JEE(MAIN) – 2015 TEST PAPER WITH SOLUTION (HELD ON SATURDAY 04th APRIL, 2015)

PART A – PHYSICS

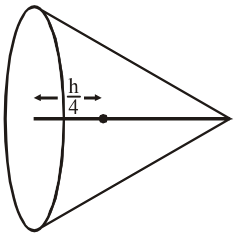
1. Distance of the centre of mass of a solid uniform cone from its vertex is z_0. If the radius of its base is R and its height is h then z_0 is equal to :-

(1) $\frac{5h}{8}$ (2) $\frac{3h^2}{8R}$

(3) $\frac{h^2}{4R}$ (4) $\frac{3h}{4}$

Ans. (4)

Sol.



for solid cone c.m. is $\frac{h}{4}$ from base

so $z_0 = h - \frac{h}{4} = \frac{3h}{4}$

2. A red LED emits light at 0.1 watt uniformly around it. The amplitude of the electric field of the light at a distance of 1 m from the diode is:-

(1) 5.48 V/m (2) 7.75 V/m

(3) 1.73 V/m (4) 2.45 V/m

Ans. (4)

Sol. $I_{av} = \frac{1}{2}\varepsilon_0 E^2 C = \frac{P}{4\pi r^2}$

$E = \sqrt{\frac{2P}{4\pi r^2 \varepsilon_0 c}}$

On putting value we get

= 2.45 v/m.

3. A pendulum made of a uniform wire of cross sectional area A has time period T. When an additional mass M is added to its bob, the time period changes to T_M. If the Young's modulus of the material of the wire is Y then $\frac{1}{Y}$ is equal to :- (g = gravitational acceleration)

(1) $\left[1-\left(\frac{T_M}{T}\right)^2\right]\frac{A}{Mg}$

(2) $\left[1-\left(\frac{T}{T_M}\right)^2\right]\frac{A}{Mg}$

(3) $\left[\left(\frac{T_M}{T}\right)^2-1\right]\frac{A}{Mg}$

(4) $\left[\left(\frac{T_M}{T}\right)^2-1\right]\frac{Mg}{A}$

Ans. (3)

Sol. $T = 2\pi\sqrt{\frac{L}{g}}$ ...(1)

$T_M = 2\pi\sqrt{\frac{L+\Delta L}{g}}$ ...(2)

$Y = \frac{F/A}{\Delta L/L}$

$\Delta L = \frac{FL}{AY}$ ...(3)

Putting (3) in (2)

solving the equation we get the value of $\frac{1}{Y}$ as

$\left[\left(\frac{T_M}{T}\right)^2-1\right]\frac{A}{mg}$

4. For a simple pendulum, a graph is plotted between its kinetic energy (KE) and potential energy (PE) against its displacement d. Which one of the following represents these correctly ? (graphs are schematic and not drawn to scale)

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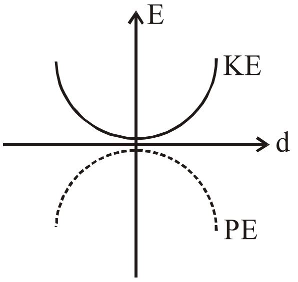

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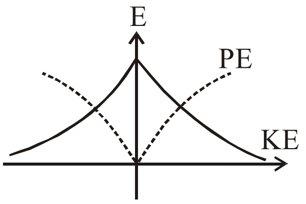

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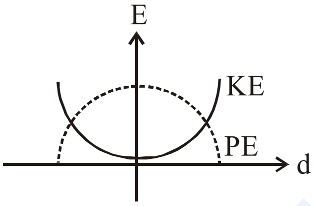

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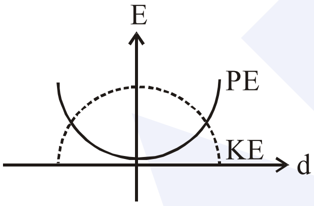
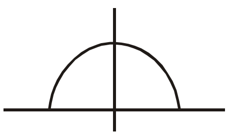
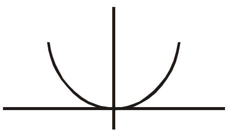


Ans. (4)

Sol. KE = $\frac{1}{2}m\omega^2[A^2 - d^2]$, downward parabola

PE = $\frac{1}{2}m\omega^2 d^2$, upward parabola.

