JEE Main January 2026

Question Paper With Text Solution

23 January | Shift-1

PHYSICS

JEE MAIN JANUARY 2026 | 23 JANUARY SHIFT-1

SECTION – A
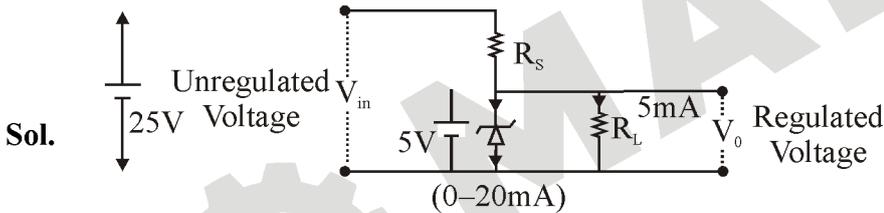
Question ID : 8606541395

26.   The following diagram shows a Zener diode as a voltage regulator. The Zener diode is rated at $V_z = 5$ V and the desired current in load is 5 mA. The unregulated voltage source can supply upto 25 V. Considering the Zener diode can withstand four times of the load current, the value of resistor R_S (shown in circuit) should be _____ Ω.
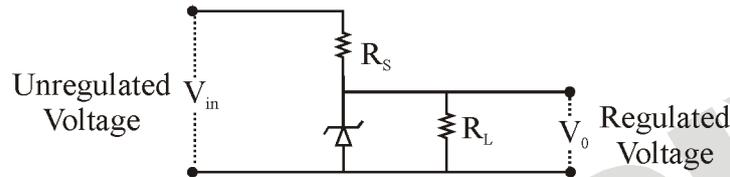
क

(1) 100   (2) 1000   (3) 10   (4) 4000

Ans.   Official answer NTA (Dropped)

Sol.

$i_{R_S} = (5\text{mA} - 25\text{mA})\ldots$ range

$V_{R_S} = I_{R_S} R_S$

$25 - 5 = 5\text{mA}R_S, \qquad 25 - 5 = 25\text{mA}R_S$

$R_S = \dfrac{20}{5} \times 1000$

$R_S = 4000 \qquad\qquad R_S = 800$

$800 < R_S < 4000$

Two answers matches hence it got dropped.

Question ID : 8606541376

27. Four persons measure the length of a rod as 20.00 cm, 19.75 cm, 17.01 cm and 18.25 cm. The relative error in the measurement of average length of the rod is :

क

(1) 0.08   (2) 0.06   (3) 0.18   (4) 0.24

Ans. Official answer NTA (2)

Sol. $\ell_1 = 20.00\,\text{cm}$

$\ell_2 = 19.75\,\text{cm}$

$\ell_3 = 17.01\,\text{cm}$

$\ell_4 = 18.25\,\text{cm}$

$\ell_{mean} = \dfrac{\ell_1 + \ell_2 + \ell_3 + \ell_4}{4} = 18.7525$

$\ell_{mean} = 18.75$

Absolute error in $\ell_1 \Rightarrow |\Delta\ell_1| = |\ell_1 - \ell_m|$

$\Delta\ell_m = \dfrac{|\Delta\ell_1| + |\Delta\ell_2| + |\Delta\ell_3| + |\Delta\ell_4|}{4}$

$= \dfrac{1.25 + 1.00 + 1.74 + 0.50}{4}$

$\Delta\ell_m = 1.1225$

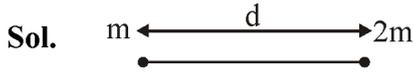$\text{Relarive ener} = \dfrac{\Delta\ell_m}{\ell_m} = \dfrac{1.12}{18.75} = 0.059$

$= 0.06$

Question ID : 8606541378

28. Two small balls with masses m and 2m are attached to both ends of a rigid rod of length d and negligible mass. If angular momentum of this system is L about an axis (A) passing through its centre of mass and perpendicular to the rod then angular velocity of the system about A is :

क

(1) $\dfrac{3}{2}\dfrac{L}{md^2}$ (2) $\dfrac{2L}{md^2}$ (3) $\dfrac{4}{3}\dfrac{L}{md^2}$ (4) $\dfrac{2L}{5\,md^2}$

Ans. Official answer NTA (1)

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Sol.

