times 10^{-6}\times 2}{1\times 10^{-3}}\text{m}$$

$= 2.4 \times 10^{-3}$ m

= 2.4 mm

36. In the Young's double-slit experiment, the intensity of light at a point on the screen where the path difference is λ is K, (λ being the wave length of light used). The intensity at a poijnt where the path difference is $\lambda/4$, will be :-

(1) K (2) K/4

(3) K/2 (4) Zero

Ans. **(3)**

Sol. For path difference λ, phase difference = 2π rad

For path difference $\frac{\lambda}{4}$, phase difference = $\frac{\pi}{2}$ rad

As $K = 4I_0$ so intensity at given point where path difference is $\frac{\lambda}{4}$

$$K' = 4I_0 \cos^2\left(\frac{\pi}{4}\right) = 2I_0 = \frac{K}{2}$$

37. If the focal length of objective lens is increased then magnefying power of :-

(1) microscope will increase but that of telescope decrease.

(2) microscope and telescope both will increase.

(3) microscope and telescope both will decrease

(4) microscope will decrease but that of telescope increase.

Ans. **(4)**

Sol. Magnifying power of Microscope = $\frac{LD}{f_0 f_e} \propto \frac{1}{f_0}$

Magnifying power of Telescope = $\frac{f_0}{f_e} \propto f_0$

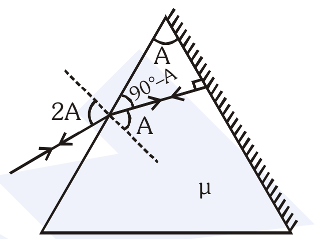
38. The angle of a prism is 'A'. One of its refracting surfaces is silvered. Light rays falling at an angle of incidence 2A on the first surface returns back through the same path after suffering reflection at the silvered surface. The refractive index μ, of the prism is :-

(1) 2sinA (2) 2cos A

(3) $\frac{1}{2}$cosA (4) tanA

Ans. **(2)**

Sol.



By Snell's law

(1) $\sin 2A = (\mu)\sin A \Rightarrow \mu = 2\cos A$

39. When the energy of the incident radiation is incredased by 20%, the kinetic energy of the photoelectrons emitted from a metal surface increased from 0.5 eV to 0.8 eV. The work function of the metal is :-

(1) 0.65 eV (2) 1.0 eV

(3) 1.3 eV (4) 1.5 eV

Ans. **(2)**

Sol. By using $h\nu = \phi_0 + K_{max}$

We have

$h\nu = \phi_0 + 0.5$ .... (i)

and $1.2h\nu = \phi_0 + 0.8$ ...... (ii)

Therefore $\phi_0 = 1.0$ eV

40. If the kinetic energy of the particle is increased to 16 times its previous value, the percentage change in the de-Broglie wavelength of the particle is :-

(1) 25 (2) 75 (3) 60 (4) 50

Ans. **(2)**

Sol. $l = \frac{h}{\sqrt{2mK}}$

$$\frac{\lambda_1}{\lambda_2} = \sqrt{\frac{K_2}{K_1}} = \sqrt{\frac{16K}{K}} = \frac{4}{1}$$

$$= \frac{1-4}{4}\times 100 = -75\%$$

41. Hydrogne atom is ground state is excited by a monochromatic radiation of $\lambda = 975$ Å. Number of spectral lines in the resulting spectrum emitted will be

(1) 3 (2) 2

(3) 6 (4) 10

Ans. (3)

42. The Binding energy per nucleon of ${}^{7}_{3}Li$ and ${}^{4}_{2}He$ nuclei are 5.60 MeV and 7.06 MeV, respectively.

In the nuclear reaction ${}^{7}_{3}Li + {}^{1}_{1}H \rightarrow {}^{4}_{2}He + Q$, the value of energy Q released is :-

(1) 19.6 MeV (2) –2.4 MeV

(3) 8.4 MeV (4) 17.3 MeV

Ans. (4)

Sol. BE of ${}_{2}He^{4} = 4 \times 7.06 = 28.24$ MeV

BE of ${}^{7}_{3}Li = 7 \times 5.60 = 39.20$ MeV

$${}^{7}_{3}Li + {}^{1}_{1}H \longrightarrow {}_{2}He^{4} + {}_{2}He^{4} + Q$$

39.20 $\quad$ 28.24 × 2

Q = 56.48 – 39.20 = 17.28 MeV

43. A radio isotope 'X' with a half life 1.4×10^{9} years decays to 'Y' which is stable. A sample of the rock from a cave was found to contain 'X' and 'Y' in the ratio 1 : 7. The age of the rock is :

(1) 1.96×10^{9} years

(2) 3.92×10^{9} years

(3) 4.20×10^{9} years

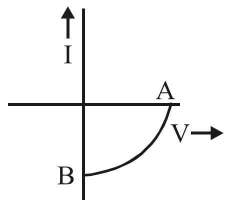
(4) 8.40×10^{9} years

Ans. (3)

Sol. As $\frac{N_x}{N_y} = \frac{1}{7} \Rightarrow \frac{N_x}{N_x + N_y} = \frac{1}{8} = \left(\frac{1}{2}\right)^3$

so $t = 3T_{1/2} = 3 \times 1.4 \times 10^{9}$ yrs. $= 4.2 \times 10^{9}$ yrs.

44. The given graph represents V - I characteristic for a semiconductor device.



Which of the following statement is **correct** ?

(1) It is V - I characteristic for solar cell where, point A represents open circuit voltage and point B short circuit current.

(2) It is a for a solar cell and point A and B represent open circuit voltage and current, respectively.

(3) It is for a photodiode and points A and B represent open circuit voltage and current, respectively.

(4) It is for a LED and points A and B represent open circuit voltage and short circuit current, respectively.

Ans. (1)

45. The barrier potential of a p-n junction depends on:

(a) type of semi conductor material

(g) amount of doping

(c) temperature

Which one of the following is correct ?

(1) (a) and (b) only

(2) (b) only

(3) (b) and (c)only

(4) (a), (b) and (c)

Ans. (4)