JEE–MAIN EXAMINATION – JANUARY 2026

(HELD ON THURSDAY 22nd JANUARY 2026) **TIME : 9:00 AM TO 12:00 NOON**

PHYSICS — TEST PAPER WITH SOLUTION

SECTION-A

26. A solid sphere of mass 5 kg and radius 10 cm is kept in contact with another solid sphere of mass 10 kg and radius 20 cm. The moment of inertia of this pair of spheres about the tangent passing through the point of contact is_________$kg.m^2$.

(1) 0.36 (2) 0.72
(3) 0.18 (4) 0.63

Ans. (4)

Sol. $I = \frac{7}{5}\left[m_1R_1^2 + m_2R_2^2\right]$

$= \frac{7}{5}\left[5(10)^2 + 10\times(20)^2\right]\times 10^{-4}$

$I = 63 \times 10^{-2}$ kg m^2

$I = 0.63$ kg m^2

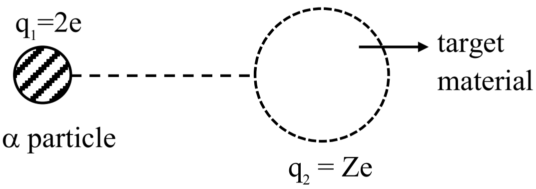
27. 7.9 MeV α–particle scatters from a target material of atomic number 79. From the given data the estimated diameter of nuclei of the target material is (approximately)________m.

$\left[\frac{1}{4\pi\epsilon_0} = 9\times10^9 Nm^2/C^2 \text{ and electron charge} = 1.6\times10^{-19}C\right]$

(1) 5.76×10^{-14} (2) 1.44×10^{-13}
(3) 2.88×10^{-14} (4) 1.69×10^{-12}

Ans. (1)

Sol. By mechanical energy conservation



$(Me)_i = (Me)_f$

$PE_i + KE_i = PE_f + KE_f$

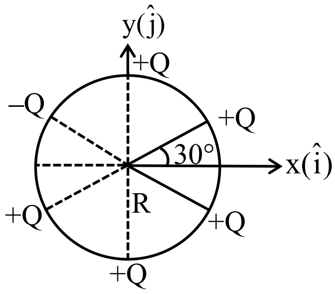
$0 + 7.9 \times 10^6 \times 1.6 \times 10^{-19} = \frac{k(2e)(Ze)}{r} + 0$

$r = \frac{9\times10^9 \times 2\times(1.6\times10^{-19})^2 \times 79}{7.9\times10^6 \times 1.6\times10^{-19}} = 2.88 \times 10^{-14}$ m

For diameter ⇒ $D = 2r = 5.76 \times 10^{-14}$ m

28. Six point charges are kept 60° apart from each other on the circumference of a circle of radius R as shown in figure. The net electric field at the centre of the circle is ________.

(ϵ_o is permittivity of free space)



(1) $-\frac{5Q}{8\pi\epsilon_0 R^2}(\hat{i} + \sqrt{3}\hat{j})$

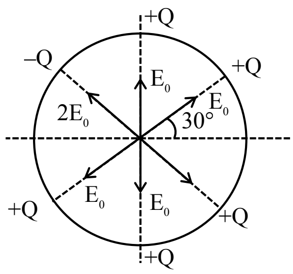
(2) $-\frac{Q}{4\pi\epsilon_0 R^2}(\sqrt{3}\,\hat{i} - \hat{j})$

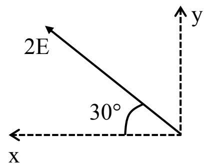
(3) $-\left(\frac{5Q}{8\pi\epsilon_0 R^2}\right)(\hat{i} - 3\hat{j})$

(4) $\frac{Q}{4\pi\epsilon_0 R^2}(\sqrt{3}\,\hat{i} - \hat{j})$

Ans. (2)

Sol. Let $\frac{KQ}{r^2} = E_0$





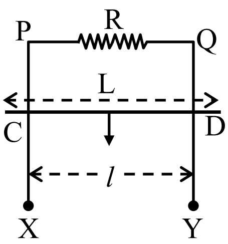
$\vec{E}_{net} = 2E_0\cos30^\circ(-\hat{i}) + 2E_0\sin30^\circ(\hat{j})$

$= \frac{2kQ}{r^2}\left[\frac{\sqrt{3}}{2}(-\hat{i}) + \frac{1}{2}\hat{j}\right]$

$= \frac{-1Q}{4\pi\varepsilon_0 r^2}(\sqrt{3}\hat{i} - \hat{j})$

29. XPQY is a vertical smooth long loop having a total resistance R where PX is parallel to QY and separation between them is l. A constant magnetic field B perpendicular to the plane of the loop exists in the entire space. A rod CD of length L ($L > l$) and mass m is made to slide down from rest under the gravity as shown in figure. The terminal speed acquired by the rod is_________m/s.