m ←————d————→ 2m

We know for two mass system, angular momentum is

$L = \mu d^2 \omega$

reduced mass = $\dfrac{m_1 m_2}{m_1 + m_2}$

$L = \left(\dfrac{m \times 2m}{m + 2m}\right) d^2 \omega$

$L = \dfrac{2}{3} md^2 \omega$

$\omega = \dfrac{3L}{2md^2}$

Question ID : 8606541386

29.   A 20 m long uniform copper wire held horizontally is allowed to fall under the gravity (g = 10 m/s^2) through a uniform horizontal magnetic field of 0.5 Gauss perpendicular to the length of the wire. The induced EMF across the wire when it travells a vertical distance of 200 m is _____ mV.

क

(1) $20\sqrt{10}$ (2) $0.2\sqrt{10}$ (3) $200\sqrt{10}$ (4) $2\sqrt{10}$

Ans.   Official answer NTA (1)

Sol.   (1) $v^2 = u^2 + 2as$

$v^2 = (2)(10)(200)$

$v = 20\sqrt{10}$

$emf = Bv\ell$

$= 0.5 \times 10^{-4} \times 20\sqrt{10} \times 20$

$= 20\sqrt{10} \times 10^{-3} V$

$emf = 20\sqrt{10} \, mV$

Question ID : 8606541384

30.   In a screw gauge, the zero of the circular scale lies 3 divisions above the horizontal pitch line when their metallic studs are brought in contact. Using this instrument thickness of a sheet is measured. If pitch scale reading is 1 mm and the circular scale reading is 51 then the correct thickness of the sheet is _____ mm.

[Assume least count is 0.01 mm]

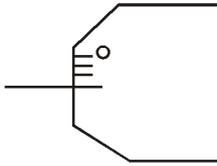**MATRIX JEE ACADEMY**
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(1) 1.48   (2) 1.50   (3) 1.54   (4) 1.51

Ans.   Official answer NTA (3)

Sol.

$|-ve\ zero\ error| = 3 \times L \cdot C$

$Reading = M \cdot S \cdot R + C \cdot C \times L \cdot C + |-ve\ zero\ error|$

$= 1mm + 51 \times 0.01mm + 3 \times 0.01mm$

$= 1.54\,mm$

Question ID : 8606541391

31.   A thin prism with angle 5° of refractive index 1.72 is combined with another prism of refractive index 1.9 to produce dispersion without deviation. The angle of second prism is _____.

क

(1) 5°   (2) 4°   (3) 6°   (4) 4.5°

Ans.   Official answer NTA (2)

Sol. $\delta_{\underset{devidian}{mean}} = (\mu_{yellow} - 1)A$

$\delta_{net} = 0$

$\delta_1 = \delta_2$
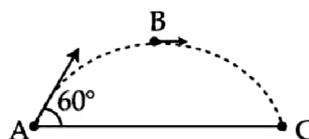
$(\mu_y - 1)A = (\mu'_y - 1)A'$

$(1.72 - 1)5° = (1.9 - 1)A'$

$\dfrac{72 \times 5}{90} = 4° = A'$

Question ID : 8606541377

32.   An object is projected with kinetic energy K from a point A at an angle 60° with the horizontal. The ratio of the difference in kinetic energies at points B and C to that at point A (see figure), in the absence of air friction is :

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क

(1) 3 : 4   (2) 2 : 3   (3) 1 : 2   (4) 1 : 4

Ans. Official answer NTA (1)

Sol. $V_A = V = V_C$

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

$$KE_B = \frac{1}{2}m(V\cos 60)^2 = \frac{1}{2}\frac{mv^2}{4}$$

$$\frac{KE_C - KE_B}{KE_A} = \frac{\frac{1}{2}mv^2 - \frac{1}{8}mv^2}{\frac{1}{2}mv^2} = \frac{\frac{3}{8}}{\frac{1}{2}} = \frac{3}{4}$$

Question ID : 8606541392

33. Consider light travelling from a medium A to medium B separated by a plane interface. If the light undergoes total internal reflection during its travel from medium A to B and the speed of light in media A and B are 2.4×10^8 m/s and 2.7×10^8 m/s, respectively, then the value of critical angle is :

