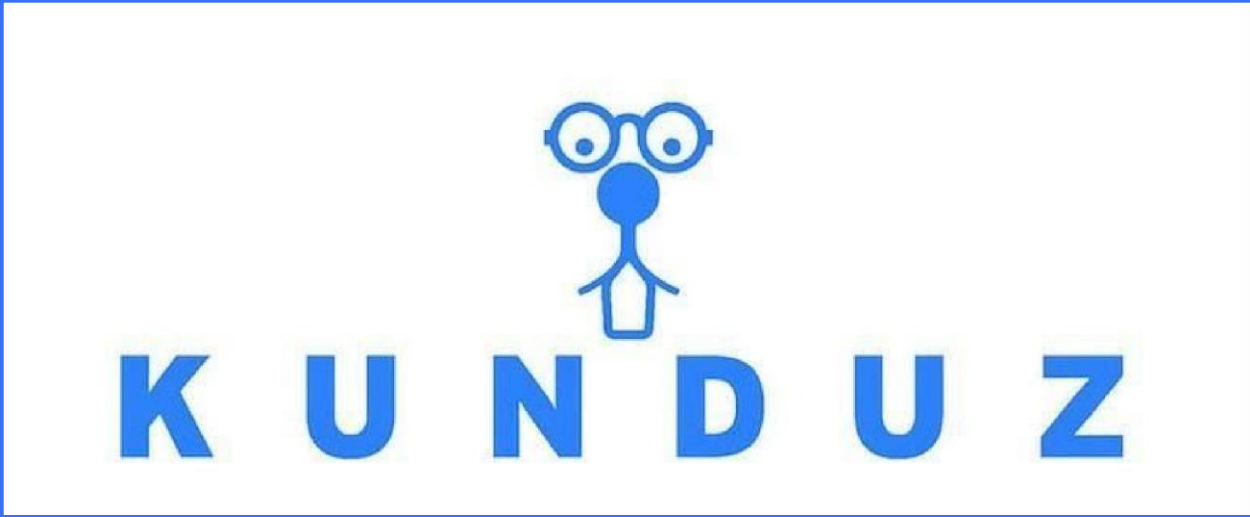


JEE Mains 5th September 2020 shift 2 Physics solutions prepared by KUNDUZ tutors

Visit Kunduz.com

Question number

Question and Answers

1

Q1. A spaceship in space sweeps stationary interplanetry dust. As a result, its mass increases at a rate $\frac{dM(t)}{dt} = bv^2$, where $v(t)$ is its instantaneous velocity. The instantaneous acceleration of the satellite is:

(1) $-\frac{bv^3}{2M(t)}$ (2) $-bv^3(t)$ (3) $-\frac{2bv^3}{M(t)}$ (4) $-\frac{bv^3}{M(t)}$

sol> we know that

$$F = \frac{dP}{dt}$$

$$P = mv$$

$$\Rightarrow F = \frac{d}{dt}(mv) = +v\frac{dm}{dt}$$

$$\Rightarrow F = -v \times bv^2 = -bv^3$$

$$\Rightarrow ma = -bv^3 \Rightarrow \boxed{a = -\frac{bv^3}{m(t)}}$$

Thus, option 4 is correct.

2

82.
A galvanometer is used in laboratory for detecting the null point in electrical experiments. If, on passing a current of 6 mA it produces a deflection of 2°, its figure of merit is close to :

(1) 6×10^{-3} A/div (2) 3×10^{-3} A/div
(3) 666° A/div (4) 333° A/div

Sol> We know that,

$$\text{current sensitivity} = \frac{I}{\theta}$$

Given $I = 6\,mA$, $\theta = 2°$

$$\Rightarrow \text{current sensitivity} = \frac{6 \times 10^{-3}}{2}$$

$$= 3 \times 10^{-3}\ A/div$$

Thus, option 2 is correct.

3

3 There are two bodies A and B of same mass. A is placed near equator of Earth and B is placed at height h above the poles of Earth. If both the bodies weigh equal, find h in terms of R, angular speed 'ω', acceleration due to gravity g.

1) $\frac{R\omega^2}{2g}$ 2) $\frac{R^2\omega^2}{2g}$ 3) $\frac{gR}{\omega^2}$ 4) $\frac{g}{\omega^2}$

Sol) Let weight of A be ω_1.

