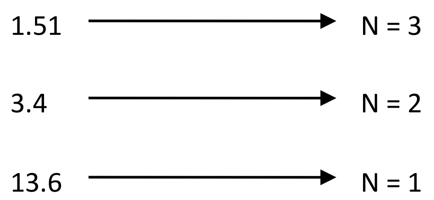
# PHYSICS
# JEE-MAIN (July-Attempt) 20 July
# (Shift-1) Paper

**SECTION - A**

**1.** The radiation corresponding to $3 \rightarrow 2$ transition of a hydrogen atom falls on a gold surface to generate photoelectrons. These electrons are passed through a magnetic field of $5 \times 10^{-4}$ T. Assume that the radius of the largest circular path followed by these electrons is 7 mm, the work function of the metal is :
(Mass of electron = $9.1 \times 10^{-31}$ kg)

(1) 0.82 eV (2) 0.16 eV (3) 1.88 eV (4) 1.36 eV

**Sol. 1**




$3 \rightarrow 2 \Rightarrow 1.89\text{eV}$

$5 \times 10^{-4}$ T r = 7mm

$r = \frac{mv}{qB} \Rightarrow mv = qrB$

$\Rightarrow E = \frac{p^2}{2m} = \frac{(qRB)^2}{2m}$

$= \frac{(1.6\times10^{-19}\times7\times10^{-3}\times5\times10^{-4})^2}{2\times9.1\times10^{-31}\text{Joule}}$

$= \frac{3136\times10^{-52}}{18.2\times10^{-31}\times1.6\times10^{-19}}\text{eV}$

= 1.077 eV

We know work function = energy incident $-(KE)_{electron}$

$\Phi$ = 1.89-1.077 = 0.813 eV

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**2.** If $\vec{A}$ and $\vec{B}$ are two vectors satisfying the relation $\vec{A}.\vec{B} = \left[\vec{A} \times \vec{B}\right]$. Then the value of $\left[\vec{A} - \vec{B}\right]$. will be :

(1) $\sqrt{A^2 + B^2 - \sqrt{2}AB}$ (2) $\sqrt{A^2 + B^2}$

(3) $\sqrt{A^2 + B^2 + \sqrt{2}AB}$ (4) $\sqrt{A^2 + B^2 + \sqrt{2}AB}$

**Sol. 1**

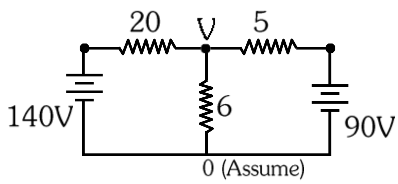
$\vec{A}.\vec{B} = |\vec{A} \times \vec{B}|$

$AB\cos\theta = AB\sin\theta \Rightarrow \theta = 45^o$

$|\vec{A} - \vec{B}| = \sqrt{A^2 + B^2 - 2AB\cos 45^o}$

$= \sqrt{A^2 + B^2 - \sqrt{2}AB}$

**3.** The value of current in the $6\Omega$ resistance is :




(1) 4A (2) 6A (3) 8A (4) 10A

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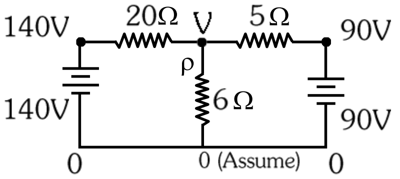
**Sol. 4**




Applying KCL at point P,

$$\frac{V-0}{6} + \frac{V-90}{5} + \frac{V-140}{20} = 0$$

$\Rightarrow 10\,V + 12\,V - 1080 + 3V - 420 = 0$

$\Rightarrow V = 60$

$\therefore$ Current in $6\Omega = \frac{V-0}{6} = 10\ A$

**4.** A deuteron and an alpha particle having equal kinetic energy enter perpendicular into a magnetic field. Let $r_d$ and $r_\alpha$ be their respective radii of circular path. The value of $\frac{r_d}{r_\alpha}$ is equal to

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

**Sol. 1**

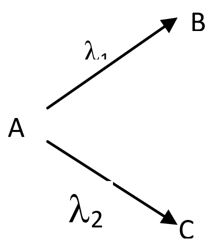
$$r = \frac{mv}{qB} = \frac{\sqrt{2mk}}{qB}$$

$$\frac{r_d}{r_\alpha} = \sqrt{\frac{m_d}{m_\alpha}}\frac{q_\alpha}{q_\delta} = \sqrt{\frac{2}{4}}\left(\frac{2}{1}\right) = \sqrt{2}$$