(g = acceleration due to gravity)

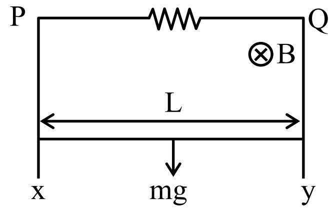


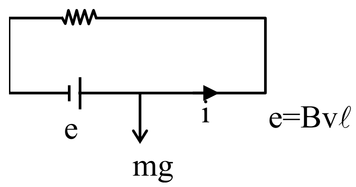
(1) $\frac{2mgR}{B^2 l^2}$ (2) $\frac{8mgR}{B^2 l^2}$

(3) $\frac{2mgR}{B^2 L^2}$ (4) $\frac{mgR}{B^2 l^2}$

Ans. **(4)**

Sol.





at equilibrium (Or for terminal velocity)

$$mg = iB\ell \Rightarrow mg = \left(\frac{Bv\ell}{R}\right)B\ell$$

$$V = \frac{mgR}{B^2\ell^2}$$

30. The escape velocity from a spherical planet A is 10 km/s. The escape velocity from another planet B whose density and radius are 10% of those of planet A, is______m/s.

(1) 1000 (2) $200\sqrt{5}$

(3) $100\sqrt{10}$ (4) $1000\sqrt{2}$

Ans. **(3)**

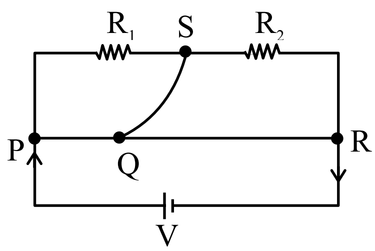
Sol. $V_e = \sqrt{\frac{2GM}{R}} = \sqrt{\frac{2G \times \rho \times \frac{4\pi R^3}{3}}{R}} \Rightarrow V_e \propto \sqrt{\rho} \times R$

$$\frac{(V_e)_B}{(V_e)_A} = \sqrt{\frac{\rho_B}{\rho_A}} \times \frac{R_B}{R_A} = \sqrt{\frac{0.1\rho_A}{\rho_A}} \times \left(\frac{0.1R_A}{R_A}\right)$$

$$\frac{(V_e)_B}{(V_e)_A} = \frac{1}{10} \times \frac{1}{\sqrt{10}}$$

$$(V_e)_B = \frac{10 \times 1000}{10\sqrt{10}} = 100\sqrt{10}\,\text{m/sec}$$

31. A meter bridge with two resistances R_1 and R_2 as shown in figure was balanced (null point) at 40 cm from the point P. The null point changed to 50 cm from the point P, when 16 Ω resistance is connected in parallel to R_2. The values of resistances R_1 and R_2 are______.



(1) $R_2 = 16\Omega, R_1 = \frac{16}{3}\Omega$

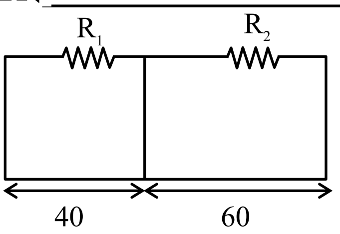
(2) $R_2 = 4\Omega, R_1 = \frac{4}{3}\Omega$

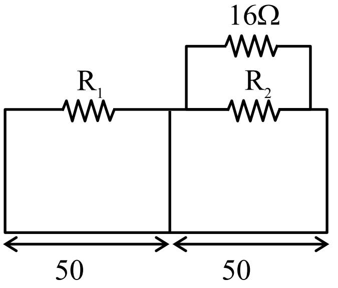
(3) $R_2 = 8\Omega, R_1 = \frac{16}{3}\Omega$

(4) $R_2 = 12\Omega, R_1 = \frac{12}{3}\Omega$

Ans. **(3)**

Sol.