$\Rightarrow \omega_1 - mg = mR\omega^2 \Rightarrow \omega_1 = mg + mR\omega^2$ —①

Let weight of B be ω_2.

At height h, acceleration due to gravity is given by $g\left(1-\frac{2h}{R}\right)$

$\Rightarrow \omega_2 = mg\left(1-\frac{2h}{R}\right)$ —②

Given that $\omega_1 = \omega_2$

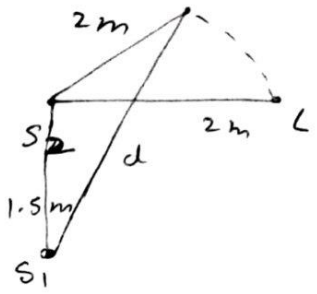
①&② $\Rightarrow mg + mR\omega^2 = mg\left(1-\frac{2h}{R}\right)$

$\Rightarrow \frac{2hg}{R} = R\omega^2 \Rightarrow \boxed{h = \frac{R^2\omega^2}{2g}}$

Thus, option 2 is correct.

4

Q4. Two coherent sources of sound, S_1 and S_2 produce sound waves of the same wavelength $\lambda = 1m$, in phase. S_1 and S_2 are placed 1.5 m apart (see fig.). A listener, located at L, directly in front of S_2 finds that the intensity is at a minimum when he is 2m away from S_2. The listener moves away from S_1, keeping the distance from S_2 fixed. The adjacent maximum of intensity is observed when the listener is at a distance d from S_1. Then, d is:



(1) 3m (2) 5m (3) 12m (4) 2m

sol) At L.

$S_1L = 2m$

$S_2L = \sqrt{1.5^2+2^2} = \frac{5}{2}\ m$

For maxima $\Delta x = n\lambda$

For minima $\Delta x = (2n+1)\frac{\lambda}{2}$

$\Rightarrow \Delta x = S_2L - S_1L = 0.5 = n\lambda$ — (1)

At other position.

$\Delta x = d - 2 = (2n+1)\frac{\lambda}{2} \Rightarrow d - 2 = n\lambda + \frac{\lambda}{2}$ — (2)

(2) − (1) $\Rightarrow d - 2.5 = \frac{\lambda}{2} \Rightarrow d = \frac{1}{2} + 2.5$

$\Rightarrow \boxed{d = 3m}$

5

Q5. Ten charges are placed on the circumference of a circle of radius R with constant angular seperation between successive charges. Alternate charges 1, 3, 5, 7, 9 have charge $(+q)$ each, while 2, 4, 6, 8, 10 have charge $(-q)$ each. The potential V and the electric field E at the centre of the circle are respectively: (Take $V=0$ at infinity)

(1) $V=0$; $E=0$

(2) $V = \frac{10q}{4\pi\epsilon_0 R}$; $E=0$

(3) $V = \frac{10q}{4\pi\epsilon_0 R}$; $E = \frac{10q}{4\pi\epsilon_0 R^2}$

(4) $V=0$, $E = \frac{10q}{4\pi\epsilon_0 R^2}$

Sol) There are five +ve charges placed with angular seperation of 72° each from origin.

This is equivalent to 5 charges placed at corners of pentagon. Thus, $E=0$.

Similar is for -ve charges as well.

we know that $V = -\frac{KQ}{r}$

$\Rightarrow V = -\frac{KQ}{r} \times 5 - \frac{K(-Q)}{r} \times 5 = 0$

$\Rightarrow \Delta V=0$, $\Delta E=0$. Thus, option 1 is correct.

6

Q6. The quantities $x = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$, $y = \frac{E}{B}$ and $z = \frac{l}{CR}$ are defined where C - capacitance, R - Resistance, l - length, E - Electric field, B - Magnetic field and ϵ_0, μ_0 - free space permittivity and permeability respectively. Then:

(1) Only y and z have the same direction
(2) Only x and y have the same dimension
(3) Only x and z have the same direction
(4) x, y, z have the same dimension

Sol) We know that $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$ is speed of light

$$\Rightarrow [x] = LT^{-1}$$

Also $E = cB \Rightarrow \frac{E}{B} = c$

$$\Rightarrow [y] = LT^{-1}$$

RC is time constant $\Rightarrow [z] = \frac{L}{T}$

$$= LT^{-1}$$

$$\Rightarrow [x] = [y] = [z] = LT^{-1}$$

Thus, option 4 is correct.

