JEE-Main-26-06-2022-Shift-1 (Memory Based)

Physics

Question: A wave of wavelength $=3Ghz$ strikes a particle of size $\frac{1}{100}$ th of λ then this phenomenon is called as

Options:

(a) Diffraction

(b) Scattering

(c) Reflection

(d) Refraction

Answer: (a)

Solution:

For the given wavelength and obstacle size, diffraction will happen.

Question: A ball of mass 0.5 gm is released from height 10 m from rest. Find height where magnitude of acceleration and velocity is same

Options:

(a) 7 m

(b) 5 m

(c) 3 m

(d) 2 m

Answer: (b)

Solution:

We need $\left|\vec{a}\right|=\left|\vec{v}\right|$

$\Rightarrow g=u+at=0+gt$

$\Rightarrow \boxed{t=1\sec}$

Distance travelled in 1 sec

$x=ut+\frac{1}{2}gt^2=\frac{1}{2}(10)(1)^2$

$=5m$

$\therefore$ Height from the ground

$= 10 - 5 = 5\text{m}$

Question: A ring (m, r) rotating at angular speed ω has two point masses (m_1) attached to its circumference. Their find angular speed is?

Options:

(a) $\frac{m\omega}{m-2m_1}$

(b) $\frac{m\omega}{m+1m_1}$

(c) $\frac{m\omega}{m-2m}$

(d) $\frac{m\omega}{m+2m_1}$

Answer: (d)

Solution:

$I_1\omega_i = I_2\omega_2$

$mr^2\omega = \left(mx^2 + m_1r^2 \times 2\right)\omega_f$

$m\omega = \left(m+2m_1\right)\omega_f$

$\omega_f = \frac{m\omega}{m+2m_1}$

Question: An ideal Gas having molecular mass m_0 is in a container moving with velocity v. If container is suddenly stopped, then find the rise in m temp of Gas. [r = 1.4]

Options:

(a) $\frac{m_0v^2}{5R}$

(b) $\frac{m_0v^2}{1R}$

(c) $\frac{m_0v^2}{3R}$

(d) $\frac{m_0v^2}{4R}$

Answer: (a)

Solution:

Since r = 1.4, it is a diatomic gas.

K.E. of n moles of gas $= \frac{1}{2}m\,nv^2$

Loss in this K.E. = Gain in internal energy

$= \frac{1}{2}mnv^2 = ncv\,\Delta T = n\left(\frac{5}{2}R\right)\Delta T$

$\Rightarrow \Delta T = \frac{m_0v^2}{5R}$

Question: An α particle and proton enter magnetic field with same speed. Find ratio of radius of α particle to proton.

Options:

(a) $\frac{3}{2}$

(b) $\frac{2}{1}$

(c) $\frac{1}{2}$

(d) $\frac{2}{4}$

Answer: (a)

Solution:

$$R = \frac{mv}{qB}$$

$$R_\alpha = \frac{m_\alpha v}{q_\alpha B}$$

$$\vec{R}_p = \frac{m_p v}{q_p B} = \frac{q_p m_\alpha}{m_p q_\alpha}$$

$$= \frac{e(4m)}{m(2e)}$$

$$= \frac{2}{1}$$

Question: A ball is thrown vertically upward. At the maximum height. Which of the following is zero?

Options:

(a) Momentum

(b) P.E

(c) Acceleration

(d) Force

Answer: (a)

Solution:

At max height, ball stops momentarily before changing its direction. Hence momentum i.e. mv is zero.

Question: The magnetic flux strength a surface is changing with time as $\phi = 5t^3 + 4t^2 + 2t$. The resistance of coil is 5Ω. Find current at t = 2 sec.