KE


PE


5. A train is moving on a straight track with speed 20 ms^{-1}. It is blowing its whistle at the frequency of 1000 Hz. The percentage change in the frequency heard by a person standing near the track as the train passes him is (speed of sound = 320 ms^{-1}) close to :-

(1) 18% (2) 24% (3) 6% (4) 12%

Ans. (4)

Sol. $f' = f\left(\frac{v}{v - v_s}\right)$

$$f'' = f\left(\frac{v}{v + v_s}\right)$$

$$\frac{f''}{f'} = \frac{v - v_s}{v + v_s}$$

$$\frac{f'' - f'}{f'} \times 100 = \frac{v - v_s - v - v_s}{v + v_s} \times 10$$

$$= -\frac{2v_s}{v + v_s}$$

$$= -\frac{2}{1 + \frac{v}{v_s}} \times 100$$

$\simeq$ 12%

6. When 5V potential difference is applied across a wire of length 0.1 m, the drift speed of electrons is 2.5 × 10^{-4} ms^{-1}. If the electron density in the wire is 8 × 10^{28} m^{-3}, the resistivity of the material is close to :-

(1) 1.6 × 10^{-6} Ωm (2) 1.6 × 10^{-5} Ωm

(3) 1.6 × 10^{-8} Ωm (4) 1.6 × 10^{-7} Ωm

Ans. (2)

Sol. $V = iR = (neAV_d)\left(\frac{\rho\ell}{A}\right)$

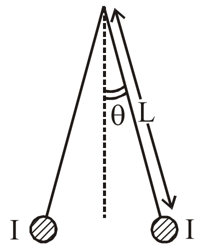
$$V = neV_d\ell$$

$$\rho = \frac{V}{neV_d\ell}$$

On putting values are got the answer

= 1.6 × 10^{-5} Ωm

7.



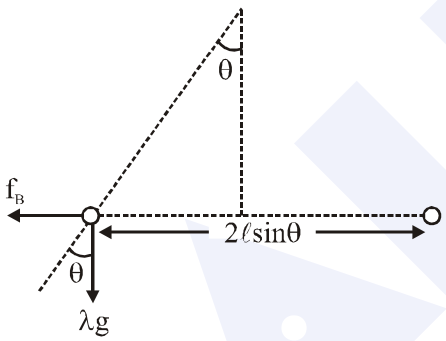
Two long current carrying thin wires, both with current I, are held by the insulating threads of length L and are in equilibrium as shown in the figure, with threads making an angle 'θ' with the vertical. If wires have mass λ per unit length then the value of I is :-

(g = gravitational acceleration)

(1) $2\sqrt{\frac{\pi gL}{\mu_0}\tan\theta}$ (2) $\sqrt{\frac{\pi\lambda gL}{\mu_0}\tan\theta}$

(3) $\sin\theta\sqrt{\frac{\pi\lambda gL}{\mu_0\cos\theta}}$ (4) $2\sin\theta\sqrt{\frac{\pi\lambda gL}{\mu_0\cos\theta}}$

Ans. (4)



$$B = \frac{\mu_0 I}{2\pi r} = \frac{\mu_0 I}{2\pi(2\ell\sin\theta)}$$

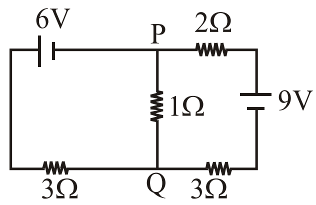
$\tan\theta = \frac{f_B}{\lambda g}$ where f_B is force per unit length(Bi)

$$\lambda g\tan\theta = \frac{\mu_0 I}{2\pi(2\ell\sin\theta)}\times I$$

on solving

$$I = 2\sin\theta\sqrt{\frac{\pi\lambda g\ell}{\mu_0\cos\theta}}$$

8.



In the circuit shown, the current in the 1Ω resistor is :-

(1) 0.13 A, from Q to P

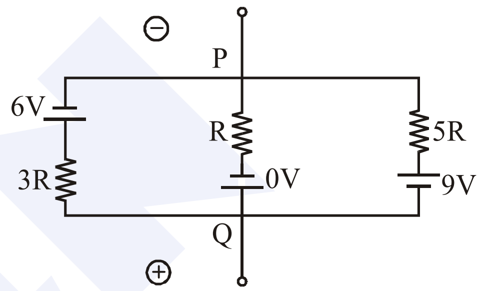
(2) 0.13 A, from P to Q

(3) 1.3 A, from P to Q

(4) 0A

Ans. (1)

Sol.



$$E = \frac{\frac{6}{3}+\frac{0}{1}-\frac{9}{5}}{\frac{1}{3}+\frac{1}{1}+\frac{1}{5}} = \frac{2-\frac{9}{5}}{\frac{5+15+3}{15}} = \frac{3}{23}$$

$$i = \frac{E}{R} = \frac{3}{23} = 0.13$$

from +ve to –ve

Q to P

9. Assuming human pupil to have a radius of 0.25cm and a comfortable viewing distance of 25cm, the minimum separation between two objects that human eye can resolve at 500 nm wavelength is :-

(1) 100 μm (2) 300 μm

(3) 1 μm (4) 30 μm

Ans. (4)