**5.** A radioactive material decays by simultaneous emissions of two particles with half lives of 1400 years and 700 years respectively. What will be the time after which one third of the material remains ? (Take ln3 = 1.1)

(1)1110 years (2) 340 years (3) 740 years (4) 700 years

**Sol. 3**




$$\text{Given}\lambda_1 = \frac{\ell n\,2}{700}/\text{year}, \lambda_2 = \frac{\ell n\,2}{1400}/\text{year}$$

$$\therefore \lambda_{net} = \lambda_1 + \lambda_2 = \ell n\,2\left[\frac{1}{700} + \frac{1}{1400}\right] = \frac{3\ell n\,2}{1400}/\text{year}$$

Now, Let initial no. of radioactive nuclei be No

$$\therefore \frac{N_0}{3} = N_0 e^{-\lambda_{net}t}$$

$$\Rightarrow \ell n\frac{1}{3} = -\lambda_{net}t$$

$$\Rightarrow 1.1\frac{3\times 0.693}{1400}t \Rightarrow t \approx 740\text{year}$$

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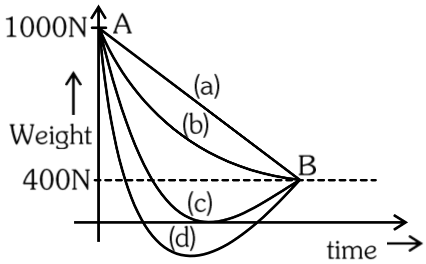
**6.** A person whose mass is 100 kg travels from Earth to Mars in a spaceship. Neglect all other objects in sky and take acceleration due to gravity on the surface of the Earth and Mars as 10 $m/s^2$ and 4 $m/s^2$ respectively. Identify from the below figures, the curve that fits best for the weight of the passenger as a function of time.




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

**Sol.** **3**

At neutral point g = 0

**7.** The amount of heat needed to raise the temperature of 4 moles of a rigid diatomic gas from 0°C to 50°C when no work is done is____. (R is the universal gas constant)

(1) 750 R (2) 175 R (3) 500 R (4) 250 R

**Sol.** **3**

$\Delta Q = \Delta U + \Delta W$

Here $\Delta W = 0$

$\Delta Q = \Delta U = nC_v\Delta T$

$\Delta Q = 4 \times \frac{5R}{2}(50) = 500R$

**8.** The value of tension in a long thin metal wire has been changed from $T_1$ to $T_2$. The lengths of the metal wire at two different values of tension $T_1$ and $T_2$ are $l_1$ and $l_2$ respectively. The actual length of the metal wire is :

(1) $\frac{T_1l_2 - T_2l_1}{T_1 - T_2}$ (2) $\sqrt{T_1T_2l_1l_2}$ (3) $\frac{l_1 + l_2}{2}$ (4) $\frac{T_1l_1 - T_2l_2}{T_1 - T_2}$

**Sol.** **1**

$Y = \frac{FL}{A\Delta L} \Rightarrow F = \left(\frac{AY}{L}\right)\Delta L$

$\therefore$ F = kx

$T_1 = k(\ell_1 - \ell_0)$ ....(i)

$T_2 = k(\ell_2 - \ell_0)$ ....(ii)

$\frac{eq(i)}{eq(ii)} = \frac{T_1}{T_2} = \frac{\ell_1 - \ell_0}{\ell_2 - \ell_0}$

$T_2\ell_1 - T_2\ell_0 = T_1\ell_2 - T_1\ell_0$

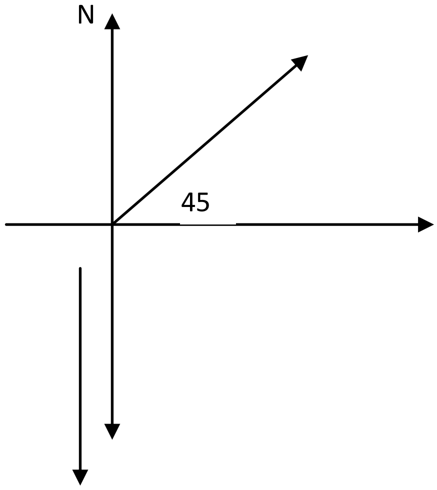
$(T_1 - T_2)\ell_0 = T_1\ell_2 - T_2\ell_0$

