KUMAR PHYSICS CLASSES

E 281 BASEMENT M BLOCK MAIN ROAD GREATER KAILASH 2 NEW DELHI

9958461445,01141032244

www.kumarphysicsclasses.com

www.kumarneetphysicsclasses.com

IIT JEE PHYSICS PAPER SOLUTION

24 JUNE 2022

EVENING SHIFT

Numerical Base Paper, Easy And Direct Formulae Base Question Asked In This Session

POC QUESTION IS TRICKY ELSE EVERYTHING IS EASY CALCULATION IS TOO MUCH

Q61: Identify the pair of physical quantities that have same dimensions

(A) velocity gradient and decay constant

(B) wien's constant and Stefan constant

(C) angular frequency and angular momentum

(D) wave number and Avogadro number

ANS - 61

velocity gradient $= \frac{dV}{dx}$

$= \frac{mt/sec}{mt^2} = sec^{-1}$

Decay constant

$\lambda = -\frac{dN}{dt} = sec^{-1}$

Q62: The distance between Sun and Earth is R. The duration of year if the distance between Sun and Earth becomes 3R will be

(A) $\sqrt{3}$ years

(B) 3 years

(C) 9 years

(D) $3\sqrt{3}$ years

ANS – 62

As per the kepler's 3RD Law

$$T^2 \propto r^3$$

$$\frac{T_2}{T_1} = \left(\frac{r_2}{r_1}\right)^{3/2} = \left(\frac{3r}{r}\right)^{3/2}$$

$$\frac{T_2}{T_1} = \left\{(3)^3\right\}^{1/2} = 3\sqrt{3}$$

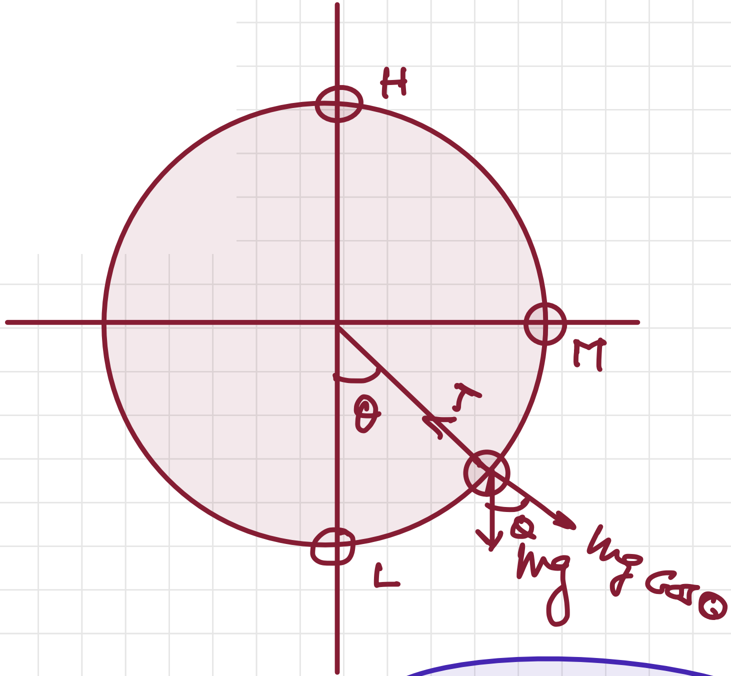
Q63: A stone of mass m. tied to a string is being whirled in a vertical circle with a uniform speed. The tension in the suing is

(A) the same throughout the motion.

(B) minimum at the highest position of the circular path.

(C) minimum at the lowest position of the circular path.

(D) minimum when the rope is in the horizontal position.



