AIPMT 2014 Physics Solution Set Q

136. 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 :

a. $\frac{Q}{4\pi\epsilon_0 R}$ and Zero

b. $\frac{Q}{4\pi\epsilon_0 R}$ and $\frac{Q}{4\pi\epsilon_0 R^2}$

c. Both are zero

d. Zero and $\frac{Q}{4\pi\epsilon_0 R^2}$

Sol. E.P = $\frac{KQ}{R}$

Electric field inside conductor is zero.

137. 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. $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{n_1}} = \frac{1}{\sqrt{n_2}} = \frac{1}{\sqrt{n_3}}$

b. $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$

3. $n = n_1 + n_2 + n_3$

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

sol. $n_1 = \frac{v}{2\ell_1}$ $\qquad$ $\ell_1 = \frac{v}{2n_1}$

$n_2 = \frac{v}{2\ell_2}$ $\qquad$ $\ell_2 = \frac{v}{2n_2}$

$n_3 = \frac{v}{2\ell_3}$ $\qquad$ $\ell_3 = \frac{v}{2n_3}$

$$n = \frac{nv}{2\,(\ell_1 + \ell_2 + \ell_3)}$$

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

138. Copper of fixed volume 'V' is drawn inot 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 ?

a. Δl versus l^2

b. Δl versus $1/l^2$

c. Δl versus l

d. Δl versus $1/l$

sol. young modulus , $Y = \frac{stress}{strain}$

$$\text{Stress} = \frac{F}{A} = \frac{F.\ell}{V}$$

$$\text{Strain} = \frac{\Delta\ell}{\ell}$$

$$Y = \frac{F\ell}{V} / \frac{\Delta\ell}{\ell} \qquad \Rightarrow \frac{F\ell^2}{\Delta\ell \cdot V}$$

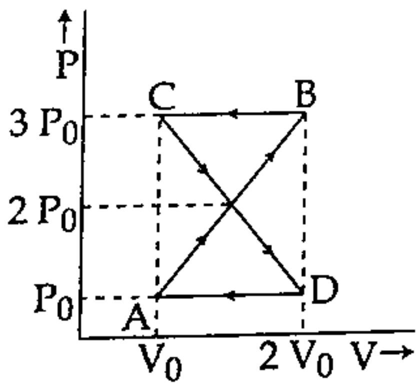
$$\Rightarrow \qquad \Delta\ell = \frac{YV}{F}\ell^2$$

$$\Delta\ell = k\,\ell^2$$

So graph is straight line

$$\Delta \ell \times \ell^2$$

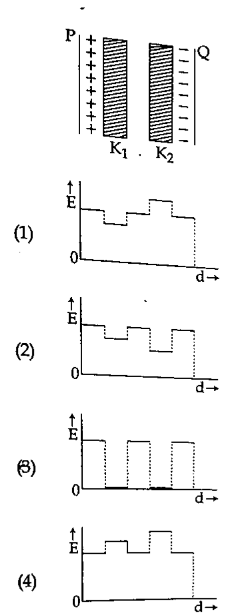
139. A thermodynamic system undergoes cyclic process ABCDA as shown in Fig. The work done by the system in the cycle is :



1. $2P_0 V_0$
2. $\frac{P_0 V_0}{2}$
3. Zero
4. $P_0 V_0$

Sol. cycles are having opposite sense so work done will be zero

140. 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 :



sol. Electric field through vaccum = E_0

Electric field through d1 electric $k_1 = \frac{E_0}{K_1} < E_0$

Similarly, $\vec{E}$ through d1 electric $k_2 = \frac{E_0}{K_2}$

So, $E_0 > \frac{E_0}{K_1} > \frac{E_0}{K_2}$

Hence, Electric field through d1 electric will be reduce accordingly and then it will recover E_0.

141. The resistances in the two arms of the meter bridge are 5 Ω and R Ω, 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 :

a. 15 Ω

b. 20 Ω

c. 25 Ω

d. 10 Ω

Sol.