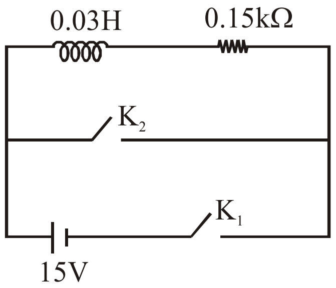
Sol. $\frac{d_0}{d_1} = \theta = \frac{1.22\lambda}{d}$

$$d_0 = \frac{1.22\times500\times10^{-9}}{0.5\times10^{-2}}\times25\times10^{-2}$$

$d_0 = 1.22 \times 25 \times 10^{-6}$

$d_0 \simeq 30$ μm

10. An inductor (L = 0.03 H) and a resistor (R = 0.15 kΩ) are connected in series to a battery of 15V EMF in a circuit shown below. The key K_1 has been kept closed for a long time. Then at t = 0, K_1 is opened and key K_2 is closed simultaneously. At t = 1ms, the current in the circuit will be ($e^5 \cong 150$) :-



(1) 6.7 mA (2) 0.67 mA

(3) 100 mA (4) 67 mA

Ans. (2)

Decay of current

$$I = I_0 e^{-\frac{tR}{L}}$$

$$= \frac{15}{150} e^{-\frac{10^{-3}\times150}{0.03}}$$

$$= \frac{1}{10} e^{-5}$$

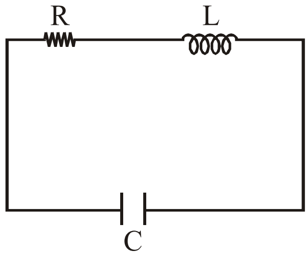
$$= \frac{1}{1500}$$

$= 6.66 \times 10^{-4}$

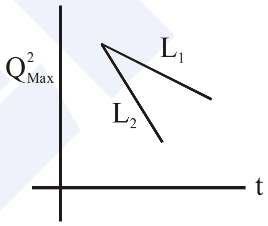
$= 0.666 \times 10^{-3}$

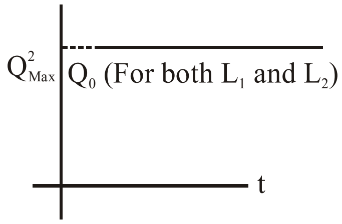
$= 0.67$ mA

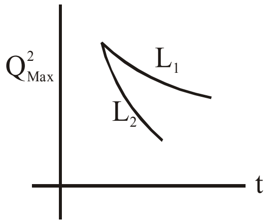
11. An LCR circuit is equivalent to a damped pendulum. In an LCR circuit the capacitor is charged to Q_0 and then connected to the L and R as shown below :-

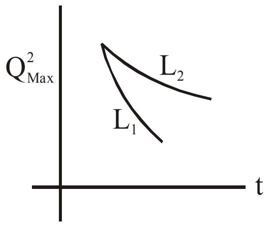


If a student plots graphs of the square of maximum charge (Q^2_{Max}) on the capacitor with time (t) for two different values L_1 and L_2 ($L_1 > L_2$) of L then which of the following represents this graph correctly ? (plots are schematic and not drawn to scale)

(1) 

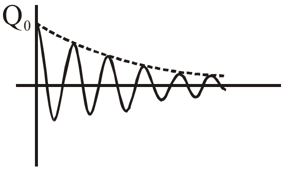
(2) 

(3) 

(4) 

Ans. (3)

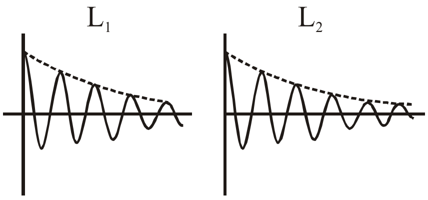
Sol. As damping is happening its amplitude would vary as



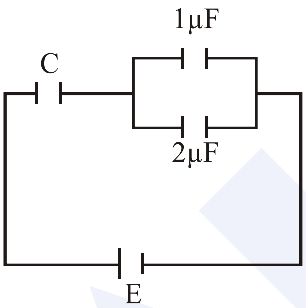
The oscillations decay exponentially and will be proportional to $e^{-\gamma t}$ where γ depends inversely on L.

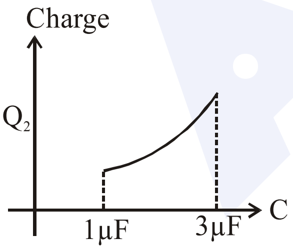
So as inductance increases decay becomes slower

$\therefore$ for



12. In the given circuit, charge Q_2 on the $2\mu F$ capacitor changes as C is varied from $1\mu F$ to $3\mu F$. Q_2 as a function of 'C' is given properly by : (figures are drawn schematically and are not to scale) :-



(1)


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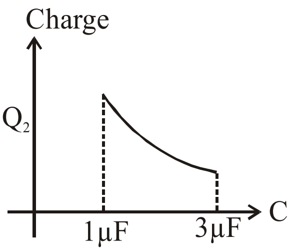