$\ell_0 = \left(\frac{T_1\ell_2 - T_2\ell_1}{T_1 - T_2}\right)$

**9.** A butterfly is flying with a velocity $4\sqrt{2}$ m/s in North-East direction. Wind is slowly blowing at 1 m/s from North to South. The resultant displacement of the butterfly in 3 seconds is :

(1) 15 m (2) $12\sqrt{2}$m (3) 3 m (4) 20 m

**Sol.** 1




$\vec{V}_{BW} = 4\sqrt{2}\cos 45\hat{i} + 4\sqrt{2}\sin 45\hat{j}$

$= 4\hat{i} + 4\hat{j}$

$\vec{V}_w = -\hat{j}$

$\vec{V}_B = \vec{V}_{BW} + \vec{V}_w = 4\hat{i} + 3\hat{j}$

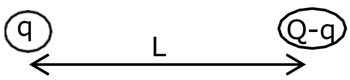
$\vec{S}_B = \vec{V}_B \times t = (4\hat{i} + 3\hat{j}) \times 3 = 12\hat{i} + 9\hat{j}$

$|\vec{S}_B| = \sqrt{(12)^2 + (9)^2} = 15\text{m}$

**10.** A certain charge Q is divided into two parts q and (Q-q). How should the charges Q and q be divided so that q and (Q-q) placed at a certain distance apart experience maximum electrostatic repulsion?

(1) $Q = \frac{q}{2}$ (2) $Q = 3q$ (3) Q = 2q (4) Q = 4q

**Sol.** 3




$F = \frac{kQ(Q-q)}{\pi^2}$

$\frac{dF}{dq} = 0$ When force is maximum

$\frac{dF}{dq} = \frac{k}{L^2}[Q - 2q] = 0$

$\Rightarrow Q - 2q = 0 \Rightarrow Q = 2q$

**11.** The entropy of any system is given by

$S = \alpha^2\beta \ln\left[\frac{\mu kR}{J\beta^2} + 3\right]$

Where $\alpha$ and $\beta$ are the constants. $\mu$,J,K and R are no. of moles, mechanical equivalent of heat, Boltzmann constant and gas constant repectively. [Take $S = \frac{dQ}{T}$]

Choose the incorrect option from the following :

(1) S, $\beta$, k and $\mu$R have the same dimensions.

(2) $\alpha$ and J have the same dimensions.

(3) S and $\alpha$ have different dimensions.

(4) $\alpha$ and k have the same dimensions.

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**Sol.** **4**

$$S=\alpha^2\beta\ell n\left(\frac{\mu KR}{j\beta^2}+3\right)$$

$$S=\frac{Q}{T}=Joule/k$$

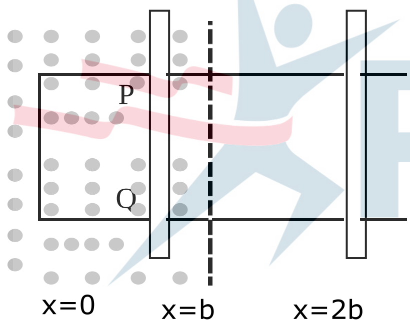
PV = nRT $\qquad \left[\frac{\mu KR}{J\beta^2}\right]=1$

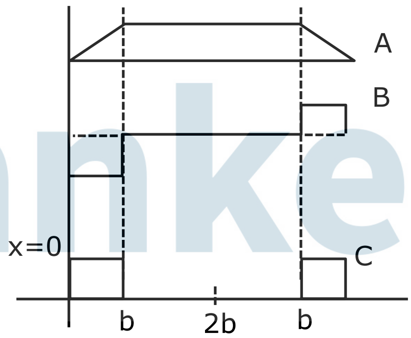
$$R=\frac{Joule}{K}$$

$$\Rightarrow \beta=\left(\frac{Joule}{K}\right)$$

$$\Rightarrow \alpha=\text{dimensionless}$$

**12.** The arm PQ of a rectangular conductor is moving from x=0 to x=2b outwards and then inwards from x=2b to x=0 as shown in the figure. A uniform magnetic field perpendicular to the plane is acting from x=0 to x=b. Identify the graph showing the variation of different quantities with distance.