Options:

(a) 14.3 A

(b) 13.2 A

(c) 15.6 A

(d) 16.1 A

Answer: (c)

Solution:

$\phi = 5t^3 + 4t^2 + 2t$

$R = 5\Omega$

$|\varepsilon| = \frac{d\phi}{dt} = 15t^2 + 8t + 2$

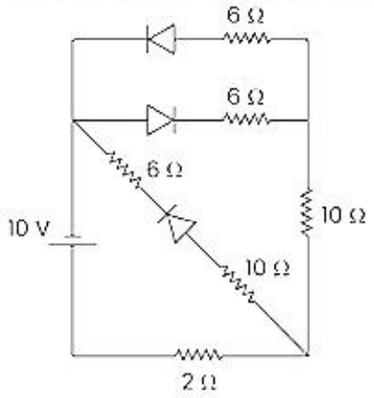
At $t = 2$ sec

$|\varepsilon| = 15(2)^2 + 8(2) + 2$

$= 78$

$\therefore i = \frac{78}{5} = 15.6A$

Question: Find current delivered by battery



Options:

(a) 1 Amp

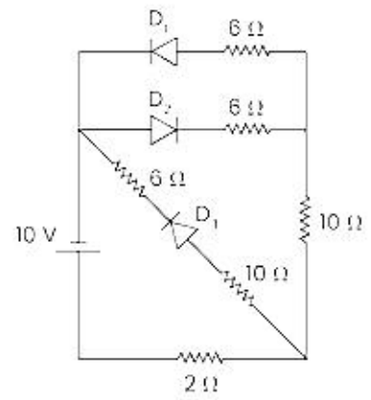
(b) 3 Amp

(c) 5 Amp

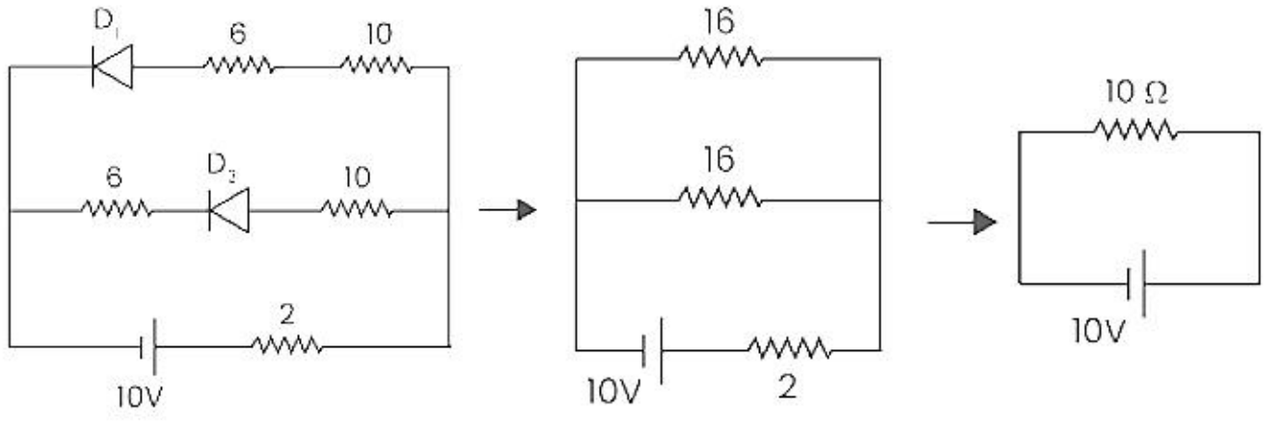
(d) 2 Amp

Answer: (a)

Solution:

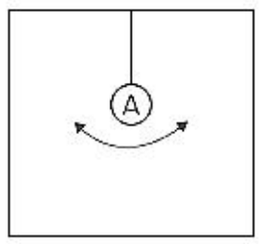


D_2 is reverse biased, therefore



$$i = \frac{10}{10} = 1\,Amp.$$

Question: A simple pendulum of length L is oscillating in lift which is Accelerating upwards with Acceleration g/6



Find time period?