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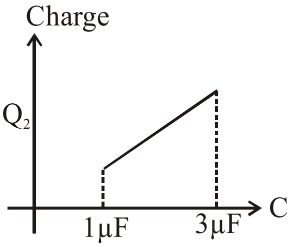

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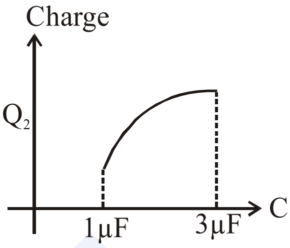
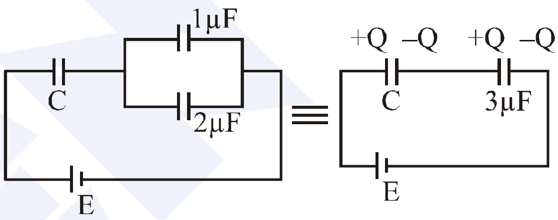


Ans. (4)

Sol.



$C_{eq} = \dfrac{3C}{3+C}$ $\quad\quad$ $Q = Ceq \cdot E$

$Q_2 = \dfrac{2CE}{(C+3)}$ $\quad\quad$ $= \dfrac{3CE}{(C+3)}$

$= 2E\left[1 - \dfrac{3}{C+3}\right]$

$Q_{2/\text{when } C = 1\mu F} = 2E\left[\dfrac{1}{4}\right] = \dfrac{E}{2}$

$Q_{2/\text{when } C = 3\mu F} = 2E\left[\dfrac{1}{2}\right] = E$

$\dfrac{dQ}{dC} = -\dfrac{2E \cdot 3}{(C+3)}(-1) = \dfrac{6E}{(C+3)^2} > 0$

$\dfrac{d^2\theta}{dC^2} = \dfrac{6E(-2)}{(C+3)^3} = -\dfrac{12E}{(C+3)^2} < 0$

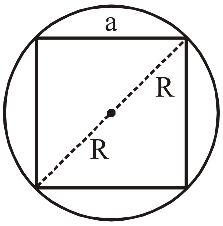
13. From a solid sphere of mass M and radius R a cube of maximum possible volume is cut. Moment of inertia of cube about an axis passing through its centre and perpendicular to one of its faces is:-

(1) $\frac{4MR^2}{9\sqrt{3}\pi}$ (2) $\frac{4MR^2}{3\sqrt{3}\pi}$

(3) $\frac{MR^2}{32\sqrt{2}\pi}$ (4) $\frac{MR^2}{16\sqrt{2}\pi}$

Ans. (1)

Sol.



Let mass and side of cube be M' and a $\sqrt{3}\,a = 2R$

$$M' = \frac{M}{\frac{4}{3}\pi R^3}a^3$$

Moment of Inertia of cube $= \frac{M'a^2}{6}$

$$= \left(\frac{M}{\frac{4}{3}\pi R^3}a^3\right)\frac{a^2}{6} = \boxed{\frac{4MR^2}{9\sqrt{3}\pi}}$$

14. The period of oscillation of a simple pendulum is $T = 2\pi\sqrt{\frac{L}{g}}$. Measured value of L is 20.0 cm known to 1 mm accuracy and time for 100 oscillations of the pendulum is found to be 90s using a wrist watch of 1s resolution. The accuracy in the determination of g is :

(1) 1% (2) 5%

(3) 2% (4) 3%

Ans. (4)

Sol. $T = 2\pi\sqrt{\frac{\ell}{g}}$

$$g = \frac{4\pi^2\ell}{T^2}$$

$$\frac{\Delta g}{g} = \frac{\Delta\ell}{\ell} + 2\frac{\Delta T}{T}$$

$$\frac{\Delta g}{g} = \frac{1\times10^{-3}}{20\times10^{-2}} + 2\times\frac{1}{100\times\frac{90}{100}}$$

$$\therefore \quad \frac{\Delta g}{g}\times 100 = 2.722\% \approx 3\%$$

15. On a hot summer night, the refractive index of air is smallest near the ground and increases with height from the ground. When a light beam is directed horizontally, the Huygens' principle leads us to conclude that as it travels, the light beam :

(1) bends downwards

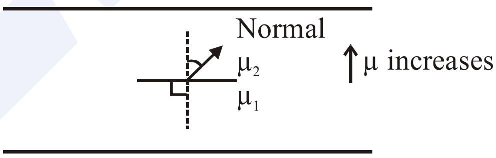
(2) bends upwards

(3) becomes narrower

(4) goes horizontally without any deflection

Ans. (2)

Sol.