At any instant

$$T - mg\cos\theta = \frac{mv^2}{r}$$

$$T = mg\cos\theta + \frac{mv^2}{r}$$

at lowest point

$\theta = 0°$, $T_L = mg + \frac{mv^2}{r}$

at middle point

$\theta = 90°$ $T_M = mg\cos 90 + \frac{mv^2}{r} = \frac{mv^2}{r}$

at highest point

$\theta = 180°$ $T_H = mg\cos 180° + \frac{mv^2}{r} = -mg + \frac{mv^2}{r}$

$T_H < T_M < T_L$

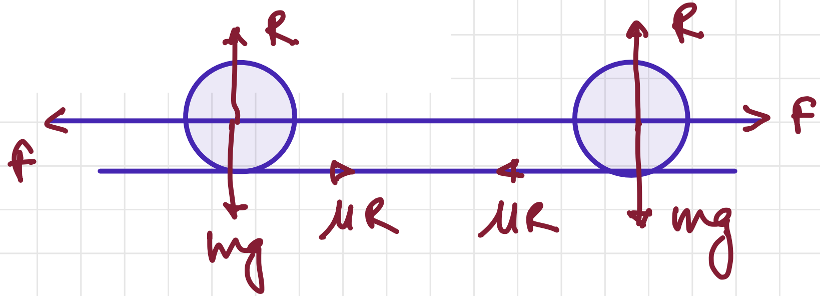
Q64: Two identical charged particles each having a mass 10 g and charge 2.0 x 10^{-7} C are placed on a horizontal table with a separation of L between them such that they stay in limitted equilibrium. If the coefficient of friction between each particle and the table is 0.25. find the value of L. [Use g = $10ms^{-2}$]

(A) 12 cm ✓

(B) 10 cm

(C) 8 cm

(D) 5 cm



Under equilibrium condition

$$F = \mu R \Rightarrow \frac{1}{4\pi\epsilon_0}\frac{q^2}{(L)^2} = \mu(mg)$$

$$L^2 = \frac{1}{4\pi\epsilon_0}\frac{q^2}{[\mu mg]} \Rightarrow L = \sqrt{\frac{1}{4\pi\epsilon_0}\frac{q^2}{(\mu mg)}}$$

$$L = \sqrt{\frac{9\times10^9 \times (2.0\times10^{-7})^2}{0.25\times10\times10^{-3}\times9.8}} = 0.12\,mt = 12\,cm$$

Q65: A Carnot engine takes 5000 kcal of heat from a reservoir at 727°C and gives heat to a sink at 127°C. The work done by the engine is

(A) $3 \times 10^6 J$

(B) Zero

(C) $12.6 \times 10^6 J$

(D) $8.4 \times 10^6 J$

ANS - 65

$T_1 = 727 + 273 = 1000 K$

$T_2 = 227 + 273 = 400 K$

$\eta = \left(1 - \frac{T_2}{T_1}\right) = \frac{W}{Q_1}$

$W = Q_1 \left(1 - \frac{T_2}{T_1}\right)$

$= 5000 \left(1 - \frac{400}{1000}\right) \times 10^3$

$= 5000 \times \frac{3}{5} \times 10^3$ cal

$= 3 \times 10^6$ cal $= 3 \times 10^6 \times 4.2$

$= 12.6 \times 10^6$ Joule

1 cal = 4.2 Joules

Q66: Two massless springs with spring constant 2k and 9k, carry 50 g and 100 g masses at their free ends. These two masses oscillate vertically such that their maximum velocities are equal. Then the ratio of their respective amplitude will be

(A) 1 : 2

(B) 3 : 2 ✓

(C) 3 : 1

(D) 2 : 3

ANS-66 → $v_{max} = a\omega$

$$v_{max}\big|_1 = v_{max}\big|_2$$

$$a_1 \omega_1 = a_2 \omega_2$$

$$\frac{a_1}{a_2} = \frac{\omega_2}{\omega_1} = \frac{\sqrt{k_2/m_2}}{\sqrt{k_1/m_1}}$$

$$= \sqrt{\frac{k_2}{k_1}}\sqrt{\frac{m_1}{m_2}}$$

$$= \sqrt{\frac{9k}{2k}}\sqrt{\frac{50}{100}} = 3/2$$

$$f = \frac{1}{2\pi}\sqrt{\frac{m}{k}}$$

$$\omega = \sqrt{\frac{m}{k}}$$

Q67: What will be the most suitable combination of three resistors $A = 2\Omega, B = 4\Omega, C = 6\Omega$ so that $\left(\frac{22}{3}\right)\Omega$ is equivalent resistance of combination?

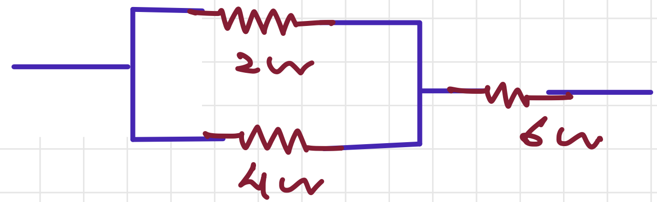
(A) A Parallel combination of A and C connected in series with B

(B) ✓ Parallel combination of A and B connected in series with C

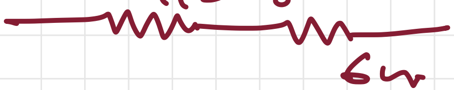
(C) Series combination of A and C connected in parallel with B

(D) Series combination of B and C connected in parallel with A

ANS - 67



$$\frac{4\times 2}{4+2} = \frac{8}{6} = \frac{2}{3}$$



$$R_{eq} = \frac{2}{3} + 6 = \frac{2+18}{3} = 21/3\ \Omega$$

Q68: The soft-iron is a suitable material for making an electromagnet. This is because soft- iron has

(A) low coercivity and high retentivity

(B) low coercivity and low permeability

✓ (C) high permeability and low retentivity

(D) high permeability and high retantivity

ANS- 68

Always high permeability and low retentivity.