(1) A-Flux, B-EMF, C-Power dissipated (2) A-Power dissipated, B-Flux, C-EMF
(3) A-Flux, B-Power, dissipated, C-EMF (4) A-EMF, B-Power dissipeated, C-Flux

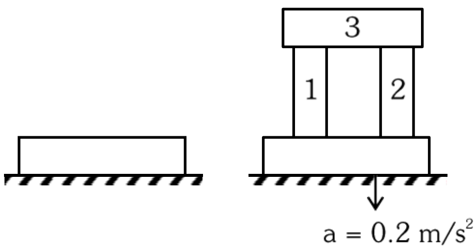
**Sol.** **1**

As rod moves in field area increases upto x = b then field is absent and again flux is generated on return journey from x = b to x = 0. Thus plot A for flux.

$$\Rightarrow e=-\frac{d\phi}{dt}\Rightarrow curve\ B\ for\ emf$$

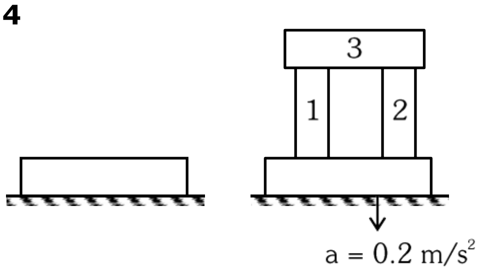
$\Rightarrow$ Power dissipated = vi $\Rightarrow$ curve C for power dissipated

**13.** A steel block of 10 kg rests on a horizontal floor as shown. When three iron cylinders are placed on it as shown, the block and cylinders go down with an acceleration 0.2m/s$^2$. The normal reaction R' by the floor if mass of the iron cylinders are equal and of 20 kg each, is ___________ N.
[Take g= 10 m/s$^2$ and $\mu_s$ = 0.2]



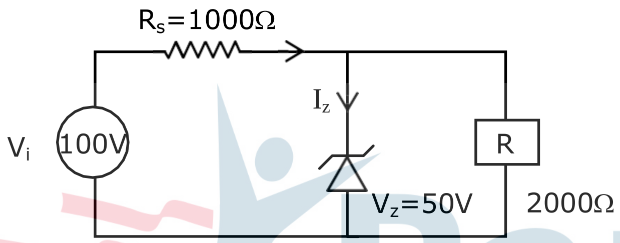

(1) 714 (2) 716 (3) 684 (4) 686

**Sol.** **4**




Writing force equation in vertical direction
Mg – N = Ma
$\Rightarrow$ 70g – N = 70 × 0.2
$\Rightarrow$ N = 70 [g-0.2] = 70 × 9.8
$\therefore$ N = 686 Newton
Note : Since there is no compressive normal from the sides, hence friction will not act.

**14.** For the circuit shown below, calculate the value of $I_z$ :

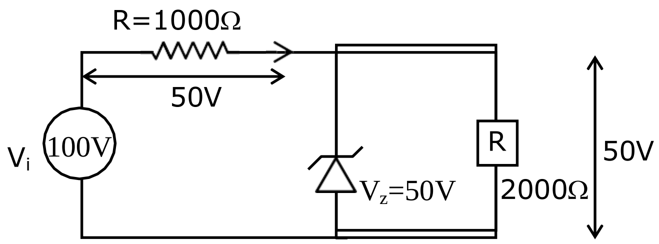



(1) 0.15 A (2) 0.05 A (3) 0.1 A (4) 25 mA

**Sol.** **4**

$I = \frac{50}{1000} = 50mA$

R = 1000Ω




$I = \frac{50}{2000} = 25mA$

$I_z = I_{1000} - I_{2000}$
= 50 -25 = 25 mA

**15.** A nucleus of masss M emits ϒ-ray photon of frequency 'v'. The loss of internal energy by the nucleus is :

(1) 0 (2) $hv\left[1+\frac{hv}{2Mc^2}\right]$ (3) hv (4) $hv\left[1-\frac{hv}{2Mc^2}\right]$

**Sol.** **2**

$Energy\ of\ \gamma\ ray[E_\gamma] = hv$

Momentum of γ ray $[P_\gamma] = \frac{h}{\gamma} = \frac{hv}{C}$

Total momentum is conserved

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$\vec{P}_\gamma + \vec{P}_{Nu} = 0$

Where $\vec{P}_{Nu}$ = Momentum of decayed nuclei

$\Rightarrow P_\gamma = P_{Nu} \Rightarrow \frac{hv}{C} = P_{Nu}$

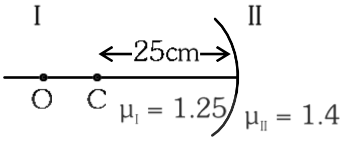
$\Rightarrow$ K.E of nuclei

$= \frac{1}{2}Mv^2 = \frac{(P_{Nu})^2}{2M} = \frac{1}{2M}\left[\frac{hv}{C}\right]^{22}$