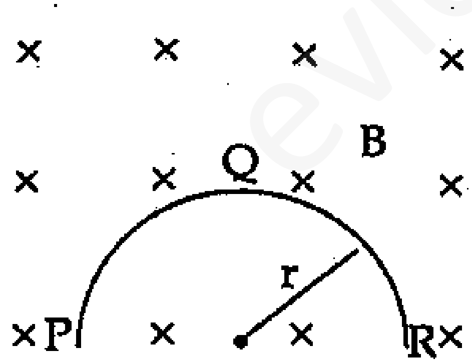
$\frac{5}{R} = \frac{\ell_1}{100-\ell_1}$ eq (1)

$\frac{5}{R} = \frac{1.6\,\ell_1}{100-1.6\,\ell_1}$ eq (2)

fromeq^n (1) & (2) we can get

R = .15 Ω

142. 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 :



a. $Bv\pi r^2/2$ and P is at higher potential

b. πrBv and R is at higher potential

c. 2rBv and R is at higher potential

d. Zero

Sol.

motional EMF = $\int(\overrightarrow{VxB})$ dℓ

$\overrightarrow{d\ell}$is avector , here it is 2 R

EMF induced = 2 Brv& from lenz rule we can get R is at higher potential

143. A particle is moving such that its position coordinates (x, y) are
(2m, 3m) at time t = 0,
(6m, 7m) at time t = 2s and
(13m, 14m) at time t = 5s.
Average velocity vector $\left(\vec{V}_{av}\right)$ from t = 0 to t = 5 s is :

a. $\frac{7}{3}(\hat{\imath} + \hat{\jmath})$

b. 2 $(\hat{\imath} + \hat{\jmath})$

c. $\frac{11}{5}(\hat{\imath} + \hat{\jmath})$

d. $\frac{1}{5}(13\hat{\imath} + 14\hat{\jmath})$

Sol. displacement vector $\vec{r}$ = 11$\hat{\imath}$ + 11$\hat{\jmath}$

V_{avg} $\frac{\text{disp.vector}}{\Delta t}$

$= \frac{11\,\hat{\imath}+11\,\hat{\jmath}}{5}$

$= \frac{11}{5}[\hat{\imath} + \hat{\jmath}]$

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144. 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_2 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 :

a. $\frac{\mu_0}{2\pi d}(I_1 + I_2)$

b. $\frac{\mu_0}{2\pi d}(I_1^2 - I_2^2)$

c. $\frac{\mu_0}{2\pi d}(I_1^2 - I_2^2)^{1/2}$

d. $\frac{\mu_0}{2\pi d}(1_1/I_2)$

sol . We have two semi – infinite wire

$$B_1 = \frac{\mu_0 I_1}{2\wedge d}$$

$$B_2 = \frac{\mu_0 I_2}{2\wedge d}$$

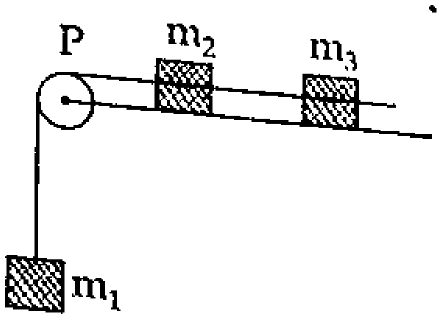
both fields are perpendicular to each other so

$$B \text{ net} = \sqrt{B_1^2 + B_2^2}$$

$$B = \frac{\mu_0}{2\ d}[I_1^2 + I_2^2]^{1/2}$$

145. 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_2 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 $m_1 = m_2 = m_3 = m$)



a. $\frac{2g\mu}{3}$
b. $\frac{g(1-2\mu)}{3}$
c. $\frac{g(1-2\mu)}{2}$
d. $\frac{g(1-2\mu)}{9}$

Sol.Writing force questions : -

$m_1 g - T_1 = m_1 a$ (1)

$T_1 - f_2 = m_2 a$ (2)