(Because electromagnet is always magnetise & demagnetise quickly)

Q69: A proton, a deuteron and an α-particle with same kinetic energy enter into a uniform magnetic field at right angle to magnetic field. The ratio of the radii of their respective circular paths is

(A) $1:\sqrt{2}:\sqrt{2}$

(B) $1:1:\sqrt{2}$

(C) $\sqrt{2}:1:1$

(D) $1:\sqrt{2}:1$ ✓

Very important question - Asked many times in All competative exams

Remember the result to save time

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

$$v = \sqrt{\frac{2(KE)}{m}}$$

$$qvB = \frac{mv^2}{r} \Rightarrow r = \frac{mv}{qB}$$

$$r = \frac{m}{qB}\sqrt{\frac{2(KE)}{m}} = \frac{\sqrt{2m(KE)}}{qB}$$

$$r_p : r_d : r_\alpha :: \frac{\sqrt{2(m)(KE)}}{eB} : \frac{\sqrt{2(2m)(KE)}}{eB} : \frac{\sqrt{2(4m)(KE)}}{2eB}$$

$$:: 1 : \sqrt{2} : 1$$

Q70: Given below are ma statements :

Statement-I: The reactance of an ac circuit is zero. It is possible that the circuit contains a capacitor and an inductor.

Statement-II: Iv ac circuit. the average power delivered by the source never becomes zero.

In the light of the above statements. choose the correct answer from the optionsgiven below

(A) Both Statement I and Statement II are true

(B) Both Statement I and Statement II are false

(C) Statement I is true but Statement II is false ✓

(D) Statement I is false but Statement II is true

Solution:

Statement I is true but Statement II is false

ANS -70

STATEMENT-I Yes Reactance of ac circuit is zero when $X_L = X_C$

$X = X_L - X_C = 0$ (CORRECT)

STATEMENT-2 → In Inductor or capacitor

↓ $P_{avg} = VI\cos 90 = 0$

FALSE

Q71: Potential energy as a function of r is given by $U = \frac{A}{r^{10}} - \frac{B}{r^5}$, where r is the interatomic distance. A and B are positive constant. The equilibrium distance between the two atoms will be

(A) $\left(\frac{A}{B}\right)^{1/5}$

(B) $\left(\frac{B}{A}\right)^{1/5}$

(C) ✓ $\left(\frac{2A}{B}\right)^{1/5}$

(D) $\left(\frac{B}{2A}\right)^{1/5}$

ANS-71

$$F = -\frac{dV}{dr} = 0$$

$$\Rightarrow -\frac{d}{dr}\left(\frac{A}{r^{10}} - \frac{B}{r^5}\right) = 0$$

$$\Rightarrow -A\frac{d}{dr}r^{-10} + B\frac{d}{dr}r^{-5} = 0$$

$$\Rightarrow -A\left(-10\,r^{-10-1}\right) + B\left[-5\,r^{-5-1}\right] = 0$$

$$\Rightarrow 10A\,r^{-11} - 5B\,r^{-6} = 0$$

$$\frac{10A}{r^{11}} = \frac{5B}{r^6} \Rightarrow r^5 = \frac{10A}{5B}$$

$$r = \left(\frac{2A}{B}\right)^{1/5}$$

Q72: An object of mass 5 kg is thrown vertically upwards from the ground. The air resistance produce a constant retarding force of 10 N throughout the motion. The ratio of time of ascent to the time of descent will be equal to: [Use g = 10 ms^{-2}]

(A) 1 : 1

(B) $\sqrt{2} : \sqrt{3}$

(C) $\sqrt{3} : \sqrt{2}$

(D) 2 : 3

ANS-72

Time of ascent ← T_A

T_B → Time of descent

$$h = \frac{1}{2}(g+a)T_A^2 \quad \text{—(1)}$$

$$h = \frac{1}{2}(g-a)T_B^2 \quad \text{—(2)}$$

$$\frac{1}{2}(g+a)T_A^2 = \frac{1}{2}(g-a)T_B^2$$

$$\frac{T_A}{T_B} = \sqrt{\frac{(g-a)}{(g+a)}} = \sqrt{\frac{(10-2)}{(10+2)}}$$

$$\frac{T_A}{T_B} = \sqrt{\frac{8}{12}} = \sqrt{\frac{2}{3}}$$

Q73: A fly wheel is accelerated uniformly from rest and rotates through 5 rad in the first second. The angle rotated by the fly wheel in the next second, will be