7

87. The correct match between the entries in Column I and column II are:

I	II
(a) Microwave	(i) 100 m
(b) Gamma rays	(ii) 10^{-15} m
(c) A.M. radio	(iii) 10^{-10} m
(d) X-rays	(iv) 10^{-3} m

(1) (a) - (iv), (b) - (ii), (c) - (i), (d) - (iii)
(2) (a) - (iii), (b) - (ii), (c) - (i), (d) - (iv)
(3) (a) - (i), (b) - (iii), (c) - (iv), (d) - (ii)
(4) (a) - (ii), (b) - (i), (c) - (iv), (d) - (iii)

sol) wavelength of γ rays is less than 0.01nm.

wavelength of x rays is between 0.01nm and 10nm

Microwave is of the order of 10^{-3} m.

Radiowaves are grater than 1cm.

Thus. a → IV c → I
b → II d → III

Thus, option 1 is correct.

8

8 There is an iron core solenoid of turn density 10 turns/cm and volume $10^{-3}\ m^3$. It carries a current of 0.5 A and relative permeability of iron core is $\mu_r = 1000$. The magnetic moment of this solenoid is approximately (in $A\text{-}m^2$)

(1) 5×10^2 (2) 5×10^3 (3) 5×10^4 (4) 5×10^5

Sol→ using the formula of M

$$M = (\mu_r - 1) \cdot NA(i)$$

Since $\mu_r >> 1$

We use $\mu_r - 1 \approx \mu_r$ (For proper approximation)

$$M = \mu_r NAi$$

using $A = \frac{V}{L}$ and $N = n \cdot L$ (n → turns/length)

So, $$M = \mu_r (n \cdot L) \times \left(\frac{V}{L}\right) i$$

$$= \mu_r n \cdot V \cdot i$$

Putting the values $\mu_r = 1000$, $n = 10\ cm^{-1}$ $V = 10^{-3} m^3$, $i = 0.5\ A$

$$M = 10^3 \times \frac{10}{10^{-2}} \times 10^{-3} \times 0.5$$

$$= 0.5 \times 10^3$$

$$= 5 \times 10^2 \quad \text{(option A)}$$

9

9 A dielectric having dielectric constant $K=4$ is filled with a capacitor having plate length l and width b. Now length of capacitor is increased by l_1 for which energy stored becomes half of its initial value. l_1 should be:

1) $2l$ 2) $6l$ 3) $8l$ 4) $4l$

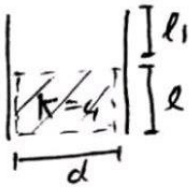
sol) Let seperation between plates be d.

$$\text{Area} = l \times b = bl$$

$$\Rightarrow C_i = K\frac{\varepsilon_0 A}{d} = K\frac{\varepsilon_0 bl}{d}$$

$$\Rightarrow U_i = \frac{Q^2}{2C_i} = \frac{Q^2 d}{2\varepsilon_0 bl K} \quad \text{---} (1)$$

when slab is inserted →



$$\text{Area} = b \times (l_1 + l)$$

$$\Rightarrow C_f = \frac{\varepsilon_0 b(l_1 + 4l)}{d}$$

$$\Rightarrow C_f = \frac{\varepsilon_0 b(4l + l_1)}{d} \Rightarrow U_f = \frac{Q^2 \times d}{2\varepsilon_0 b(4l + l_1)}$$

Given $U_f = \frac{U_i}{2}$

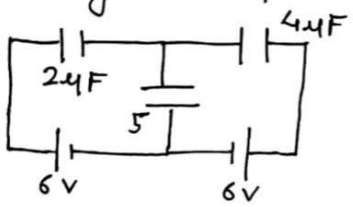
$$\Rightarrow \frac{Q^2 d}{2\varepsilon_0 b(4l + l_1)} = \frac{Q^2 d}{K 2\varepsilon_0 bl} \times \frac{1}{2} \Rightarrow \frac{1}{4l + l_1} = \frac{1}{2l \times K}$$

$$\Rightarrow 8l = 4l + l_1 \Rightarrow \boxed{l_1 = 4l}$$

Thus, option 4 is correct.