$\mu_2 > \mu_1$

∴ light bends towards normal

∴ light beam bends upwards (as μ↑with height)

16. A single of 5 kHz frequency is amplitude modulated on a carrier wave of frequency 2 MHz. The frequencies of the resultant signal is/are -

(1) 2005 kHz, 2000 kHz and 1995 kHz

(2) 2000 kHz and 1995 kHz

(3) 2 MHz only

(4) 2005 kHz and 1995 kHz

Ans. (1)

Sol. Frequency present after modulation

$$f_c,\ f_c \pm f_s$$

⇒ 2000 KHz, 2005 KHz and 1995 KHz

17. A solid body of constant heat capacity 1 J/°C is being heated by keeping it in contact with reservoirs in two ways -

(i) Sequentially keeping in contact with 2 reservoirs such that each reservoir supplies same amount of heat.

(ii) Sequentially keeping in contact with 8 reservoirs such that each reservoir supplies same amount of heat.

In both the cases body is brought from initial temperature 100°C to final temperature 200°C. Entropy change of the body in the two cases respectively is -

(1) ln2, 2ln2 (2) 2ln2, 8ln2

(3) ln2, 4ln2 (4) ln2, ln2

Ans. (4)

Sol. $\Delta S = \int_{T_1}^{T_2} nc\left(\frac{dT}{T}\right)$

$$\Delta S_1 = \int_{100}^{200} 1\left(\frac{dT}{T}\right) = \ell n2$$

$$\Delta S_2 = \int_{100}^{200} 1\left(\frac{dT}{T}\right) = \ell n2$$

18. Consider a spherical shell of radius R at temperature T. The black body radiation inside it can be considered as an ideal gas of photons with internal energy per unit volume $u = \frac{U}{V} \propto T^4$ and pressure $p = \frac{1}{3}\left(\frac{U}{V}\right)$. If the shell now undergoes an adiabatic expansion the relation between T and R is -

(1) $T \propto \frac{1}{R}$ (2) $T \propto \frac{1}{R^3}$

(3) $T \propto e^{-R}$ (4) $T \propto e^{-3R}$

Ans. (1)

Sol. $P = \frac{1}{3}\left(\frac{U}{V}\right)$

$P \propto T^4$

using $PV = nRT$

$\frac{1}{V} \propto T^3$

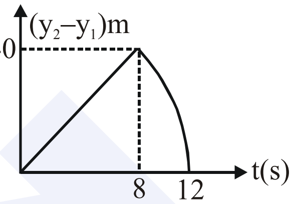
$\Rightarrow T \propto \frac{1}{R}$

19. Two stones are thrown up simultaneously from the edge of a cliff 240 m high with initial speed of 10 m/s and 40 m/s respectively. Which of the following graph best represents the time variation of relative position of the second stone with respect to the first ?

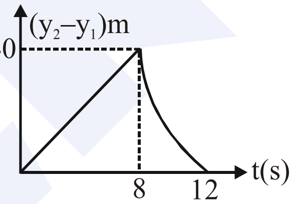
(Assume stones do not rebound after hitting the ground and neglect air resistance, take g = 10 m/s²)

(The figure are schematic and not drawn to scale)

(1)



(2)



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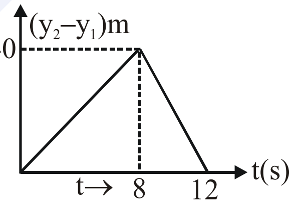

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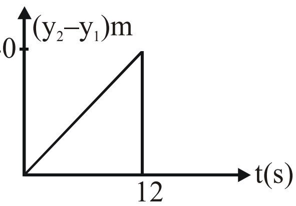
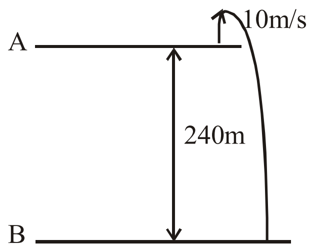


Ans. (1)

Sol. For particle 1

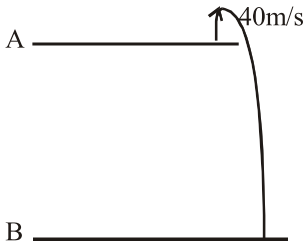


$$-240 = +10t - \frac{1}{2}gt^2$$

$5t^2 - 10t - 240 = 0$

$t_1 = 8$ sec

For particle 2



$$-240 = 40t - \frac{1}{2}gt^2$$

$5t^2 - 40t - 240 = 0$

$t_2 = 12$ sec

for $0 < t < 8$ sec $\rightarrow a_{rel} = 0$

straight line x-t graph

for $8 < t < 12$ sec $\rightarrow a_{rel} = -g$

downward parabola

for $t > 12$ sec $\rightarrow$ Both particles comes to rest

20. A uniformly charged solid sphere of radius R has potential V_0 (measured with respect to ∞) on its surface. For this sphere the equipotential surfaces with potentials $\frac{3V_0}{2}, \frac{5V_0}{4}, \frac{3V_0}{4}$ and $\frac{V_0}{4}$ have radius R_1, R_2, R_3 and R_4 respectively. Then