(A) 7.5 rad

(B) 15 rad

(C) 20 rad

(D) 30 rad

ANS-73

$\omega = \omega_0 + \alpha t$

$5 = \alpha(1), \alpha = 5 \text{ rad/sec}^2$

$\theta = \omega t + \frac{1}{2}\alpha t^2$

$\theta_1 \rightarrow$ FIRST SECOND

$\theta_1 = \frac{1}{2}\alpha(1)^2 = \alpha/2$

Next second

$\theta_1 + \theta_2 = \frac{1}{2}\alpha(2)^2$

$\frac{1}{2}\alpha(1) + \theta_2 = \frac{4\alpha}{2} \Rightarrow \theta_2 = 2\alpha - \alpha/2$

$= 3\alpha/2$

$\theta_2 = 3(\theta_1)$

$= 3 \times 5 = 15$ radian

Q74: A 100 g of iron nail is bit by a 1.5 kg hammer striking at a velocity of 60 ms^{-1}. What will be the rise in the temperature of the nail if one fourth of energy of the hammer goes into heating the nail ? [5pecific heat capacity of iron = 0.42 $Jg^{-1}{}^{o}C^{-1}$]

(A) 675° C

(B) 1600°C

(C) 16.07°C

(D) 6.75°C

Student should change the unit to J/kg°C

Remember unit game

ANS-74

1/4 th of the energy of the hammer = for heating the nail

$$\frac{1}{4}\left(\frac{1}{2}M_{hammer}v^2\right) = M_{NAIL}(S)(\Delta\theta)$$

$$\Delta\theta = \frac{1}{8}\frac{M(hammer)\,v^2}{M_{NAIL}(S)}$$

$$= \frac{1}{8} \times \frac{(1.5)(60)^2}{100\times10^{-3}\times 420}$$

$$= 16.07^{o}C$$

Q75: If the charge on a capacitor is increased by 2 C, the energy stored in it increases by 44%. The original charge on the capacitor is (in C)

(A) 10 ✓

(B) 20

(C) 30

(D) 40

ANS-75

$$U = \frac{Q^2}{2C}$$

$Q' =$ New charge $= Q + 2$

$$U' = \frac{1}{2C}(Q+2)^2$$

$U' =$ New energy $= U + U \times \frac{44}{100} = 1.44\,U$

$$\frac{(Q+2)^2}{2C} = \left(\frac{Q^2}{2C}\right)(1.44)$$

$$Q + 2 = Q(1.2)$$

$$2 = Q(1.2 - 1) = 0.2\,Q$$

$$Q = \frac{2}{0.2} = 10\ C$$

Q76: A long cylindrical volume contains a uniformly distributed charge of density ρ. The radius of cylindrical volume is R. A charge particle (q) revolves around the cylinder in a circular path. The kinetic energy of the particle is :