$T_2 - f_3 = m_3 a$ (3)

$f_2 = \mu m_2 g$ (4)

$f_3 = \mu m_3 g$ (5)

& $m_1 = m_2 = m_3 = m$

From above eq^n we will get

Q = $\frac{2}{3}$[1-2μ]

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

a. $\frac{499}{500}$ G

b. $\frac{1}{500}$ G

c. $\frac{500}{499}$ G

d. $\frac{1}{499}$ G

sol. Resistance (R) and Galranometer (G) are connected in parallel, so

$V_R = V_G$

And $(I - I_g)R = I_g G$

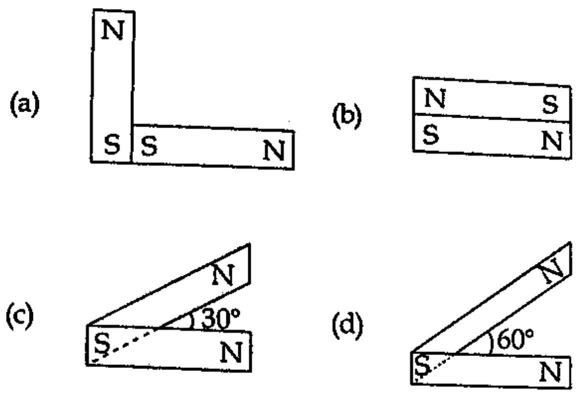
$\left(\frac{99.8}{100}\right)R = \left(\frac{0.2}{100}\right) G$

⇒ $R = \frac{0.2}{99.8} G$

So Rear = $\frac{R.G}{R+G}$

⇒ Rear = $\frac{1}{500}$G.

147. 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 dipole moment ?



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

sol. Direction of magnetic dipole moment lies from 'S' to 'N'

So Dnet = $\sqrt{D_1^2 + D_2^2 + 2D_1D_2 \cos\theta}$

Since, $D_1 = D_2 = D$

So $D_{net} \propto \cos\theta$ (should be minimum)

θ mm = 30° in option 'c'

148. If the focal length of objective lens is increased the magnifying power of ?

a. microscope and telescope both will increase.

b. microscope and telescope both will decrease.
c. microscope will decrease but that of telescope will increase.
d. microscope will increase but that of telescope decrease.

sol. Magnifying power of microscope and telescope is given by

$$m = \frac{f_0}{f_e}$$

f0 → object

fe → eye piece

So, on increase of focal length of objective lens, magnifying power will increase.

149. 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 :
a. 2 cos A
b. $\frac{1}{2}$ cos A
c. tan A
d. 2 sin A

Sol. At the 2nd face, reflection will occur we will be having situation of total internal reflection .

$r_1 + r_2 = A$

r_2= O

r_1 = A

At face (1)

(1)Sin 2A = μ Sin A

$$\mu = 2 \cos A$$

μ = 2 cos A

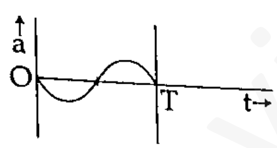
150. The oscillation of a body on a smooth horizontal surface is represented by the equation,

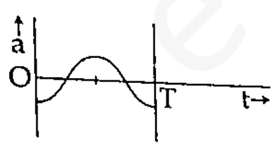
X = A cos (ωt)

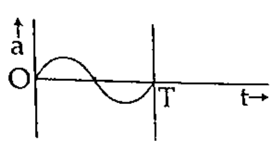
Where X = displacement at time t

ω = frequency of oscillation

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

(1)


(2)


(3)


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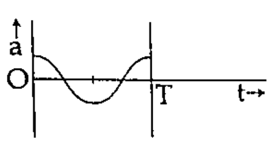


Here a = acceleration at time t

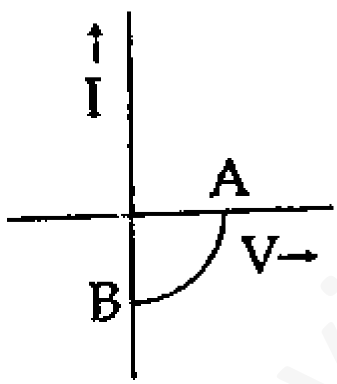
T = time period

Sol. . X = A cosωf

$\frac{dx}{dt}$Aω sin ωf

$\frac{d^2x}{dt^2}$ = a = - Aω^2cosωf

151. The give graph represents V I characteristic for a semiconductor device.



Which of the following statement is correct ?

a. It is for a solar cell and points A and B represent open circuit voltage and current, respectively.