(1) $R_1 = 0$ and $R_2 < (R_4 - R_3)$

(2) $2R < R_4$

(3) $R_1 = 0$ and $R_2 > (R_4 - R_3)$

(4) $R_1 \neq 0$ and $(R_2 - R_1) > (R_4 - R_3)$

Ans. (1 or 2)

Sol. for $r < R$ $\quad V = \frac{kQ}{2R}\left(3 - \frac{r^2}{R^2}\right)$

& for $r > R$ $\quad V = \frac{kQ}{r}$

at $r = R$ $\quad V_0 = \frac{kQ}{R}$

at $r = 0$ $\quad V_0 = \frac{3}{2}\frac{kQ}{R} = \frac{3}{2}V_0$

$\therefore R_1 = 0$

for $V = \frac{5}{4}V_0$ $\quad \frac{kQ}{2R}\left(3 - \frac{r^2}{R^2}\right) = \frac{5}{4}\cdot\frac{kQ}{R}$

$R_2 = \frac{R}{\sqrt{2}}$

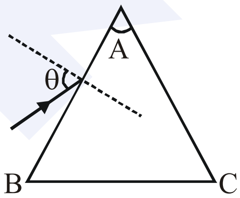
for $V = \frac{3}{4}V_0$ $\quad \frac{kQ}{R_3} = \frac{3}{4}\frac{kQ}{R}$

$R_3 = \frac{4R}{3}$

for $V = \frac{V_0}{4}$ $\quad \frac{kQ}{R_4} = \frac{kQ}{4R_0}$

$R_4 = 4R_0$.

21. Monochromatic light is incident on a glass prism of angle A. If the refractive index of the material of the prism is μ, a ray, incident at an angle θ, on the face AB would get transmitted through the face AC of the prism provided :



(1) $\theta > \cos^{-1}\left[\mu\sin\left(A + \sin^{-1}\left(\frac{1}{\mu}\right)\right)\right]$

(2) $\theta < \cos^{-1}\left[\mu\sin\left(A + \sin^{-1}\left(\frac{1}{\mu}\right)\right)\right]$

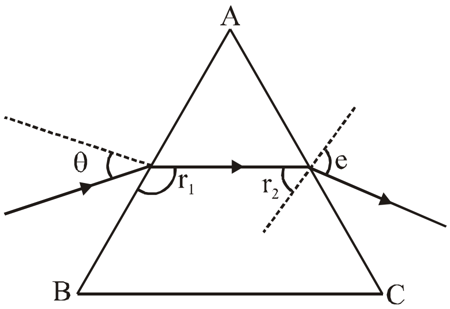
(3) $\theta > \sin^{-1}\left[\mu\sin\left(A - \sin^{-1}\left(\frac{1}{\mu}\right)\right)\right]$

(4) $\theta < \sin^{-1}\left[\mu\sin\left(A - \sin^{-1}\left(\frac{1}{\mu}\right)\right)\right]$

Ans. (3)

Sol.

(Prism)



For all light to come out from face AC angle of emergence $\boxed{e = 90}$

Apply Snell's Law at face AC

$\mu \sin r_2 = 1 \sin e$

$r_2 = \sin^{-1}\left(\frac{1}{\mu}\right)$ (if e = 90)

$r_1 = A - \sin^{-1}\left(\frac{1}{\mu}\right)$ $(\because r_1 + r_2 = A)$

Apply Snell's law at face AB

$1 \sin\theta = \mu \sin(r_1)$

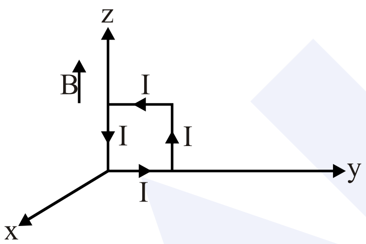
$\theta = \sin^{-1}\left(\mu \sin\left(A - \sin^{-1}\left(\frac{1}{\mu}\right)\right)\right)$

for all light transmitted through AC, $e < 90°$

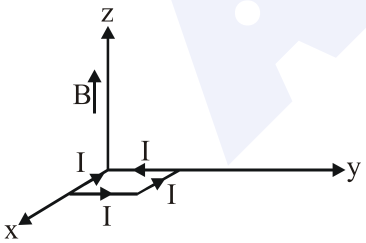
$\Rightarrow \quad \theta > \sin^{-1}\left(\mu \sin\left(A - \sin^{-1}\left(\frac{1}{\mu}\right)\right)\right)$

22. A rectangular loop of sides 10 cm and 5 cm carrying a current I of 12 A is place in different orientations as shown in the figures below :

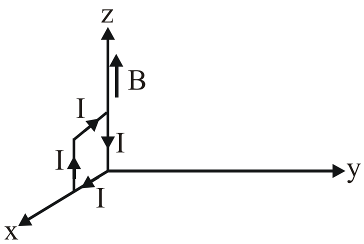
(a)



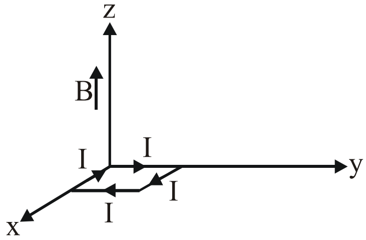
(b)



(c)



(d)



If there is a uniform magnetic field of 0.3 T in the positive z direction, in which orientations the loop would be in (i) stable equilibrium and (ii) unstable equilibrium ?