(A) ✓ $\frac{\rho q R^2}{4\varepsilon_0}$

(B) $\frac{\rho q R^2}{2\varepsilon_0}$

(C) $\frac{q\rho}{4\varepsilon_0 R^2}$

(D) $\frac{4\varepsilon_0 R^2}{q\rho}$

Volume of the cylinder $= \pi R^2 (l)$

$\rho = q/V$

$q = \rho V$

$= \pi R^2 (l) \rho$

$E_P = \frac{1}{2\pi\epsilon_0}\frac{\lambda}{r}$

$= \frac{1}{2\pi\epsilon_0}\frac{q}{l r}$

$= \frac{1}{2\pi\epsilon_0}\frac{\rho \pi R^2 (l)}{l r}$

$= \frac{1}{2\pi\epsilon_0}\frac{\rho \pi R^2}{r}$

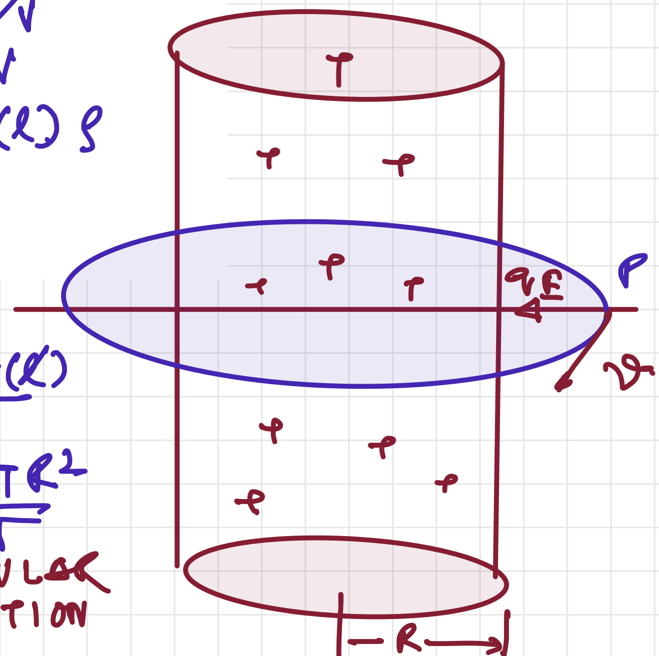
— FOR CIRCULAR MOTION

$qE = \frac{mv^2}{r}$

$q\left(\frac{1}{2\pi\epsilon_0}\frac{\rho\pi R^2}{r}\right) = \frac{mv^2}{r}$

$\frac{1}{2}\left(q\left[\frac{\rho R^2}{2\epsilon_0}\right]\right) = (mv^2)\times\frac{1}{2}$

$\frac{1}{2}mv^2 = \frac{q\rho R^2}{4\epsilon_0}$



Q77: An electric bulb is rated as 200W. What will be the peak magnetic field at 4 m distance produced by the radiations coming from this bulb? Consider this bulb as a point source with 3.5% efficiency.

(A) 1.19×10^{-8} T

(B) 1.71×10^{-8} T

(C) 0.84×10^{-8} T

(D) 3.36×10^{-8} T

ANS-77

Power = 200 watt

$$\text{Intensity} = \frac{\text{Power}}{4\pi r^2} = \frac{(3.5)\times 100}{100 \times 4\pi (4)^2} \left(\frac{\text{watt}}{\text{mt}^2}\right)$$

I of $\frac{\text{Joules}}{\text{sec mt}^2}$

$$I = \frac{B_0^2 c}{2\mu_0}$$

Remember this formula

$$B_0 = \sqrt{\frac{I.(2\mu_0)}{c}}$$

$$= \sqrt{\frac{(3.5)\times 2\times 4\pi\times 10^{-7}}{4\times\pi\times 16\times 3\times 10^{8}}}$$

$$= 1.2\times 10^{-8}\,T$$

Q78: The light of two different frequencies whose photons have energies 3.8 eVand 1.4 eV respectively, illuminate a metallic surface whose work function is 0.6 eV successively. The ratio of maximum speeds of emitted electrons for the two frequencies respectively will be :

(A) 1 : 1

(B) 2 : 1 ✓

(C) 4 : 1

(D) 1 : 4

ANS- 78

$$h\nu = h\nu_0 + (KE)_{max}$$

Case-1

$$3.8 = 0.6 + \frac{1}{2} m v_1^2$$

$$3.8 - 0.6 = \frac{1}{2} m v_1^2$$

$$3.2 = \frac{1}{2} m v_1^2 \quad \text{--- (1)}$$

Case-2

$$1.4 = 0.6 + \frac{1}{2} m v_2^2$$

$$0.8 = \frac{1}{2} m v_2^2 \quad \text{--- (2)}$$

$$\frac{\text{eq}^n (1)}{\text{eq}^n (2)}$$

$$\frac{3.2}{0.8} = \frac{4}{1} = \frac{\frac{1}{2} m v_1^2}{\frac{1}{2} m v_2^2} \Rightarrow \frac{v_1}{v_2} = \sqrt{\frac{4}{1}} = 2$$

Q79: Two light beams of intensities in the ratio of 9: 4 are allowed to interfere. The ratio of the intensity of maxima and minima will be

(A) 2 : 3

(B) 16 : 81

(C) 25 : 169

(D) 25 : 1 ✓

ANS-79

$$\frac{I_1}{I_2} = \frac{a^2}{b^2} = \frac{9}{4} \Rightarrow \frac{a}{b} = \frac{3}{2} \Rightarrow a = \frac{3}{2}b$$

$$\frac{I_{max}}{I_{min}} = \frac{(a+b)^2}{(a-b)^2} = \frac{\left(\frac{3}{2}b+b\right)^2}{\left(\frac{3}{2}b-b\right)^2}$$

$$= \frac{(5/2)^2}{(1/2)^2}$$

$$= \frac{25}{1}$$

Q80: In Bohr's atomic model of hydrogen. let K. P and E arc the kinetic energy, potential energy and total energy of the electron respectively. Choose the correct options when the electron undergoes transitions to a higher level :