Loss in internal energy = $E_\gamma + K.E_{Nu}$

$= hv + \frac{1}{2M}\left[\frac{hv}{C}\right]^2 = hv\left[1 + \frac{hv}{2MC^2}\right]$

**16.** Region I and II are separated by a spherical surface of radius 25 cm. An object is kept in region I at a distance of 40 cm from the surface. The distance of the image from the surface is :




(1) 55.44 cm (2) 9.52 cm (3) 37.58 cm (4) 18.23 cm

**Sol.** **3**

$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$

$\frac{1.4}{v} - \frac{1.25}{-40} = \frac{1.4 - 1.25}{-25}$

$\frac{1.4}{v} = -\frac{0.15}{25} - \frac{1.25}{40}$

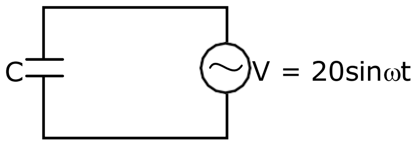
$v = -37.58\,\text{cm}$

**17.** AC voltage V(t)=20 sinωt of frequency 50 Hz is applied to a parallel plate capacitor. The separation between the plates is 2mm and the area is 1 $m^2$. The amplitude of the oscillating displacement current for the applied AC voltage is__________.

[Take $\varepsilon_0 = 8.85\times10^{-12}$ F/m]

(1) 21.14 μA (2) 83.37 μA (3) 55.58 μA (4) 27.79 μA

**Sol.** **4**




From the given information,

$C = \frac{\epsilon_0 A}{d} = k\frac{\epsilon_0 \times 1}{2\times10^{-3}}F$

$\therefore X_C = \frac{1}{\omega C} = \frac{2\times10^{-3}}{2\times50\pi\times\epsilon_0} = \frac{2\times10^{-3}}{25\times4\pi\epsilon_0}\Omega$

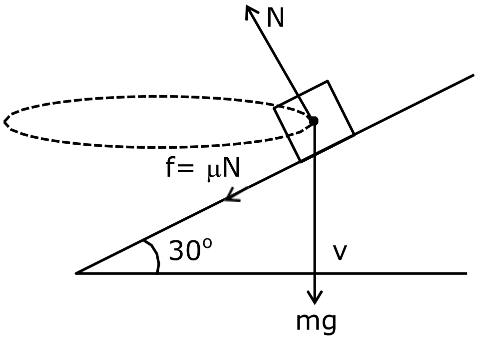
$\therefore X_C = \frac{2\times10^{-3}}{25}\times9\times10^9 = \frac{18}{25}\times10^6\Omega$

$\therefore i_0 = \frac{V_0}{X_C} = \frac{20\times25}{18}\times10^{-6}A = 27.47\mu A.$

The value of amplitude of displacement current will be same as value of amplitude of conventional current.

**18.** The normal reaction 'N' for a vehicle of 800 kg mass, negotiating a turn on a 30° banked road at maximum possible speed without skidding is __________ $\times 10^3$ kg m/s$^2$.
[Given cos30°=0.87, $\mu_s$=0.2]
(1) 12.4 (2) 7.2 (3) 6.96 (4) 10.2

**Sol.** **4**




At $V_{max}$, f will be limiting in nature.
∴ Balancing force in vertical direction,
$N\cos 30^\circ - mg - \mu N\cos 60^\circ = 0$
$\Rightarrow N[\cos 30^\circ - \mu\cos 60^\circ] = mg$
$\therefore N = \dfrac{800\times 10}{(0.87-0.1)} \approx 10.2\times 10^3 kgm/s^2$

**19.** A current of 5 A is passing through a non-linear magnesium wire of cross-section 0.04 m$^2$. At every point the direction of current density is at an angle of 60° with the unit vector of area of cross-section. The magnitude of electric field at every point of the conductor is :
(1) $11\times10^{-3}$ V/m (2) $11\times10^{-5}$ V/m (3) $11\times10^{-7}$ V/m (4) $11\times10^{-2}$ V/m