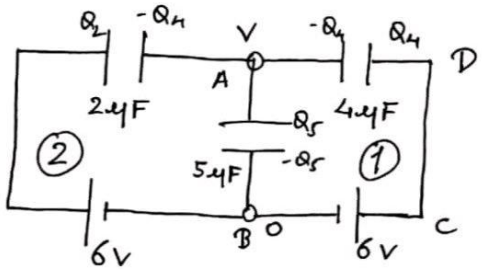
10

Que 10) Find charge on 5μF.



(1) $\frac{120}{11}$ μC (2) $\frac{150}{11}$ μC (3) $\frac{180}{11}$ μC (4) $\frac{90}{11}$ μC

Ans ⇒



Let the potential at point A be V

$V_A = V$, $V_B = 0$

In loop (1) $V = 6 - \frac{Q_4}{4}$

In loop (2) $V = 6 - \frac{Q_2}{2}$

Equating, we get ⇒ $Q_4 = 2Q_2$

Now by charge conservation, $Q_5 = Q_4 + Q_2$

$= 3Q_2 \longrightarrow (3)$

In loop (2) ⇒ $\frac{Q_5}{5} + \frac{Q_2}{2} - 6 = 0$

⇒ $\frac{3Q_2}{5} + \frac{Q_2}{2} = 6 \Rightarrow (0.6 + 0.5)Q_2 = 6$

⇒ $Q_2 = \frac{6}{1.1} \Rightarrow Q_2 = \frac{60}{11}$ μC

So, by (3), $Q_5 = 3Q_2 = \frac{180}{11}$ μC (option (3))

11

11 A car is moving towards a fixed wall. It blows horn of frequency of 440 Hz. The frequency of reflected sound observed by the driver is 480 Hz. Then find speed of car in Km/h. (speed of sound = 350 m/s).

1) 64.78 Km/h 2) 26.78 Km/h 3) 54.78 Km/h 4) 47.78 Km/h

Sol) Let the frequency observed by wall be f'.

$f_0 = 440\ Hz$

$$\Rightarrow f' = \left(\frac{V_w - V_0}{V_w - V_s}\right) f_0$$

Given $V_w = 350$ m/s , $V_0 = 0$, $V_s = ?$

$$\Rightarrow f' = \left(\frac{350}{350 - V_s}\right) 440$$

Let the frequency received by car be f''

$$\Rightarrow f'' = \left(\frac{V_w + V_s}{V_w - V_0}\right) f'$$

$$\Rightarrow f'' = \left(\frac{350 + V_s}{350}\right) \times \frac{350 \times 440}{350 - V_s}$$

$$\Rightarrow f'' = \left(\frac{350 + V_s}{350 - V_s}\right) \times 440 \quad \{ f'' = 480 \text{ (given)} \}$$

$$\Rightarrow \frac{48}{44} = \frac{350 + V_s}{350 - V_s} \Rightarrow 12(350 - V_s) = 11(350 + V_s)$$

$$\Rightarrow V_s = \frac{350}{23} \text{ m/s} = \boxed{54.78 \text{ Km/h}}$$

Thus, option 3 is correct.

12

12 A ball is dropped from height h into a liquid. Its velocity does not change when it enters the liquid. Find height h in terms of r = radius of ball, density of liquid 'σ', density of ball 'ρ', coefficient of viscocity 'η', and acceleration due to gravity 'g'.

1) $\frac{2}{81}\frac{r^4 g(\rho-\sigma)^2}{\eta^2}$ 2) $\frac{2}{50}\frac{r^4 g(\rho-\sigma)^2}{\eta^2}$

3) $\frac{2}{25}\frac{r^4 g(\rho-\sigma)^2}{\eta^2}$ 4) $\frac{2}{90}\frac{r^4 g(\rho-\sigma)^2}{\eta^2}$

Sol) Speed of ball when it drops height $h = \sqrt{2gh}$

Also terminal velocity $= \frac{2}{9}\frac{r^2 g(\rho-\sigma)}{\eta}$

$\Rightarrow \frac{2}{9}\frac{r^2 g(\rho-\sigma)}{\eta} = \sqrt{2gh}$

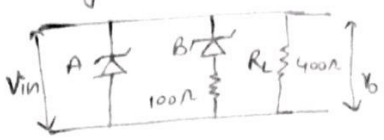
$\Rightarrow h = \left(\frac{2}{9}\frac{r^2 g(\rho-\sigma)}{\eta}\right)^2 \times \frac{1}{2g}$