(A) All K, P and E increase

(B) K decreases, P and E increase ✓

(C) P decreases, K and E increase

(D) K increases, P and E decrease

ANS- B

$$PE = -\frac{Zke^2}{r}$$

$$TE = -\frac{Zke^2}{2r}$$

$$TE = KE + PE$$

$$KE = TE - PE = -\frac{Zke^2}{2r} + \frac{Zke^2}{r}$$

$$KE = +\frac{1}{2}\frac{kZe^2}{r}$$

when $r \uparrow \uparrow$

then

$$KE = \frac{1}{2}\frac{kZe^2}{r} \downarrow$$

$$P = -\frac{Zke^2}{r} \uparrow$$

$$TE = -\frac{Zke^2}{2r} \uparrow$$

Q81: A body is projected from the ground at an angle of 45° with the horizontal. Its velocity after 2s is 20 ms^{-1}. The maximum height reached by the body during its motion is _____m. (us g = 10 ms^{-2})

20. mt

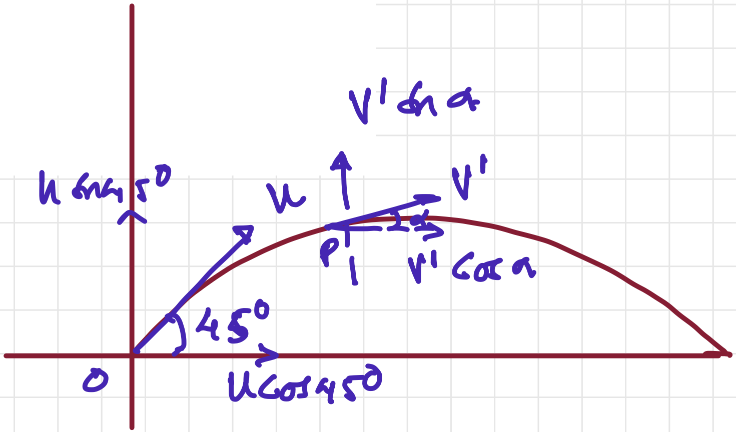
$V_x = u_x + a_x t$

$V' \cos\alpha = u \cos 45^\circ$ —— ①

$V_y = u_y + a_y t$

$V' \sin\alpha = u \sin 45 - g(2)$ —— ②

SQUARING AND ADDING EQUATION ① & ②



$$V' = \sqrt{(u \cos 45)^2 + (u \sin 45 - 20)^2}$$

$$(V')^2 = \frac{u^2}{2} + \frac{u^2}{2} + 400 - \frac{40u}{\sqrt{2}}$$

$$400 = u^2 - \frac{40u}{\sqrt{2}} + 400$$

$$u = \frac{40}{\sqrt{2}} \text{ mt/sec}$$

MAX HEIGHT

$$H = \frac{u^2 \sin^2\theta}{2g} = \frac{\left(\frac{40}{\sqrt{2}} \times \frac{1}{\sqrt{2}}\right)^2}{2 \times 10}$$

$$= \frac{(20)^2}{20} = 20 \text{ mt}$$

Q82: An antenna is placed in a dielectric medium of dielectric constant 6.25. If the maximum size of that antenna is 5.0 mm, it can radiate a signal of minimum frequency of __________GHz. (Given μ_r =1 for dielectric medium)