Options:

(a) $2\pi\sqrt{\frac{5l}{7g}}$

(b) $2\pi\sqrt{\frac{6l}{7g}}$

(c) $2\pi\sqrt{\frac{6l}{3g}}$

(d) $2\pi\sqrt{\frac{4l}{5g}}$

Answer: (b)

Solution:

$$2\pi\sqrt{\frac{6L}{7g}}$$

$$T = 2\pi\sqrt{\frac{l}{g_{eff}}} = 2\pi\sqrt{\frac{l}{g + g/6}}$$

$$= 2\pi\sqrt{\frac{6l}{7g}}$$

Question: Find direction and magnitude of magnetic field if EMW is travelling along +z axis and $\dot{E}$ is along -x direction.

Options:

(a) $B_0 = \frac{E_0}{C}$

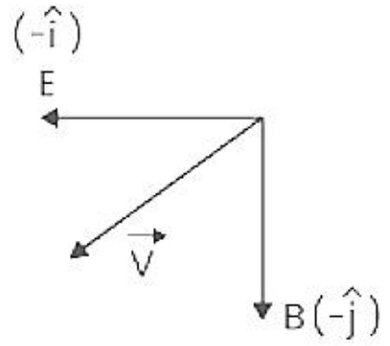
(b) $B_0 = \frac{C}{E_0}$

(c) $B_0 = C$

(d) $B_0 = CE_0$

Answer: (a)

Solution:



$$B_0 = \frac{E_0}{C}$$

Question: De Broglie wavelength of photon and electron are same, then the ratio of their energy is?

Options:

(a) $\frac{C}{V}$

(b) CV

(c) $\frac{2C}{V}$

(d) $\frac{2V}{C}$

Answer: (c)

Solution: $\lambda_p = \lambda_e$

$P_p = P_e$

$$\frac{E_p}{E_e} = \frac{h_C / \lambda_p}{P_e^2} = \frac{P_p.C}{P_e^2} 2m$$

$$= \frac{C.2m}{m.V}$$

$$\frac{E_p}{E_e} = \frac{2C}{V}$$

Question: Carnot cycle works on steam temperature and ice temperature. Find efficiency

Options:

(a) 0.2

(b) 0.16

(c) 0.06

(d) 0.26

Answer: (d)

Solution: $\eta = 1 - \frac{T_c}{T_H}$

$$= 1 - \frac{273}{373}$$

$$= \frac{100}{373} = 0.26$$

Question: A capacitor C_1 is charged to a potential difference V. The charging battery is then removed and the capacitor is connected to an uncharged capacitor C_2. The potential difference across the combination is

Options:

(a) $V\frac{C_1}{C_1+C_2}$

(b) $V\frac{C_2}{C_1+C_2}$

(c) $V\frac{C_1C_2}{C_1+C_2}$

(d) $\frac{V}{C_1+C_2}$

Answer: (a)

Solution:

Initial the charge $Q = C_1V$

After removing the battery the both capacitors are in parallel.

So total capacitance $C = C_1 + C_2$

Let the potential difference across the combination is V'

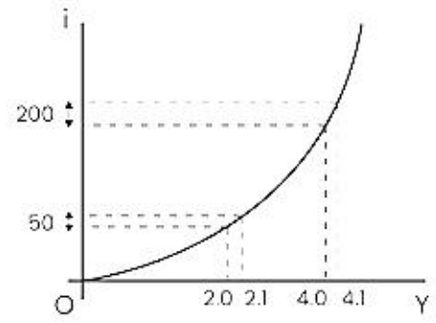
Now charge $Q' = CV' = (C_1 + C_2)V'$

As the total charge is conserved so $Q = Q'$

$\Rightarrow C_1V = (C_1 + C_2)V'$

$\therefore V' = \frac{C_1V}{C_1 + C_2}$

Question: Find the ratio of dynamic resistance at 2V and 4V for a semiconductor device?



Options:

(a) 4: 1

(b) 2: 1

(c) 1: 1

(d) 3: 2

Answer: (a)

Solution:

Dynamic $R = \frac{\Delta V}{\Delta i}$

$\frac{R_1}{R_2} = \frac{0.1/50}{0.1/200} = \frac{200}{50} = \frac{4}{1}$

Question: How many α and β particles are emitted when uranium $^{238}_{92}U$ decays to lead $^{306}_{82}Pb$?