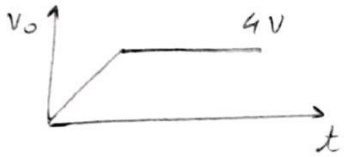
$\Rightarrow \boxed{h = \frac{2}{81}\frac{r^4 g(\rho-\sigma)^2}{\eta^2}}$

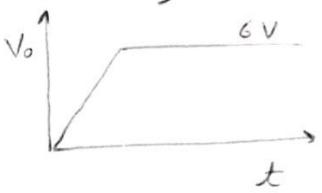
Thus, option 1 is correct.

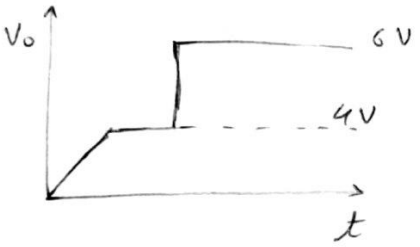
13

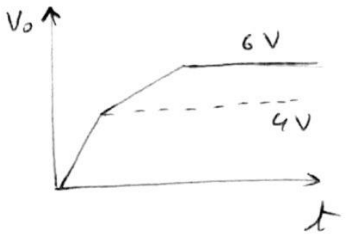
Q13. Two Zener diodes (A and B) having breakdown voltages of 6V and 4V respectively, are connected as shown in the circuit. The output voltage V_0 variation with input voltage linearly increasing with time, is given by ($V_{input} = 0V$ at $t=0$)



1)


2)


3)


4)


Sol>

Zener diode maintain constant voltage after break down.

Diode B break down at 4V.

It try to maintain 4V across itself, but V_0 is not 4V as it has a resistor in series.

After breakdown of A, 6V is maintained

Thus, option 4 is correct.

14

14 Radioactive nucleus A decays into B with half life 10 sec. A also convert into C with half life 100 sec. Find half life of A for both emission.

1) 6 sec 2) 9 sec 3) 3sec 4) 2sec

Sol) We know that

$$N_A - N_B = N_A e^{-\lambda_1 t}$$

$$N_A - N_C = N_A e^{-\lambda_2 t}$$

$$\Rightarrow \lambda = \lambda_1 + \lambda_2$$

$$\Rightarrow \frac{1}{T} = \frac{1}{T_1} + \frac{1}{T_2}$$

Given $T_1 = 10$ sec , $T_2 = 100$ sec

$$\Rightarrow \frac{1}{T} = \frac{1}{10} + \frac{1}{100} \Rightarrow \frac{1}{T} = 0.11$$

$$\Rightarrow T = \frac{1}{0.11} = \frac{100}{11} \approx \boxed{9 \text{ sec}}$$

Thus, option 2 is correct

15

15 An ideal diatomic gas is taken through an adiabatic process in which density increases to 32 times, if pressure increases to n times. Find n.

1) 4 2) 8 3) 64 4) 128

sol) For adiabatic process :

$$PV^{\gamma} = c$$

Also $PV = nRT$ {n is no. of moles}

$$\Rightarrow n = \frac{w}{M}$$

$$\Rightarrow PV = \frac{w}{M}RT \quad \Rightarrow \rho = \frac{PM}{RT} = \frac{w}{V}$$

$$\rho = \frac{w}{V} \Rightarrow V = \frac{w}{\rho}$$

$$\Rightarrow P\left(\frac{w}{\rho}\right)^{\gamma} = c \quad \Rightarrow \frac{P}{\rho^{\gamma}} = c$$

$$\Rightarrow \frac{P_1}{P_2} = \left(\frac{\rho_1}{\rho_2}\right)^{\gamma}$$

$$\Rightarrow \frac{1}{(n)} = \left(\frac{1}{32}\right)^{\gamma} \Rightarrow n = 32^{\gamma}$$

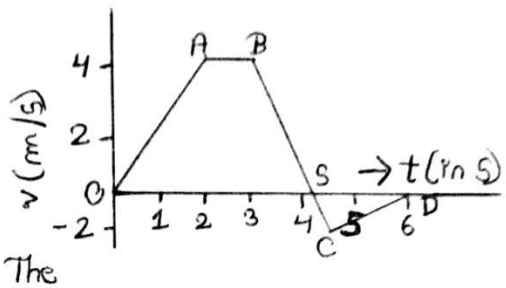
For diatomic gas $\gamma = 7/5$

$$\Rightarrow n = 32^{7/5} = \boxed{128}$$

Thus, option 4 is correct.