6×10^9 Hz

$$l = \lambda/4$$

$$\lambda = 4(l)$$

$$\mu = \sqrt{\epsilon_r \mu_r}$$

$$= \sqrt{\frac{625}{100}\times 1} = \frac{25}{10} = 2.5$$

$$\mu = \frac{c}{v_m}$$

$$v_m = \frac{c}{\mu} = \frac{3\times10^8}{0.25}$$

$$v_m = f(\lambda)$$

$$f = \frac{v_m}{\lambda} = \frac{3\times10^8}{2.5\times4\times5\times10^{-3}}$$

$$= \frac{3\times10^8\times10^3\times10}{25\times20}$$

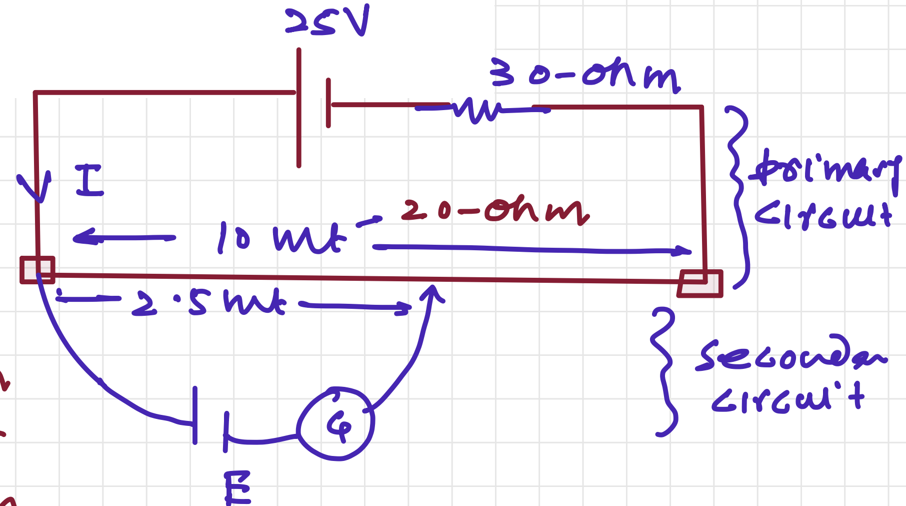
$$= \frac{300}{25\times20}\times10^9$$

6×10^9 Hz

6 GHz

Q83: A potentiometer wire of length 10 m and resistance 20Ω is connected in series with a 25 V battery and an external resistance 30 Ω . A cell of emf E in secondary circuit is balanced by 250 cm long potentiometer wire. The value of E (in volt) is $\frac{x}{10}$. The value of x is ______

25



current in primary circuit $I = \frac{25}{30+20}$

$= \frac{25}{50} = \frac{1}{2}$ Amp

Resistance of 10 mt = 20-ohm

" " 2.5 mt $= \frac{20}{10} \times 2.5$

$= 5$ ohm

$E = \frac{1}{2}(5) = \frac{5}{2}$ volt

$= \frac{25}{10}$ volt $= \frac{x}{10}$

$x = 25$

Q84: True travelling waves of equal amplitudes and equal frequencies move in opposite directions along a string. They interfere to produce a stationary wave whose equation is given by $y = \left(10 \cos \pi x \sin \frac{2\pi t}{T}\right) cm$

The amplitude of the particle at $x = \frac{4}{3} cm$ will be 5 cm.

5

ANS - 84

$y = (10 \cos \pi x) \sin \frac{2\pi t}{T}$

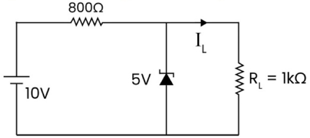
Amplitude $= 10 \cos \pi x$

$= 10 \cos \pi \left(\frac{4}{3}\right)$

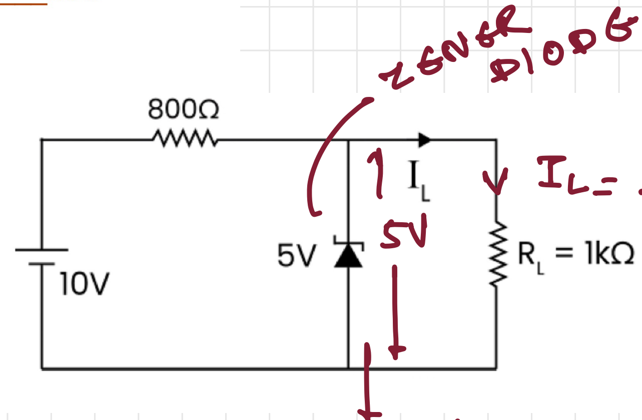
$= 10 \cos \frac{4\pi}{3}$

$= 10 \left(\frac{1}{2}\right) = 5 \text{ cm.}$

Q85: If the given circuit, the value of current I_L will be __5__ mA.
(When $R_L = 1k\Omega$)



5 mA



$$I_L = \frac{5}{1\times10^3} = 5\times10^{-3}\ \text{Amp}$$

Always the output voltage across zener diode remains constant hence it will also act as a

Voltage Regulator

Q86: A sample contains 10^{-2} kg each of two substances A and B with half lives 4s and 8s respectively. The ratio of their atomic weights is 1: 2. The ratio of the amounts of A and B after 16 is $\frac{x}{100}$. The value of x is ________

25

ANS-86

$$\frac{N_A}{N_B} = \frac{N_{0A}(1/2)^{n_1}}{N_{0A}(1/2)^{n_1}}$$

$$T.T = n\,(T_{1/2})$$

for A → $16 = n_1\,(4) \Rightarrow n_1 = 4$

$16 = n_2\,(8) \Rightarrow n_2 = 2$

$$\frac{N_A}{N_B} = \frac{1}{1}\,\frac{(1/2)^4}{(1/2)^2} = \frac{1}{4}$$

$$\frac{1}{4} = \frac{x}{100} \Rightarrow x = 25$$

Q87: A ray of light is incident at an angle of incidence 60° on the glass slab of refractive index $\sqrt{3}$. After refraction, the light ray emerges out from other parallel faces and lateral shift between incident ray and emergent ray is $4\sqrt{3}$ cm. The thickness of the glass slab is _______ cm.