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

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

d. It is V – I characteristic for solar cell where, point A represents open circuit voltage and point B short circuit current.

sol. V-I chkts for solar cell is exists for current to be in short ckt when,

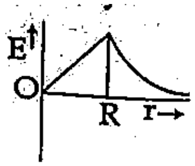
$$V = 0$$

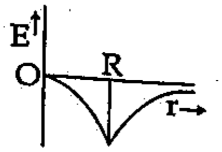
For short ckt, $v = 0$, $I \rightarrow$ short ckt current

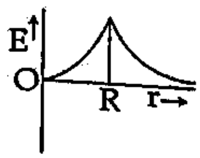
And of $I = 0$, $V \rightarrow$ open circuit voltage

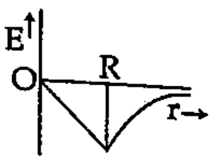
Hence, V-I chkts for solar cell, where point A represent open ckt voltage and poin B short ckt circuit

152. Dependence of intensity of gravitational field (E) of earth with distance (r) from centre of earth is correctly represent by :

(1) 

(2) 

(3) 

(4) 

Sol. Gravitational field inside & outside of earth

E in = $-\frac{GM}{R^3}$ (r) Where r is distance from centre of earth

$E_{out} = \frac{GM}{R^2}$

153. The number of possible natural oscillations 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})

a. 5

b. 7

c. 6

d. 4

sol. for a pipe which is closed at one end & open at other end

F = $\left(n + \frac{1}{2}\right)\frac{u}{2l}$

1250 = $\left(n + \frac{1}{2}\right)\frac{340}{2 \times 85 \times 1_0 - 2}$

N = 6

154. 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 wire is ;

a. 19.2 kW
b. 19.2 J
c. 12.2 kW
d. 19.2 W

Sol. Total distance, 150 km

Fall of potential $8\frac{8v}{km}$

So for 150 k, $V_{drop} = 8 \times 150 = 1200$ v

Similarly, Resistance for 150 km, $R_{net} = 0.5 \times 150 = 75\ \Omega$

Powerless $= \frac{V^2}{R} = \frac{(120)^2}{75} = 19.2$ kw

155. 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 :

a. 1.2 mm

b. 2.4 cm

c. 2.4 mm

d. 1.2 cm

sol. Distance between dark Fringe on either side

$$B = \frac{D\lambda}{d} = \frac{2\times(600\times10^{-9})}{(1\times10^{-3})}$$

$$\Rightarrow \quad B = 1.2 \text{ mm}$$

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

a. $[F\ V\ T^{-2}]$

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

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

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

Sol. .$m \alpha F^a V^b T^c$

Taking climensions both side

$[M] = [K]\ [MLT^{-2}]^a\ [LT^{-1}]^b\ [T]^c$

$M^1\ L^0\ T^0 = M^a\ L^a\ T^{-2a} L^b\ T^{-B\ T} c$

$^{M}1L^{6}\ T^{6} = M^{a}L^{(a + b)}\ T^{(-29 – b + c)}$

a = 1

a + b = 0

- 2a – b + c = 0

After solving these eq^{n} we will get ans.