16

Q16 The velocity (v) and time (t) graph of a body in a straight line motion is shown in the figure. The point S is at 4.333 seconds. The total distance covered by the body in 6 sec is:



(1) 12m (2) $\frac{49}{4}$ m (3) 11m (4) $\frac{37}{3}$ m

Sol) As we will have to take out the distance travelled. So, we will add (not subtract, as in case of displacement) both the shapes i.e. triangle and parallelogram.

* We know that area under velocity-time graph gives us displacement.

∴ Distance travelled = area of parallelogram + area of triangle

$= \left[\frac{1}{2_1} \times 5.333 \times \overset{2}{\cancel{4}}\right] + \left[\frac{1}{\cancel{2}_1} \times 1.667 \times \cancel{2}_1\right]$

$= 10.666 + 1.667$

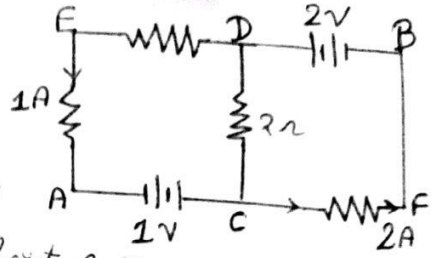
$= 12.333\,m$

$= \boxed{\frac{37}{3} m}$

Thus, option (4) is correct answer.

17

817. In the circuit, given in the figure currents in different branches and value of one resistor are shown. Then potential at point B with respect to the point A is:



(1) +1V (2) +2V (3) -2V (4) -1V

Sol> Let us Apply KCL at C.

Let current from C to D be I_{CD}

$\Rightarrow I_{CD} + 2 = 1$

$\Rightarrow I_{CD} = -1$ A

KVL from A to B

$\Rightarrow V_A + 1 - 2I_{CD} - 2 = V_B$

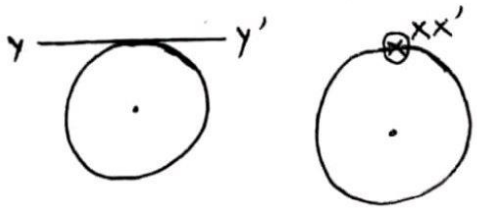
$\Rightarrow V_A + 1 - 2(-1) - 2 = V_B$

$\Rightarrow V_A - V_B = -1 \Rightarrow \boxed{V_B - V_A = 1}$

Thus, option 1 is correct.

18

18 A ring 1 oscillate with period T_1 about tangential axis in the plane of the ring and another ring 2 oscillate with period T_2 about tangential axis perpendicular to plane of ring. Then $\frac{T_1}{T_2} = ?$



1) $\sqrt{\frac{3}{4}}$ 2) $\sqrt{\frac{5}{8}}$ 3) $\sqrt{\frac{8}{5}}$ 4) $\sqrt{\frac{4}{3}}$

sol) we know that, $T = \frac{2\pi}{\omega}$

$$\omega = \sqrt{\frac{mgd}{I}}$$

$$\Rightarrow T = 2\pi\sqrt{\frac{I}{mgd}} \Rightarrow T_1 = 2\pi\sqrt{\frac{I_{YY'}}{mgd}}$$

$$\Rightarrow T_2 = 2\pi\sqrt{\frac{I_{XX'}}{mgd}} \Rightarrow \frac{T_1}{T_2} = \sqrt{\frac{I_{YY'}}{I_{XX'}}}$$

$$I_{YY'} = \frac{mR^2}{2} + mR^2 = \frac{3mR^2}{2}$$

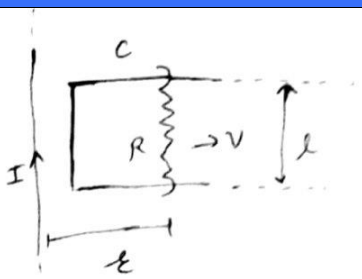
$$I_{XX'} = mR^2 + mR^2 = 2mR^2$$

$$\Rightarrow \frac{T_1}{T_2} = \sqrt{\frac{\frac{3}{2}mR^2}{2mR^2}} = \boxed{\sqrt{\frac{3}{4}}}$$

Thus, option 1 is correct.