$$\frac{R_1}{R_2}=\frac{40}{60}=\frac{2}{3} \quad \ldots (1)$$

$$\frac{R_1}{\left(\frac{R_2\times 16}{R_2+16}\right)}=\frac{50}{50}\Rightarrow R_1=\frac{16R_2}{16+R_2} \quad \ldots (2)$$

$$\frac{2}{3}R_2=\frac{16R_2}{16+R_2}$$

$$\frac{32}{3}+\frac{2R_2}{3}=16$$

$$\frac{2R_2}{3}=16-\frac{32}{3}=\frac{16}{3}$$

$R_2 = 8\Omega$

By equation (1)

$$R_1=\frac{2}{3}R_2=\frac{16}{3}\Omega$$

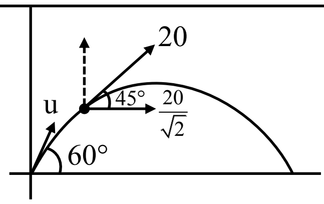
32. A projectile is thrown upward at an angle 60° with the horizontal. The speed of the projectile is 20 m/s when its direction of motion is 45° with the horizontal. The initial speed of the projectile is______ m/s.

(1) $40\sqrt{2}$ (2) 40

(3) $20\sqrt{3}$ (4) $20\sqrt{2}$

Ans. **(4)**

Sol.



$$u\cos 60^\circ=\frac{20}{\sqrt{2}}$$

$$\frac{u}{2}=\frac{20}{\sqrt{2}}$$

$$u=\frac{40}{\sqrt{2}}$$

$u = 20\sqrt{2}$ m/s

33. Given below are two statements:

Statement I : Pressure of fluid is exerted only on a solid surface in contact as the fluid-pressure does not exist everywhere in a still fluid.

Statement II: Excess potential energy of the molecules on the surface of a liquid, when compared to interior, results in surface tension.

In the light of the above statements, choose the **correct** answer from the options given below.

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

(2) Both Statement I and Statement II are false

(3) Both Statement I and Statement II are true

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

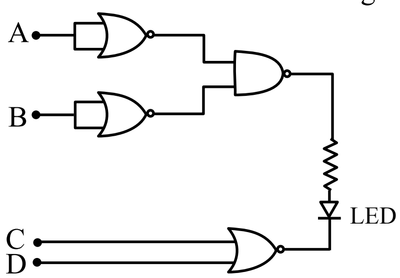
Ans. **(4)**

Sol. According to pascal's law pressure at any point in liquid at rest is same in all direction.

It exist at every point in the liquid not just at boundaries. So statement (1) is false.

For interior molecule net cohesive forces are zero statement (2) is correct.

34. Find the correct combination of A, B, C and D inputs which can cause the LED to glow.

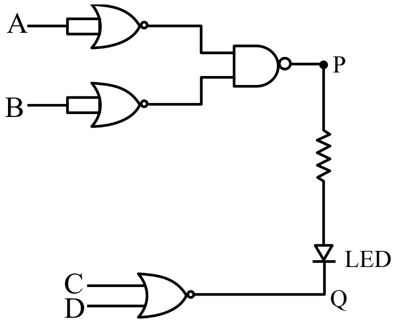


(1) 0100 (2) 0011

(3) 1000 (4) 1101

Ans. **(4)**

Sol.

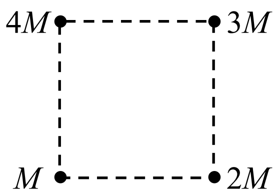


LED will glow in forward biasing :

P higher potential – 1

Q lower potential – 0

35. Net gravitational force at the centre of a square is found to be F_1 when four particles having mass *M, 2M, 3M* and *4M* are placed at the four corners of the square as shown in figure and it is F_2 when the positions of *3M* and *4M* are interchanged. The ratio $\frac{F_1}{F_2}$ is $\frac{\alpha}{\sqrt{5}}$. The value of α is _____.