**Sol.** **2**

$I = \vec{J}.\vec{A} = JA\cos(\theta)$

$5 = J\left(\dfrac{4}{100}\right)\times\cos(60)$

$J = 5\times 50 = 250\ A/m^2$

Now, $\vec{E} = \rho.\vec{J}$

$= 44\times10^{-8}\times250 = 11\times10^{-5}$ V/m

**20.** Consider a mixture of gas molecule of types A, B and C having masses $m_A<m_B<m_C$ ratio of their root mean square speeds at normal temperature and pressure is :
(1) $\upsilon_A = \upsilon_B \neq \upsilon_C$ (2) $\dfrac{1}{\upsilon_A} > \dfrac{1}{\upsilon_B} > \dfrac{1}{\upsilon_C}$ (3) $\upsilon_A = \upsilon_B = \upsilon_C = 0$ (4) $\dfrac{1}{\upsilon_A} < \dfrac{1}{\upsilon_B} < \dfrac{1}{\upsilon_C}$

**Sol.** **4**

$V_{RMS} = \sqrt{\dfrac{3RT}{M}}$

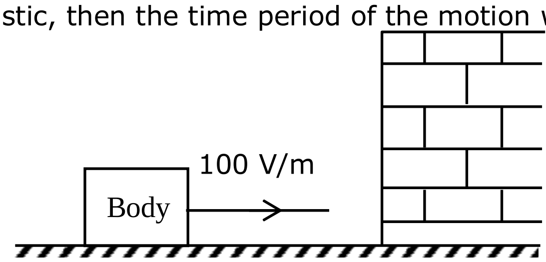
$m_A < m_B < m_c$

$\Rightarrow V_A > V_B > V_C$

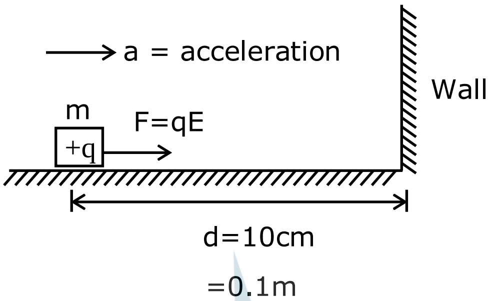
$\Rightarrow \dfrac{1}{V_A} < \dfrac{1}{V_B} < \dfrac{1}{V_C}$

## Section B

**1.** A body having specific charge 8 μC/g is resting on a frictionless plane at a distance 10 cm from the wall (as shown in the figure). It starts moving towards the wall when a uniform electric field of 100 V/m is applied horizontally toward the wall. If the collision of the body with the wall is perfectly elastic, then the time period of the motion will be __________s.




**Sol. 1**




$F = ma$

$qE = ma$

$a = \frac{qE}{m}$

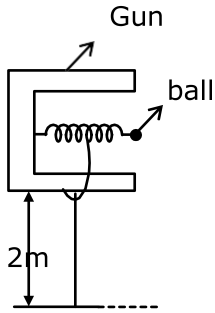
Now $d = \frac{1}{2}at^2$

$t = \sqrt{\frac{2d}{a}}$

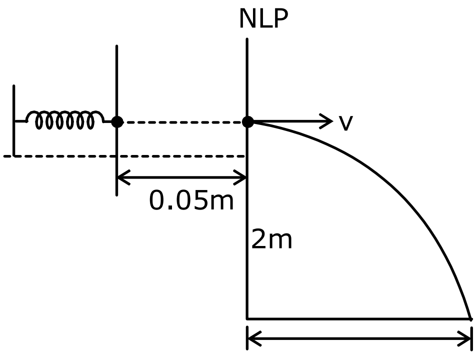
$t = \sqrt{\frac{2d}{\left(\frac{qE}{m}\right)}}$

$t = \sqrt{\frac{2 \times 0.1}{\left(\frac{8 \times 10^{-6}}{m10^{-3}}\right) \times 100}} = \frac{1}{2}$

**2.** In a spring gun having spring constant 100 N/m a small ball 'B' of mass 100 g is put in its barrel (as shown in figure) by compressing the spring through 0.05 m. There should be a box placed at a distance 'd' on the ground so that the ball falls in it. If the ball leaves the gun horizontally at a height of 2 m above the ground. The value of d is___________m. ($g = 10\ m/s^2$).