12 cm

$$1 \sin 60^\circ = \sqrt{3} \sin r$$

$$\frac{\sqrt{3}}{2} = \sqrt{3} \sin r$$

$$r = 30^\circ$$

Lateral shift

$$4\sqrt{3} = \frac{t \sin(i-r)}{\cos r}$$

$$4\sqrt{3} = \frac{t \sin(60-30^\circ)}{\cos 30^\circ}$$

$$t = \frac{(4\sqrt{3}) \cos 30^\circ}{\sin 30^\circ} = \frac{(4\sqrt{3})(\sqrt{3}/2)}{(1/2)}$$

$$= 12 \text{ cm}$$

DERIVATION OF LATERAL SHIFT

MN – LATERAL DISPLACEMENT

$$\sin(i-r) = \frac{MN}{LN}$$

$$\cos r = \frac{t}{LN}$$

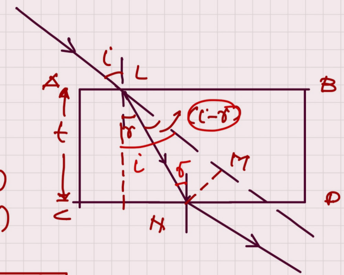
$$LN = \frac{t}{\cos r}$$

$$\sin(i-r) = \frac{MN}{LN}$$

$$MN = (LN) \sin(i-r)$$

$$= \frac{t}{\cos r} \sin(i-r)$$

$$MN = \frac{t \sin(i-r)}{\cos r}$$



Q88: A circular coil of 1000 turns each pith area $1m^2$ is rotated about its vertical diameter at the rate of one revolution per second in a uniform horizontal magnetic field of 0.07T. The maximum voltage generation will be 440 V.

440

ANS- 88

$$e_0 = NBA\omega$$

$$= (1000)(.07) \times 1 \times 2 \times 3.14$$

$$= 440 \text{ volt}$$

Q89: A monoatomic gas performs a work of $\frac{Q}{4}$ where Q is the heat supplied to it. The molar heat capacity of the gas will be ___2___R during this transformation. Where R is the gas constant.

2R

ANS- 89

$W = Q/4$

$Q = \Delta U + W$

$Q = \Delta U + Q/4$

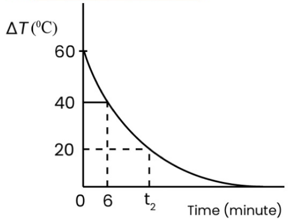
$\Delta U = Q - Q/4 = \frac{3Q}{4}$

$nC_v \Delta T = \frac{3Q}{4}$

$nC\Delta T = Q$

$C = \frac{4}{3} C_v = \frac{4}{3} \times \frac{3R}{2} = 2R$

Q90: In an experiment to verify Newton's law of cooling, a graph is plotted between, the temperature difference (ΔT) of the water and surroundings and time as shown in figure. The initial temperature of water is taken as 80°C. The value of t_2 as mentioned in the graph will be___________.



$$\Delta T = T_{water} - T_{surrounding}$$
$$= T - T_s$$
$$\Delta T = 60, \quad T = 80°C$$
$$80 - T_s = 60 \Rightarrow T_s = 20°C$$

FROM NEWTON'S LAW OF COOLING

$$-\frac{(T_f - T_i)}{\Delta t} = K\left[\frac{T_i + T_f}{2} - T_s\right]$$

0 – 6 min

$$\frac{20}{6} = K\left[\left(\frac{60+40}{2} + 20\right) - 20\right] \quad \text{—(1)}$$

6 – t_2 min

$$\frac{20}{t_2 - 6} = K\left[\left(\frac{40+20}{2} + 20\right) - 20\right] \quad \text{—(2)}$$

$$\frac{\text{EQUATION (1)}}{\text{EQUATION (2)}}, \quad t_2 = 16 \text{ min}$$

Rough work sheet

Rough work sheet

Rough work sheet

- Physics Tutors in Gurgaon