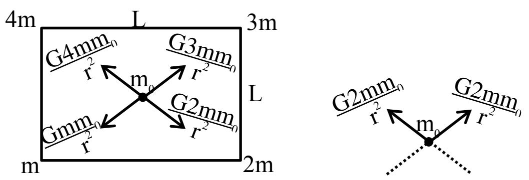


(1) 2 (2) 3

(3) 1 (4) $2\sqrt{5}$

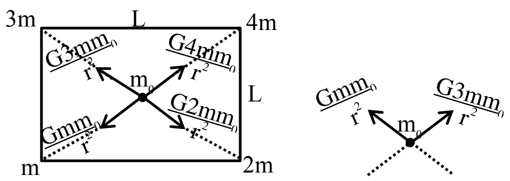
Ans. **(1)**

Sol. Initial configuration



$$F = 2\sqrt{2}\frac{Gmm_0}{r^2}$$

New configuration



$$F' = \sqrt{10}\frac{Gmm_0}{r^2} \Rightarrow \frac{F}{F'} = 2\sqrt{2}.\frac{1}{\sqrt{10}} = \frac{2}{\sqrt{5}}$$

$\therefore \alpha = 2$

36. The minimum frequency of photon required to break a particle of mass 15.348 amu into 4α particles is ____ kHz.

[mass of He nucleus = 4.002 amu,

1 amu = 1.66×10^{-27} kg, h = 6.6×10^{-34} J.s and c = 3×10^8 m/s]

(1) 9×10^{19}

(2) 9×10^{20}

(3) 14.94×10^{20}

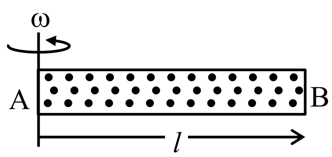
(4) 14.94×10^{19}

Ans. **(4)**

Sol. $h\nu = (4 \times 4.002 - 15.348) \times 1.66 \times 10^{-27} \times (3 \times 10^8)^2$

$\nu = 14.94 \times 10^{19}$ kHz

37. A cylindrical tube *AB* of length *l*, closed at both ends contains an ideal gas of 1 mol having molecular weight *M*. The tube is rotated in a horizontal plane with constant angular velocity *ω* about an axis perpendicular to *AB* and passing through the edge at end A, as shown in the figure. If P_A and P_B are the pressures at *A* and *B* respectively, then (Consider the temperature is same at all points in the tube)



(1) $P_B = P_A \exp(M\omega^2 l^2 / 2RT)$

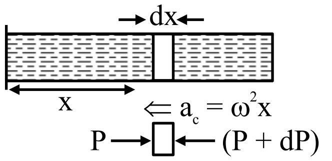
(2) $P_B = P_A$

(3) $P_B = P_A \exp(M\omega^2 l^2 / 3RT)$

(4) $P_B = P_A \exp(M\omega^2 l^2 / RT)$

Ans. **(1)**

Sol.



$$A[(P + dP) - P] = (dm)(\omega^2 x)$$

$$dP = \frac{(dm)}{A}\omega^2 x$$

$$dP = \frac{(\rho)(A)(dx)\omega^2 x}{A}$$

also $[PM = \rho RT]$

$$\rho = \frac{PM}{RT}$$

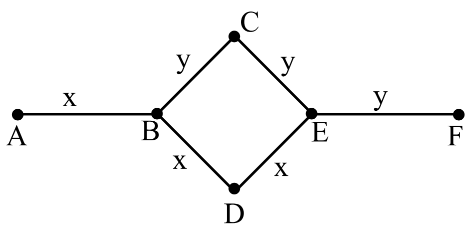
$$dP = \left(\frac{PM}{RT}\right)\omega^2 x dx$$

$$\int_{P_A}^{P_B}\frac{dP}{P} = \frac{\omega^2 M}{RT}\int_0^{\ell} x dx$$

$$\ell n\left(\frac{P_B}{P_A}\right) = \frac{\omega^2 \ell^2 M}{2RT}$$

$$P_B = P_A e^{\frac{M\omega^2\ell^2}{2RT}}$$

38. Rods x and y of equal dimensions but of different materials are joined as shown in figure. Temperatures of end points *A* and *F* are maintained at 100 °C and 40 °C respectively. Given the thermal conductivity of rod x is three times of that of rod y, the temperature at junction points *B* and *E* are (close to) :



(1) 89 °C and 73 °C respectively

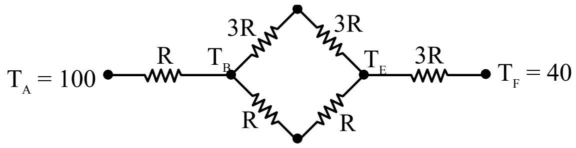
(2) 80 °C and 60 °C respectively

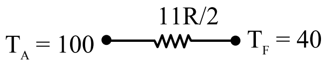
(3) 80 °C and 70 °C respectively

(4) 60 °C and 45 °C respectively

Ans. (1)