157. The barrier potential of a p-n junction depends on :
a. type of semi conductor material
b. amount of doping
c. temperature
which one of the following is correct ?
1. (b) only
2. (b) and (c) only
3. (a), (b) and (c)
d. (a) and (b) only

sol. Barrier potential in between the P-N type of diode to jumping of minority charge carrier depends on type of semi-conducting material, also on Temperature as according to relation of Fermi-dirac and on doping of extend agent

158. 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 $^{7}_{3}Li$ + $^{1}_{1}H \rightarrow$ $^{4}_{2}He$ + $^{4}_{2}He$ + Q, the value of energy Q released is :

a. -2.4 MeV
b. 8.4 MeV
c. 17.3 MeV
d. 19.6 MeV

Sol. $Q = \Delta mc^2$

Finding the mass defect and multiplying the result to 931 MeV.

159. 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 :
a. 75
b. 60
c. 50
d. 25

sol. $\lambda = \frac{h}{mv} = \frac{h}{\sqrt{2km}}$

For two cases, $\lambda 1 = \frac{h}{\ }$ .....(i)

$\lambda_2 = \frac{h}{\sqrt{K_2}}$ ....(ii)

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

$$\frac{\lambda_2 - \lambda_1}{\lambda_1} = \frac{4-1}{4} = \frac{3}{4}$$

So, $\frac{\Delta\lambda}{\lambda}\% = \frac{3}{4} \times 100 = 75\%$

160. Light with an energy flux of 25 X 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 :

a. 2.50 X 10^{-6} N

b. 1.20 X 10^{-6} N

c. 3.0 X 10^{-6} N

d. 1.25 X 10^{-6} N

Sol. . F = $\frac{2I}{C}$ X A

$= \frac{2 \times 25 \times 10^4 \times 15 \times 10^{-4}}{3 \times 10^6}$

F = 2.5 X 10^{-6} N

161. 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 re in meters. The electric force experienced by a charge of 2 coulomb situated at point (1, 1, 1) is :

a. 30 N

b. 24 N

3. $4\sqrt{35}$ N

d. 6 $\sqrt{35}$ N

Sol. V (x, y, z) = 6x – 8xy – 8y + 6yz

Ex = $\frac{dv}{dx}$ = (-6 + 8y) $\hat{\imath}$

Ex = $\frac{dv}{dx}$ = (-8x – 8 + 6z) $\hat{\jmath}$

Ex = $\frac{-dv}{dx}$ = (6y) $\hat{k}$

Ex = - 2 $\hat{\imath}$

Fy = - 10$\hat{\jmath}$

Ez = 6 $\hat{k}$

F = q$\sqrt{Ex^2 + Ey^2 + Ez^2}$

= 4 $\sqrt{35}$ N ans.

162. A speeding motorcyclist sees traffic 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 18km/hour is honking at a frequency of 1392 Hz. If the speed of sound is 343 m/s, the frequency of the honk as heard by him will be :

a. 1372 Hz

b. 1412 Hz

c. 1454 Hz

d. 1332 Hz

sol. . f' = $f_0\left[\frac{V+V_0}{V-Vs}\right]$

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$F' = 1392 \left[\frac{343+10}{343-5}\right]$

= 1454 Hz.

163. The ratio of the accelerations 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. 2 : 3

b. 2 : 5

c. 7 : 5

d. 5 : 7

sol. Slipping without rolling on inclined plane,

$a_1 = g$ since

Rolling without stopping

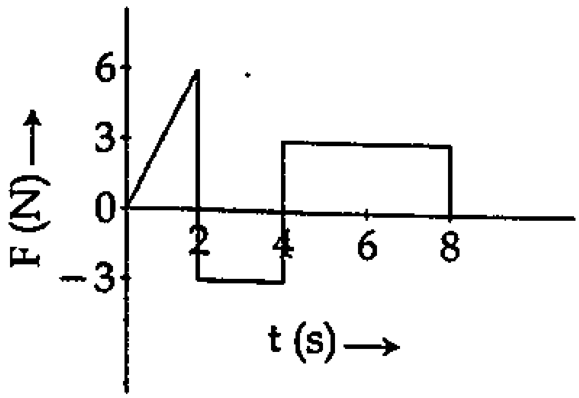
$a_2 = \frac{g\ sin\theta}{1+\frac{I}{mR}}$