**Sol. 1**




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

$kx^2 = mv^2$

$V = x\sqrt{\frac{k}{m}} = 0.05\sqrt{\frac{100}{1}} = 0.05 \times 10\sqrt{10}$

$v = 0.5\sqrt{10}$

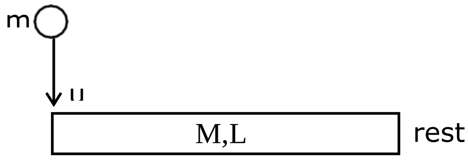
From $h = \frac{1}{2}gt^2$

$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 2}{10}} = \frac{2}{\sqrt{10}}$

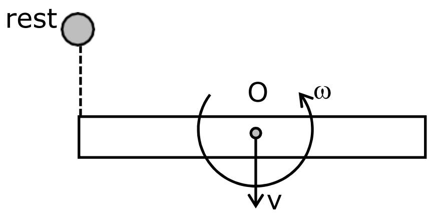
$\therefore d = vt = 0.5\sqrt{10} \times \frac{2}{\sqrt{10}} = 1m$

**3.** A rod of mass M and length L is lying on a horizontal frictionless surface. A particle of mass 'm' travelling along the surface hits at one end of the rod with velocity 'u' in a direction perpendicular to the rod. The collision is completely elastic. After collision, particle comes to rest. The ratio of masses $\left(\frac{m}{M}\right)$ is $\frac{1}{x}$. The value of 'x' will be ____________.

**Sol. 4**




Just before collision




Just after collision
From momentum conservation , $P_i^o = p_F$
mu = Mv ......(i)
From angular momentum conservation about O,

$mu.\frac{L}{2} = \frac{ML^2}{12}\omega$

$\Rightarrow \omega = \frac{6mu}{ML}$ .....(ii0

From $e = \frac{R.V.S}{R.V.A}$

$1 = \frac{V + \frac{\omega L}{2}}{u}$

$v + \frac{\omega L}{2} = u$

$v + \frac{3mu}{M} = u$

$\frac{mu}{M} + \frac{3mu}{M} = u$

$\frac{4mu}{M} = u$

$\frac{m}{M} = \frac{1}{4}$

X = 4

**4.** An object viewed from a near point distance of 25 cm, using a microscopic lens with magnification '6', gives an unresolved image. A resolved image is observed at infinite distance with a total magnification double the earlier using an eyepiece along with the given lens and a tube of length 0.6 m, if the focal length of the eyepiece is euqal to______cm.

**Sol. 25**

For simple microscope,

$m = 1 + \frac{D}{f_0}$

$6 = 1 + \frac{D}{f_0}$

$5 = \frac{25}{f_0}$

$f_0 = 5\,cm$

For compound microscope,

$m = \frac{l.D}{f_0.f_e}$

$12 = \frac{60 \times 25}{5.f_e}$

**5.** In an LCR series circuit, an inductor 30 mH and a resistor 1 Ω are connected to an AC source of angular frequency 300 rad/s. The value of capacitance for which, the current leads the voltage by $45^o$ is $\frac{1}{x} \times 10^{-3}$ F. Then the value of x is______________.

**Sol. 3**

$\tan\phi = \frac{X_C - X_L}{R}$

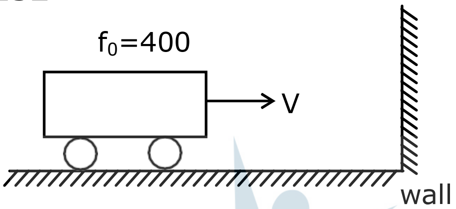
$\tan 45 = \frac{X_C - X_L}{R}$

$X_C - X_L = R$

$$\frac{1}{\omega C} - \omega L = R$$
$$\frac{1}{\omega C} - 300 \times 0.03 = 1$$
$$\frac{1}{\omega C} = 10$$
$$C = \frac{1}{10\omega} = \frac{1}{10 \times 300}$$
$$C = \frac{1}{3} \times 10^{-3}$$
X = 3

**6.** The frequency of a car horn encountered a change from 400 Hz to 500 Hz, when the car approaches a vertical wall. If the speed of sound is 330 m/s. Then the speed of car is _______ km/h.