Sol. Let $\left[R = \frac{\ell}{3KA}\right]$





$$\left[H = \frac{100 - 40}{\frac{11R}{2}}\right] \dots (1)$$

$$H = \frac{100 - T_B}{R} \dots\dots (2)$$

$$H = \frac{T_E - 40}{3R} \dots\dots (3)$$

using (1) and (2)

$120 = 1100 - 11T_A$

$T_B = 89°C$

using (1) and (3)

$T_E = 73°C$

39. A thin convex lens of focal length 5 cm and a thin concave lens of focal length 4 cm are combined together (without any gap) and this combination has magnification m_1 when an object is placed 10 cm before the convex lens. Keeping the positions of convex lens and object undisturbed a gap of 1 cm is introduced between the lenses by moving the concave lens away, which lead to a change in magnification of total lens system to m_2.

The value of $\left|\frac{m_1}{m_2}\right|$ is ______.

(1) $\frac{5}{9}$ (2) $\frac{5}{27}$

(3) $\frac{3}{2}$ (4) $\frac{25}{27}$

Ans. (Dropped)

40. Consider an equilateral prism (refractive index $\sqrt{2}$). A ray of light is incident on its one surface at a certain angle *i*. If the emergent ray is found to graze along the other surface then the angle of refraction at the incident surface is close to ____.

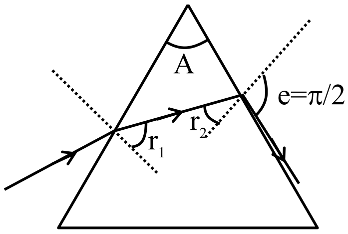
(1) 15° (2) 20°

(3) 40° (4) 30°

Ans. **(1)**

Sol. Equilateral prism.

A = 60°



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

$\sin r_2 = \frac{1}{\mu} = \frac{1}{\sqrt{2}}$

$r_2 = 45°$

$\therefore r_1 = A - r_2 = 15°$

41. The volume of an ideal gas increases 8 times and temperature becomes $(1/4)^{th}$ of initial temperature during a reversible change. If there is no exchange of heat in this process ($\Delta Q = 0$) then identify the gas from the following options (Assuming the gases given in the options are ideal gases) :

(1) CO_2 (2) O_2

(3) NH_3 (4) He

Ans. **(4)**

Sol. PV^{γ} = constant

$TV^{\gamma-1}$ = constant

$TV^{\gamma-1} = \left(\frac{T}{4}\right)(8V)^{(\gamma-1)}$

$4 = 8^{(\gamma-1)}$

$2^2 = 2^{3\gamma-3}$

$2 = 3(\gamma-1)$

$\gamma = \frac{5}{3}$

Gas is a monoatomic gas

Answer is He.

42. Electric field in a region is given by $\vec{E} = Ax\hat{i} + By\hat{j}$, where A = 10 V/m² and B = 5 V/m². If the electric potential at a point (10, 20) is 500 V, then the electric potential at origin is ______ V.

(1) 1000 (2) 500

(3) 2000 (4) 0

Ans. **(3)**

Sol. $\vec{E} = 10x\hat{i} + 5y\hat{j}$

$V_{\text{at }(10,20)} = 500\text{ V}$

$\Delta V - \int \vec{E}\cdot d\vec{r}$

$$500 - V_0 = -\int_{(0,0)}^{(10,20)} \left(10x\,\hat{i} + 5y\,\hat{j}\right)\cdot\left(dx\,\hat{i} + dy\,\hat{j}\right)$$

$$500 - V_0 = -\left[5x^2 + \frac{5y^2}{2}\right]_{(0,0)}^{(10,20)}$$

$$V_0 - 500 = \left(500 + 5\times\frac{400}{2}\right) - (0-0)$$

$V_0 - 500 = 500 + 1000$

$V_0 = 2000\text{V}$

43. A simple pendulum has a bob with mass *m* and charge q. The pendulum string has negligible mass. When a uniform and horizontal electric field $\vec{E}$ is applied, the tension in the string changes. The final tension in the string, when pendulum attains an equilibrium position is _____.