Since, $I_s = \frac{2}{5} mr^2$

$\Rightarrow \frac{a_2}{a_1} \quad \frac{gsin\theta}{\left(1+\frac{2}{5}mr^2/mr^2\right)} / g\ sin\theta$

$\Rightarrow \frac{a_2}{a_1} = \frac{7}{5}$

164. 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 :



a. 20 Ns
b. 12 Ns
c. 6 Ns
d. 24 Ns

sol. Area under curve

$$\frac{1}{2}(6 \times 2) + [(4-2)(-3)] + [(8-4)(3)]$$

$= 12$ N-S

165. 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 point whre the path difference is $\lambda/4$, will be :
a. K/4

2. K/2

3. Zero

d. K

Sol. . I = $I_0 \cos^2\frac{\emptyset}{2}$

$\emptyset$ = kΔx

= $\frac{2\lambda}{\lambda}\frac{\lambda}{4} = \frac{\lambda}{2}$

I = K $\cos^2\frac{\lambda}{4} = \frac{K}{4}$

166. 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' ?

a. $\frac{2\,ma}{g-a}$

b. $\frac{ma}{g+a}$

c. $\frac{ma}{g-a}$

d. $\frac{2\,ma}{g+a}$

sol. mg – B = ma

B – (m – m') g = (m – m')a

a = $\frac{2ma}{g+a}$

167. 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 4 m long. When the resistance, R, connected across the given cell, has values of.

(i) infinity

(ii) 9.5 Ω

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 :

a. 0.95 Ω

b. 0.5 Ω

c. 0.75 Ω

d. 0.25 Ω

sol. By using formula internal resistance,

$$r = \left(\frac{E}{V} - 1\right)R'$$

Or $$r = \left(\frac{\ell_1 - \ell}{\ell_2}\right)R'$$

$$\Rightarrow \quad r = \left[\frac{3-2.85}{2.85}\right] \times 9.5\ \Omega$$

$$r = 0.5\ \Omega$$

168. A monoatomic gas at a pressure P, having a volume V expands isothermally to a volume 2V and than adiabatically to a volume 16V. The final pressure of the gas is (take γ= 5/3)

a. 32P

b. P/64

c. 16P

d. 64P

Sol. .iso thermal process

$P_0 V_0 = 2v \times p'$

$p' = \frac{p_0}{2}$

adiabatic process

$\frac{p_0}{2}(2v)^{5/3} = p\,(16\,v)^{5/3}$

$Pf = \frac{p_0}{64}$

169. 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 tensionf the liquid, then :

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

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

c. energy is neither released nor absorbed.

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

Sol.Energy is released to collapse

So, $E = \Delta w = T\Delta S$

Since, $V = S.r$

So $V = \frac{4}{3}\pi r^3$

$S = 4\pi r^2$

$V = \frac{5r}{3}$

Or $s = \frac{3V}{r}$

None $T\Delta S = T\left(\frac{3V}{r} - \frac{3V}{R}\right)$

$W = 3TV\left(\frac{1}{r} - \frac{1}{R}\right)$

170. 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 :

a. $\frac{3}{2}$ m v^2

b. 2 mv^2

c. 4 mv^2

d. mv^2

Sol. 2mv' cosθ = mv (1)

2mv' sinθ mv (2)

Tanθ = 1 θ = 45^0

Put θ = 45^0 in eq^n (1)

$\frac{2\,mv\prime}{\sqrt{2}}$ = mv v' = $\frac{v\prime}{\sqrt{2}}$

Total K.E of system

KE = $\frac{1}{2}$ mv^2 + $\frac{1}{2}$ mv^2 + $\frac{1}{2}$ (2 m) $\left(\frac{v}{\sqrt{2}}\right)^2$