Options:

(a) $\alpha = 4 \text{ and } \beta = 2$

(b) $\alpha = 6 \text{ and } \beta = 4$

(c) $\alpha = 6 \text{ and } \beta = 8$

(d) $\alpha = 4 \text{ and } \beta = 8$

Answer: (c)

Solution:

$$^{238}_{92}U \xrightarrow{-6\alpha} ^{206}_{74}X \xrightarrow{-8\beta^-} ^{206}_{82}Pb$$

(X is a hypothetical element)

So, 6α particles and 8β particles should decay

Question: If the time period of simple pendulum is T, then find its time period inside a lift moving upward with an acceleration of gm/s^2

Options:

(a) T

(b) 2T

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

(d) $\frac{T}{\sqrt{2}}$

Answer: (d)

Solution:

Time period of the pendulum $T = 2\pi\sqrt{\frac{\ell}{g}}$

So if the pendulum is in the lift and moving toward then net acceleration will be

$a_{net} = g + g = 2g$

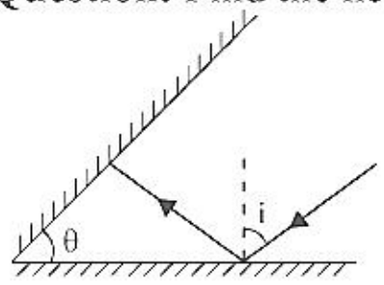
So, new time period $T' = 2\pi\sqrt{\frac{\ell}{a_{net}}}$

$$T' = 2\pi\sqrt{\frac{\ell}{2g}}$$

$$T' = 2\pi\sqrt{\frac{\ell}{g}} \times \frac{1}{\sqrt{2}}$$

$$\boxed{T' = \frac{T}{\sqrt{2}}}$$

Question: Find the net deviation in the given figure.



Options:

(a) 210°

(b) 10°

(c) 110°

(d) 100°

Answer: (a)

Solution:

$\delta_1 = \pi - 2i$

$\delta_2 = \pi - 2i'$

$\delta_{net} = 2\pi - 2\theta$

$= 360 - 2(75^\circ)$

$= 360 - 150^\circ = 210^\circ$

Question: In what condition apparent weight of man is lesser than actual weight.

Options:

(a) $N = Mg$

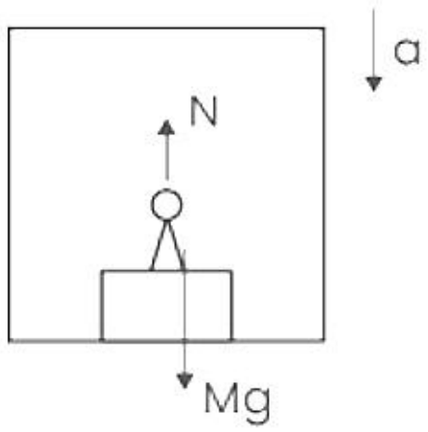
(b) $N < Mg$

(c) $N > Mg$

(d) $N \neq Mg$

Answer: (b)

Solution:



Mans accelerates downwards

$Mg - N = Ma$

$N = Mg - Ma$

$N < Mg$

Question: If length of wire increased by 0.4 % s it is stretched, change in resistance = ?

Options:

(a) 0.4%

(b) 0.2%

(c) 0.6%

(d) 0.8%

Answer: (d)

Solution:

We know

$$R = \frac{\rho \ell}{A}$$

Also, $V = A\ell$

$$A = \frac{V}{\ell} \quad (V = \text{constant})$$

$$\Rightarrow R = \frac{\rho \ell^2}{V}$$

So, $\left(\frac{\Delta R}{R} \times 100\right) = 2\left(\frac{\Delta \ell}{\ell} \times 100\right)$

$$\left(\frac{\Delta R}{R} \times 100\right) = 2 \times 0.4\%$$

$$= 0.8\%$$