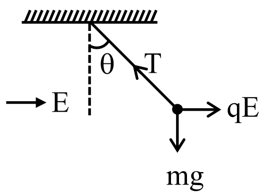
(g : acceleration due to gravity)

(1) $mg - qE$ (2) $mg + qE$

(3) $\sqrt{m^2g^2 + q^2E^2}$ (4) $\sqrt{m^2g^2 - q^2E^2}$

Ans. **(3)**

Sol.



$T = \sqrt{(qE)^2 + (mg)^2}$

44. Match the **LIST-I** with **LIST-II**

	List-I		List-II
A.	Spring constant	I.	$ML^2T^{-2}K^{-1}$
B.	Thermal conductivity	II.	ML^0T^{-2}
C.	Boltzmann constant	III.	$ML^2T^{-3}A^{-2}$
D.	Inductive reactance	IV.	$MLT^{-3}K^{-1}$

Choose the ***correct*** answer from the options given below:

(1) A-II, B-I, C-IV, D-III
(2) A-I, B-IV, C-II, D-III
(3) A-III, B-II, C-IV, D-I
(4) A-II, B-IV, C-I, D-III

Ans. **(4)**

Sol. (A) F = Kx

$[MLT^{-2}] = [K][L]$

$[K] = ML^0T^{-2}$

(B) Thermal conductivity

$$\frac{dQ}{dt} = \frac{kA}{\ell}\Delta T$$

$$ML^2T^{-3} = \frac{[k]L^2K}{L}$$

$[K^1] = MLT^{-3}\,K^{-1}$

(C) Boltzman constant

$$[K] = ML^2T^{-2}K^{-1}$$

(D) Inductive reactance

$$\frac{[V]}{[I]} = \frac{ML^2T^{-3}A^{-1}}{A}$$

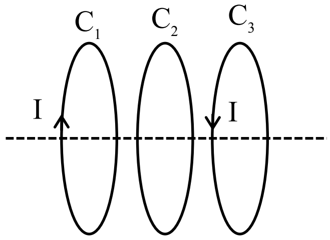
$= ML^2T^{-3}A^{-2}$

45. Three identical coils C_1, C_2 and C_3 are closely placed such that they share a common axis. C_2 is exactly midway. C_1 carries current *I* in anti-clockwise direction while C_3 carries current *I* in clockwise direction. An induced current flows through C_2 will be in clockwise direction when

(1) C_1 and C_3 move with equal speeds away from C_2
(2) C_1 moves towards C_2 and C_3 moves away from C_2
(3) C_1 moves away from C_2 and C_3 moves towards C_2
(4) C_1 and C_3 move with equal speeds towards C_2

Ans. **(2)**

Sol.



Magnetic field through the coil is

$$\vec{B} = \left(B_{C_2} - B_{C_1}\right)\hat{i}$$

$$\phi = \left(B_{C_2} - B_{C_1}\right)A$$

$$\varepsilon = \frac{-d\phi}{dt}$$

Find the direction according to Lenz's law

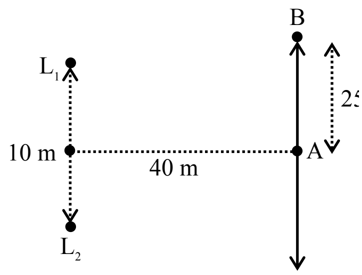
If coil move away then magnetic field decreases & vice versa

Correct Ans. (2)

SECTION-B

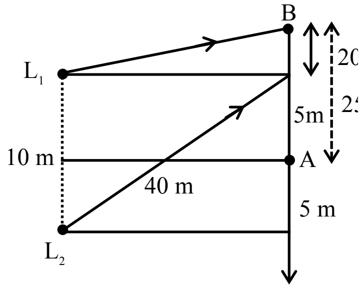
46. Two loudspeakers (L_1 and L_2) are placed with a separation of 10 m, as shown in figure. Both speakers are fed with an audio input signal of same frequency with constant volume. A voice recorder, initially at point *A*, at equidistance to both loud speakers, is moved by 25 m along the line *AB* while monitoring the audio signal. The measured signal was found to undergo 10 cycles of minima and maxima during the movement. The frequency of the input signal is _____ Hz

(Speed of sound in air is 324 m/s and $\sqrt{5} = 2.23$)



Ans. **(600)**

Sol.