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

171. Hydrogen atom in ground state is excited by a monochromatic radiation of λ = 975 Å. Number of spectral lines in the resulting spectrum emitted will be :

a. 2

b. 6

c. 10

d. 3

Sol. .$\frac{1}{\lambda}$ = R $\left[\frac{1-1}{n^2}\right]$

$\frac{1}{975 \times 10^{-10}}$ = 1·1 X $10^7\left[\frac{n^2-1}{n2}\right]$

N = 4

No of spectral lines = $\frac{n(n-1)}{2}$

= $\frac{n(3)}{2}$

= 6

172. 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 X 10^{24} kg) have to be compressed to be a black hole ?

a. 10^{-6} m
b. 10^{-2} m
c. 100 m
d. 10^{-9} m

Sol. $\sqrt{\frac{2GM}{R}}$ = C

$\frac{2GM}{R}$ = C^2

R = $\frac{2GM}{C2}$

R = $\frac{2 \times 6{\cdot}67 \times 10^{-11} \times 5{\cdot}98 \times 10^{24}}{9 \times 10'2}$

= $\frac{2 \times 6{\cdot}67 \times 5{\cdot}98}{9}$ X 10^{-1}

R = 10^{-2} m ans

173. 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}) is : (given g = 9.8 ms^{-2})

a. 5.9

b. 16.3

c. 110.8

d. 3.5

Sol. 5 sin θ = gf

3 sin θ = g' f

$\frac{5}{3} = \frac{g}{g\,1}$

$G^1 = \frac{3g}{5} = 6\ m/s^2$

174. 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 :

a. 20 C

b. 42 C

c. 10 C

d. 45 C

Sol. $\frac{10^0}{5\,min}$ = - K [65^0 - Ts] (1)

$\frac{6^0}{5\,min}$ = - K [57^0 - Ts] (2)

Solving eq^n (1) 2 (2)

Ts = 45^0C

175. A solid cylinder of mass 50kg 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 :

a. 50 N
b. 78.5 N
c. 157 N
d. 25 N

Sol. T = $\frac{1}{2}$ mR ∝

= $\frac{1}{2}$ X 50 X $\frac{1}{2}$ X 2 X 2λ

= 157 N ans

176. Steam at 100^0C is passed into 20 g of water at 10^0C. when water acquires a temperature of 80^0C, the mass of water present will be :

[Take specific heat of water = 1 cal $g^{-1 0}C^{-1}$ and latent heat of steam = 540 cal g^{-1}]

a. a. 31.5 g
b. B. 42.5 g
c. C. 22.5 g
d. 24 g

Sol. q =- msΔT

= 20 X 1 X 70

= 1400 cal

Q = mLv

1400 cal = m X 540 cal

M = $\frac{1400}{540}$ = 2.59

M = 22.5g ans

177. A radio isotope 'X' with a half life 1.4 X 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 :

a. 3.92 X 10^9 years
b. 4.20 X 10^9 years
c. 8.40 X 10^9 years
d. 1.96 X 10^9 years

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sol.$t_{1/2} = 1.4 \times 10^9$

λ = 0.693/1.4*10^9 sec

life, T = 2.303/λ log (Ny/Nx)

T = 2.0303/.693*(1.4*10^9) log7

T = 3.92 *10^9 years

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

a. 450 V, 15 A
b. 450 V, 13.5 A
c. 600 V, 15 A
d. 300 V, 15 A

Sol. . n = $\frac{IsVs}{IpVp}$

IpVp = 0.9 IsVs

6 X Vs = .9 X 3 X 10^3

Vs = 450V

Ip = 15 A

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

a. 1.0 eV

b. 1.3 eV

c. 1.5 eV

d. 0.65 eV

Sol. T = $\frac{1}{2}$ mR ∝

= $\frac{1}{2}$ X 50 X $\frac{1}{2}$ X 2 X 2λ

= 157 N ans

180. The mean free path of molecules of a gas, (radius ‘r’) is inversely proportional to :

a. r^2

b. r

c. $\sqrt{r}$

d. r^3

Sol. mean free path of a molecule

$l = RT/\sqrt{2}\pi(2r)2$

$l \propto 1/r^2$