19

Q19. An infinitely long straight wire carrying current I, one side opened rectangular loop and a conductor C with a sliding connector are located



in the same plane, as shown in figure. The connector has length l and resistance R. It slides to the right with a velocity v. The resistance of the conductor and the self inductance of the loop are negligible. The induced current in the loop, as an function of seperation x, between the connector and the straight wire is:

(1) $\frac{\mu_0}{\pi}\frac{Ivl}{Rx}$

(2) $\frac{2\mu_0}{\pi}\frac{Ivl}{Rx}$

(3) $\frac{\mu_0}{4\pi}\frac{Ivl}{Rx}$

(4) $\frac{\mu_0}{2\pi}\frac{Ivl}{Rx}$

Sol) Magnetic field due to wire at distance R

$$= B = \frac{\mu_0 I}{2\pi x}$$

Also, $emf = Bvl = \frac{\mu_0 I}{2\pi x} vl$

$$\Rightarrow I = \frac{emf}{R} = \boxed{\frac{\mu_0}{2\pi}\frac{Ivl}{Rx}}$$

Thus, option 4 is correct.

20

20 There are two rods of length l_1 and l_2 and coeffecient of linear expansion are α_1 and α_2 respectively. Find equivalent coefficient of thermal expansion for their combination in series.

1) $\frac{\alpha_1+\alpha_2}{2}$ 2) $\frac{\alpha_1 l_1+\alpha_2 l_2}{\alpha_1+\alpha_2}$

3) $\frac{\alpha_1 l_1+\alpha_2 l_2}{l_1+l_2}$ 4) $\sqrt{\alpha_1\alpha_2}$

Sol) We know that:

$$\Delta l_1 = \alpha_1 l_1 \Delta t$$
$$\Delta l_2 = \alpha_2 l_2 \Delta t$$

length of series $= l_1+l_2$

$$\Rightarrow \Delta(l_1+l_2) = \alpha(l_1+l_2)\Delta t$$
$$\Rightarrow \Delta l_1 + \Delta l_2 = \alpha(l_1+l_2)\Delta t$$
$$\Rightarrow \alpha_1 l_1 \Delta t + \alpha_2 l_2 \Delta t = \alpha(l_1+l_2)\Delta t$$
$$\Rightarrow \boxed{\alpha = \frac{\alpha_1 l_1+\alpha_2 l_2}{l_1+l_2}}$$

Thus, option 3 is correct.

21

Q21 Nitrogen gas is at 300°C temperature. The temperature (in K) at which the rms speed of a H_2 molecule would be equal to the rms speed of a nitrogen molecule, is ..... (Molar mass of N_2 gas is 28g)

Sol> We Know that $V_{rms} = \sqrt{\frac{3RT}{M}}$

$V_{rms\,N_2} = V_{rms\,H_2}$

$\Rightarrow \sqrt{\frac{3R\,T_{N_2}}{M_{N_2}}} = \sqrt{\frac{3R\,T_{H_2}}{M_{H_2}}}$

$\Rightarrow \frac{T_{N_2}}{M_{N_2}} = \frac{T_{H_2}}{M_{H_2}}$

$\Rightarrow \frac{300+273}{28} = \frac{T_{H_2}}{2}$

$\Rightarrow T_{H_2} = \frac{573}{14}\,K = 40.9\,K$

$\Rightarrow \boxed{T_{H_2} \approx 41\,K}$

22

22 There is a prism of refractive index 1.5 and prism angle 2°. Find the minimum deviation caused by the prism

Ans → If prism angle = A and angle of min^m deviation = δ

Then, the formula for refractive index will be,

$$\mu = \frac{\sin\left(\frac{A+\delta}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

Given $\mu = 1.5$, $A = 2°$

$$\Rightarrow \quad (1.5)\sin(1°) = \sin\left(1° + \frac{\delta}{2}\right) \longrightarrow (1)$$

We know that, for θ close to 0

$\sin\theta \approx \theta$ (θ in radian)

So Eq(1) becomes

$$1.5 \times 1 \times \frac{\pi}{180} = \left(1 + \frac{\delta}{2}\right) \times \frac{\pi}{180}$$

$$1.5 = 1 + \frac{\delta}{2}$$

$$\Rightarrow \quad \delta = 1°$$

23

Q23. The surface of a metal is illuminated alternately with photons of energies $E_1 = 4eV$ and $E_2 = 2.5eV$ respectively. The ratio of maximum speeds of the photoelectrons emitted in two cases is 2. The work function of the metal in (eV) is.....