Point B will 10^{th} maxima

$\Delta x = L_2B - L_1B$

$L_1B = \sqrt{20^2 + 40^2} = 20\sqrt{5}\text{m} = 44.6\text{m}$

$L_2B = \sqrt{40^2 + 30^2} = 50\text{m}$

$\Delta x = 50 - 44.6 = 5.4$ m

$\Delta x = n\lambda$

$5.4 = 10 \times \lambda$

$\lambda = 0.54$ m

$V = f\lambda$

$$f = \frac{324}{0.54} = 600\text{Hz}$$

47. The electric field of a plane electromagnetic wave, travelling in an unknown non-magnetic medium is given by,

$E_y = 20 \sin (3 \times 10^6 x - 4.5 \times 10^{14} t)$ V/m

(where x, t and other values have S.I. units). The dielectric constant of the medium is ____.

(speed of light in free space is 3×10^8 m/s)

Ans. **(4)**

Sol. $n = \frac{C}{V}$

$$V = \frac{\omega}{k} = \frac{4.5 \times 10^{14}}{3 \times 10^6} = \frac{3}{2} \times 10^8$$

$n = 2$

$n = \sqrt{\mu_r \varepsilon_r} \quad (\mu_r = 1)$

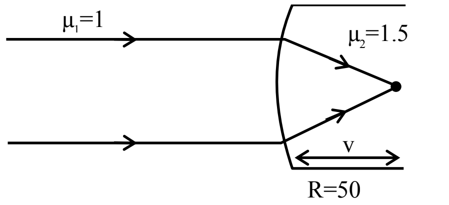
$2 = \sqrt{\varepsilon_r}$

$\varepsilon_r = 4$

48. A parallel beam of light travelling in air (refractive index 1.0) is incident on a convex spherical glass surface of radius of curvature 50 cm. Refractive index of glass is 1.5. The rays converge to a point at a distance x cm from the centre of the curvature of the spherical surface. The value of x is ____ cm.

Ans. **(100)**

Sol.



$$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R} \Rightarrow \frac{1.5}{v} - \frac{1}{\infty} = \frac{1.5 - 1}{50}$$

V = 150 cm

x $\rightarrow$ measure from center

x = V – R

= 150 – 50 = 100 cm

49. A circular disc has radius R_1 and thickness T_1. Another circular disc made of the same material has radius R_2 and thickness T_2. If the moment of inertia of both discs are same and $\frac{R_1}{R_2} = 2$ then $\frac{T_1}{T_2} = \frac{1}{\alpha}$. The value of α is ____.

Ans. **(16)**

Sol.

$m_1 = \pi R_1^2 T_1 \rho \qquad m_2 = \pi R_2^2 T_2 \rho$

$I_1 = \frac{m_1 R_1^2}{2} \qquad I_2 = \frac{m_2 R_2^2}{2}$

$I_1 = I_2$

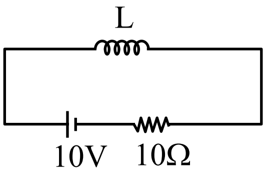
$$\frac{\pi R_1^2 T_1 \rho R_1^2}{2} = \frac{\pi R_2^2 T_2 \rho R_2^2}{2} \Rightarrow \frac{T_1}{T_2} = \frac{1}{16}$$

50. Inductance of a coil with 10^4 turns is 10 mH and it is connected to a dc source of 10 V with internal resistance of 10Ω. The energy density in the inductor when the current reaches $\left(\frac{1}{e}\right)$ of its maximum value is $\alpha\pi \times \frac{1}{e^2}$ J/m^3. The value of α is ___. ($\mu_0 = 4\pi \times 10^{-7}$ Tm/A).

Ans. **(20)**

Sol. $L = 10 \times 10^{-3}$ H

$N = 10^4$



$$I_0 = \frac{10}{10} = 1\text{A} \ \text{(max current)}$$

$$I = \frac{1}{e}$$

$$E_d = \frac{B^2}{2\mu_0}$$

$$B = \mu_0 n I$$

$$L = \mu_0 n^2 \pi R^2 \ell$$

$$E_d = \frac{\mu_0 n^2 I^2}{2}$$

$$= \frac{4\pi \times 10^{-7} \times 10^8 \times \frac{1}{e^2}}{2}$$

$$= \frac{20\pi}{e^2}$$