**Sol. 132**




Wall as an observer
Frequency received by wall
$$f_1 = f_0\left(\frac{C}{C - V}\right)$$
Again wall as a source
Frequency received by observer on car
$$f_2 = f_1\left(\frac{C + V}{C}\right)$$
$$500 = 400\left(\frac{C + V}{C - V}\right)$$
$$\frac{5}{4} = \frac{C + V}{C - V}$$
C = 9V
$$V = \frac{C}{9} = \frac{330}{9}\,m/s$$
$$V = \frac{330}{9} \times \frac{18}{5} = 132\,km/hr$$

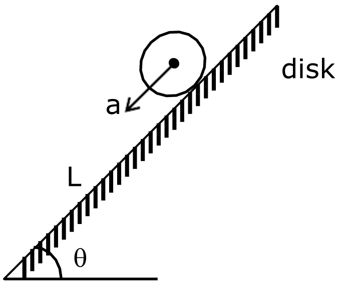
**7.** A carrier wave $V_c(t) = 160 \sin(2\pi\times10^6 t)$ volts is made to vary between $V_{max}$ =200 V and $V_{min}$ = 120 V by a message signal $V_m(t)=A_m \sin(2\pi\times10^3 t)$ volts. The peak voltage $A_m$ of the modulating signal is___________.

**Sol. 40**

$A_{max} = A_m + A_C$
$\Rightarrow v_{max} = V_m + V_C$
$200 = V_m + 160$
$V_m = 40$
$\therefore$ Peak voltage $A_m = 40$
Ans. 40

**8.** A circular disc reaches from top to bottom of an inclined plane of length 'L'. When it slips down the plane, it takes time '$t_1$'.when it rolls down the plane, it takes time $t_2$. The value of $\frac{t_2}{t_1}$ is $\sqrt{\frac{3}{x}}$. The value of x will be________.

**Sol. 2**




If disk slips on inclined plane, then it's aceleration

$a_1 = g\sin\theta$

$L = \frac{1}{2}a_1 t_1^2$

$\Rightarrow t_1 = \sqrt{\frac{2L}{a_1}}$ .....(i)

If disk rols on inclined plane, its acceleration,

$a_2 = \frac{g\sin\theta}{1+\frac{I}{mR^2}}$

$a_2 = \frac{g\sin\theta}{1+\frac{mR^2}{2mR^2}}$

$a_2 = \frac{2}{3}g\sin\theta$

Now $L = \frac{1}{2}a_2.t_2^2$

$\Rightarrow t_2 = \sqrt{\frac{2L}{a_2}}$ .....(ii0

Now $\frac{t_2}{t_1} = \sqrt{\frac{a_1}{a_2}} = \sqrt{\frac{3}{2}}$

$\Rightarrow x = 2$

**9.** The amplitude of wave disturbance propagating in the positive x-direction is given by $y = \frac{1}{(1+x)^2}$ at time t=0 and $y = \frac{1}{1+(x-2)^2}$ at t=1 s, where x and y are in metres. The shape of wave does not change during the propagation. The velocity of the wave will be_____m/s.

**Sol. 2**

At t = 0, Y= $\frac{1}{1+x^2}$

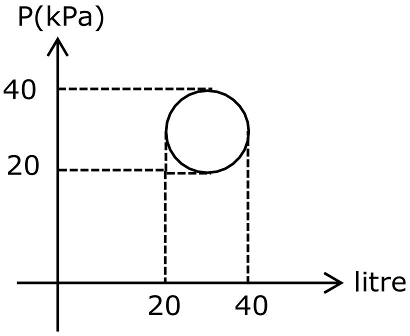
At time t = t, y = $\frac{1}{1+(x-vt)^2}$

At t = 1, y = $\frac{1}{1+(x-v)^2}$ .....(i)

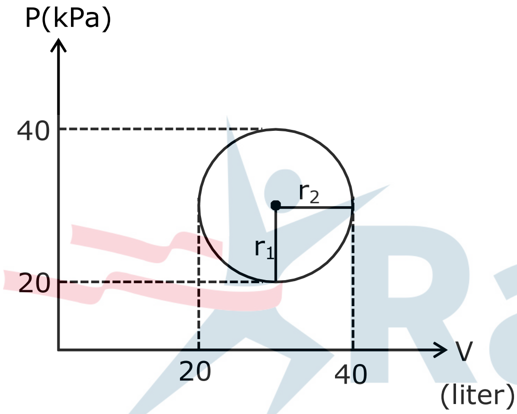
At t = 1, y = $\frac{1}{1+(x-2)^2}$ ......(ii)

comparing (i) & (ii)

**10** In the reported figure, heat energy absorbed by a system in going through a cyclic process is________$\pi$J.




**Sol. 100**




For complete cyclic process

$\Delta U = 0$

$\therefore$ from $\Delta Q = \Delta U + W$

$= 0 + W$

$\Delta Q = W$

= Area

$= \pi r_1 . r_2$

$= \pi \times (10\times10^3)(10\times10^{-3})$

$\Delta Q = 100\pi$

$\therefore$ Ans. = 100