(1) (b) and (d), respectively

(2) (b) and (c), respectively

(3) (a) and (b), respectively

(4) (a) and (c), respectively

Ans. (1)

Sol. For stable equilibrium $\vec{B} \| \vec{M}$

For unstable equilibrium $\vec{B} \downarrow\uparrow \vec{M}$

B = magnetic field

M = magnetic moment

23. Two coaxial solenoids of different radii carry current I in the same direction. Let $\vec{F}_1$ be the magnetic force on the inner solenoid due to the outer one and $\vec{F}_2$ be the magnetic force on the outer solenoid due to the inner one. Then :

(1) $\vec{F}_1$ is radially inwards and $\vec{F}_2 = 0$

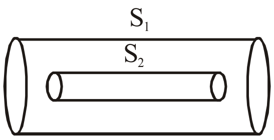
(2) $\vec{F}_1$ is radially outwards and $\vec{F}_2 = 0$

(3) $\vec{F}_1 = \vec{F}_2 = 0$

(4) $\vec{F}_1$ is radially inwards and $\vec{F}_2$ is radially outwards.

Ans. (3)

Sol.



Field due to solenoid 2 outside the solenoid is zero

$\therefore \quad \vec{f}_1 = 0$

Due to action reaction $\vec{f}_2 = 0$

or solenoid 2 behave as magnetic dipole

$$\vec{f}_2 = \frac{M\,dB}{dx}$$

field of 1 is uniform $\quad \therefore \frac{dB}{dx} = 0$

$f_2 = 0$

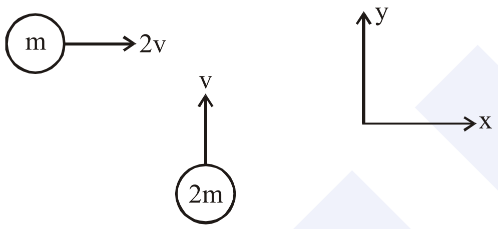
24. A particle of mass m moving in the x direction with speed 2υ is hit by another particle of mass 2m moving in the y direction with speed υ. If the collisions perfectly inelastic , the percentage loss in the energy during the collision is close to :

(1) 56 % (2) 62%

(3) 44% (4) 50%

Ans. (1)

Sol. **Before collison**



Kinetic energy $= \frac{1}{2}m(2v)^2 \times \frac{1}{2}2m(v)^2$

$= 3\ mv^2$

After collison

Applying momentum conservation for inelastic collision

$$2mv\hat{j} + m2v\hat{i} = 3m\,\vec{v}_f$$

$$|\vec{v}_f| = \sqrt{\frac{8}{9}}\,v$$

$$K_f = \frac{1}{2} \times 3m \times (v_f^2) = \frac{4mv^2}{3}$$

$$\%\ \Delta K = \frac{K_i - K_f}{K_i} = \frac{5mv^2/3}{3mv^2} = \frac{5}{9} = 56\%$$

25. Consider an ideal gas confined in an isolated closed chamber. As the gas undergoes an adiabatic expansion, the average time of collision between molecules increases as V^q, where V is the volume of the gas. The value of q is :-

$\left(\gamma = \frac{C_p}{C_v}\right)$

(1) $\frac{\gamma+1}{2}$ (2) $\frac{\gamma-1}{2}$

(3) $\frac{3\gamma+5}{6}$ (4) $\frac{3\gamma-5}{6}$

Ans. (1)

Sol. $\tau \propto \frac{\text{Volume}}{v_{avg}}$

$\tau \propto V^1 T^{-1/2}$

For adiabatic process

$T \propto V^{1-\gamma}$

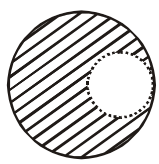
$\tau \propto V^1 T^{-1/2} \propto V^{\frac{\gamma+1}{2}}$

comparing

$$\boxed{q = \frac{\gamma+1}{2}}$$

26. From a solid sphere of mass M and radius R, a spherical portion of radius $\frac{R}{2}$ is removed, as shown in the figure. Taking gravitational potential V = 0 at r = ∞, the potential at the centre of the cavity thus formed is :

(G = *gravitational constant*)



(1) $\frac{-2GM}{3R}$ (2) $\frac{-2GM}{R}$

(3) $\frac{-GM}{2R}$ (4) $\frac{-GM}{R}$

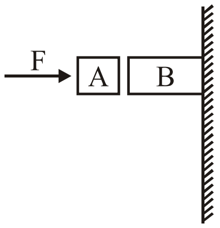
Ans. (4)

Sol. By principle of superosition

$$V = -\frac{GM}{2R^3}\left[3R^2 - \frac{R^2}{4}\right] + \frac{3G}{2}\frac{M}{8\frac{R}{2}}$$

$$= \frac{-11\,GM}{8R} + \frac{3GM}{8R} = -\frac{GM}{R}$$

27.