Sol) We know that $KE = \frac{hc}{\lambda} - \phi$

$$\Rightarrow \quad KE_1 = 4 - \phi \quad — (1)$$

$$KE_2 = 2.5 - \phi \quad — (2)$$

$$\frac{(1)}{(2)} \Rightarrow \frac{KE_2}{KE_1} = \frac{4-\phi}{2.5-\phi}$$

Given $\frac{v_1}{v_2} = 2 \Rightarrow \frac{KE_1}{KE_2} = \left(\frac{v_1}{v_2}\right)^2 = 4$

$$\Rightarrow \quad 4 = \frac{4-\phi}{2.5-\phi}$$

$$\Rightarrow \quad 10 - 4\phi = 4 - \phi$$

$$\Rightarrow \quad 6 = 3\phi \quad \Rightarrow \boxed{\phi = 2eV}$$

24

24 A body of mass 2kg at rest is supplied constant power 1J/s. The distance travelled by the body after 9 sec is:

sol) P is constant

$\Rightarrow$ By work energy theorem:

$$Pt = \frac{1}{2} m v^2 \Rightarrow v = \sqrt{\frac{2 \times P t}{m}}$$

$$\Rightarrow v = \sqrt{\frac{2 \times 1}{2} t} \Rightarrow v = \sqrt{t}$$

$$\Rightarrow \frac{dx}{dt} = \sqrt{t} \Rightarrow dx = \sqrt{t}\, dt$$

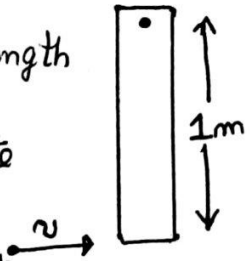
Integrating both the sides.

$$\Rightarrow \int_0^x dx = \int_0^9 \sqrt{t}\, dt$$

$$\Rightarrow x = \frac{2}{3} \times 9^{3/2} = \boxed{18 \text{ m}}$$

25

Q25. A thin rod of mass 0.9 kg and length 1m is suspended, at rest, from one end so that it can freely oscillate in the vertical plane. A particle of mass 0.1 kg moving in a straight line with velocity 80m/s hits the road at its bottom most point and sticks to it (see figure). The angular speed (in rad/s) of the rod immediately after the collision will be .....



Sol) Initially, angular momentum $= L_i$

$\Rightarrow L_i = 0.1 \text{ V} \times 1 = 0.1 \text{V}$

Final angular momentum $= L_f$

$\Rightarrow L_f = \left[\frac{0.9 \times 1^2}{3} + (0.1 \times 1^2)\right]\omega$

$\Rightarrow L_f = 0.4\,\omega$

By conservation of angular momentum:

$L_i = L_f$

$\Rightarrow 0.1\text{V} = 0.4\,\omega$

Given that $V = 80\text{m/s}$

$\Rightarrow \frac{0.1 \times 80}{0.4} = \omega \Rightarrow \boxed{\omega = 20 \text{ rad/s}}$

Enrolling yourself for coaching classes has long been considered the first step towards cracking the jee. however, this trend is starting to slip. Recent studies show that, for the students who cleared the JEE Main/Advance, the number of students who had joined a coaching class is lower than the number of students who managed the feat with self-study.

Preparation for JEE Main/Advance requires a lot of hard work and determination. Be ready to even go through many sleepless nights, missed birthdays and extracurriculars to finish the vast JEE syllabus. But simply completing the syllabus is not enough! If you want to have an edge over your counterparts you need to step up your game. This means practicing a variety of problems and revising diligently while following a meticulous study plan that recognizes your strengths and takes care of all your weaknesses. To get your doubts solved or questions checked there is no better place than Kunduz.

Click to download Kunduz app for free

Ask first three questions for free

Download on the App Store

GET IT ON Google Play