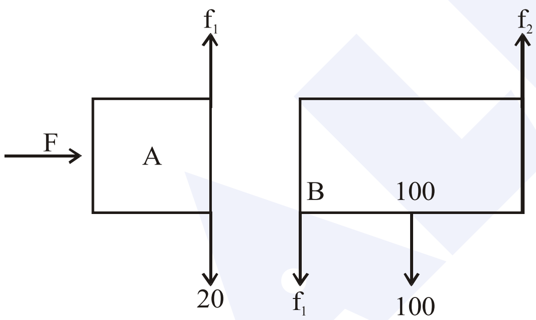
Given in the figure are two blocks A and B of weight 20 N and 100 N, respectively. These are being pressed against a wall by a force F as shown. If the coefficient of friction between the blocks is 0.1 and between block B and the wall is 0.15, the frictional force applied by the wall on block B is :-

(1) 120 N (2) 150 N

(3) 100 N (4) 80 N

Ans. (1)

Sol.



for equllibrrium of A

$f_1 = 20$

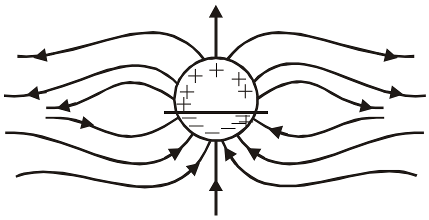
for equllibrrium of B

$f_2 = f_1 + 100$

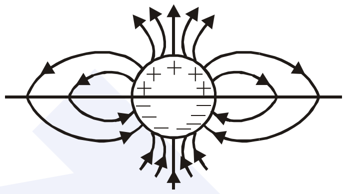
$f_2 = 120$ N

28. A long cylindrical shell carries positive surface charge σ in the upper half and negative surface charge $-\sigma$ in the lower half. The electric field lines around the cylinder will look like figure given in : (figures are schematic and not drawn to scale)

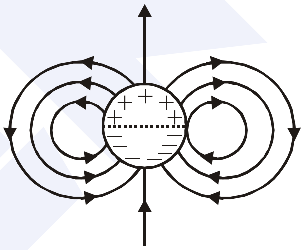
(1)



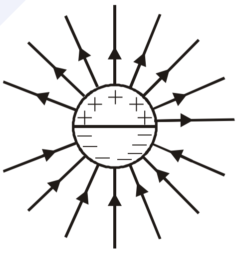
(2)



(3)

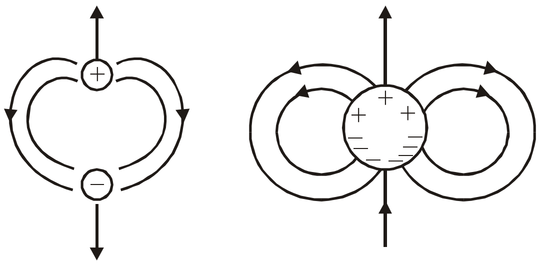


(4)



Ans. (3)

It behaves as a dipole.



29. As an electron makes a transition from an excited state to the ground state of a hydrogen - like atom/ion :

(1) kinetic energy decreases, potential energy increases but total energy remains same

(2) kinetic energy and total energy decrease but potential energy increases

(3) its kinetic energy increases but potential energy and total energy decreases

(4) kinetic energy, potential energy and total energy decrease

Ans. (3)

Sol. $K = +13.6\frac{z^2}{n^2}$ as n decreases k increases

$U = -27.2\frac{z^2}{n^2}$

$T = -13.6\frac{z^2}{n^2}$

} as n decrease U & T decrease

30. Match List-I (Fundament Experiment) with List-II (its conclusion) and select the correct option from the choices given below the list :

	List-I		List-II
(A)	Franck-Hertz Experiment.	(i)	Particle nature of light
(B)	Photo-electric experiment	(iii)	Discrete energy levels of atom
(C)	Davison-Germer Experiment	(iiii)	Wave nature of electroc
		(iv)	Structure of atom

(1) A-ii, B-i, C-iii (2) A-iv, B-iii, C-ii

(3) A-i, B-iv, C-iii (4) A-ii, B-iv, C-iii

Ans. (1)

Sol. Self Explanatory/Theory

(A) Franck-Hertz experiment explains disrete energy levels of atom

(B) Photo-electric experiment explain particle nature of light

(C) Davison Germer experiment explain wave nature of electron.