क

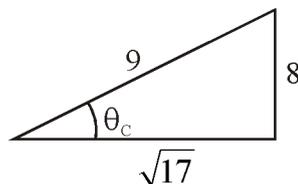(1) $\cos^{-1}\left(\frac{8}{9}\right)$ (2) $\tan^{-1}\left(\frac{8}{\sqrt{17}}\right)$ (3) $\cot^{-1}\left(\frac{3}{\sqrt{13}}\right)$ (4) $\sin^{-1}\left(\frac{9}{8}\right)$

Ans. Official answer NTA (2)

Sol. $\sin\theta_C = \frac{\mu_R}{\mu_D}$ $\mu = \frac{c}{v}$

$$\sin\theta_C = \frac{v_D}{v_R} = \frac{2.4 \times 10^8}{2.7 \times 10^8}$$

$$\sin\theta_C = \frac{8}{9}$$

$$\tan\theta_C = \frac{8}{\sqrt{17}}$$

Question ID : 8606541380

34. A small bob A of mass m is attached to a massless rigid rod of length 1 m pivoted at point P and kept at an angle of 60° with vertical as shown in figure. At distance of 1 m below point P, an identical bob B is kept at rest on a smooth horizontal surface that extends to a circular track of radius R as shown in figure. If bob B just manages to complete the circular path of radius R upto a point Q after being hit elastically by bob A, then radius R is _____ m.
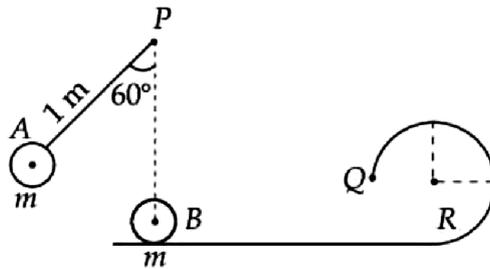
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(1) $\dfrac{3}{5}$ (2) $\dfrac{2-\sqrt{3}}{5}$ (3) $\dfrac{2+\sqrt{3}}{5}$ (4) $\dfrac{1}{5}$

Ans.   Official answer NTA (4)

Sol.   Kindic eneyy of A just before striking B.

$$mg(1-1\cos 60) = \frac{1}{2}mv^2$$

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

$$V = \sqrt{10}$$

Due to elastic collision velocity gets transferred to ball (B)
For it to complete circle

$$V = \sqrt{5gR}$$

$$\sqrt{10} = \sqrt{5gR}$$

$$\frac{1}{5} = R$$

Question ID : 8606541385

35. A simple pendulum of string length 30 cm performs 20 oscillations in 10 s. The length of the string required for the pendulum to perform 40 oscillations in the same time duration is _____ cm.

[Assume that the mass of the pendulum remains same.]

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क

(1) 0.75   (2) 15   (3) 7.5   (4) 120
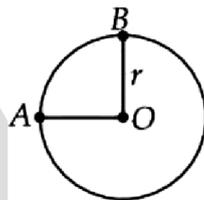
Ans. Official answer NTA (3)

Sol. $20T_1 = 40T_2$

$$20 \times 20 \sqrt{\frac{30}{g}} = 40 \times 20 \sqrt{\frac{\ell}{g}}$$

$$\frac{30}{g} = 4\frac{\ell}{g}$$

$$\ell = 7.5 \, cm$$

Question ID : 8606541390

36. A wire of uniform resistance λ Ω/m is bent into a circle of radius r and another piece of wire with length 2r is connected between points A and B (AOB) as shown in figure. The equivalent resistance between points A and B is _____ Ω.

क

(1) $\dfrac{3\pi\lambda r}{8}$ (2) $\dfrac{6\pi\lambda r}{3\pi+16}$ (3) $2\,\pi\lambda r$ (4) $(\pi + 1)2r\lambda$

Ans. Official answer NTA (2)

Sol.
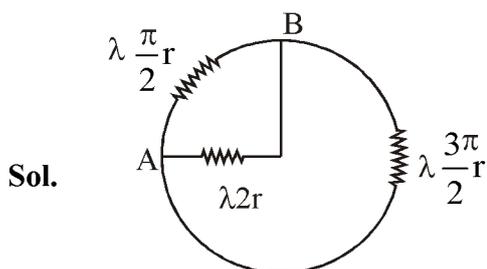
$$\frac{1}{R_4} = \frac{2}{\lambda\pi r} + \frac{1}{2\lambda\pi} + \frac{2}{\lambda 3\pi r}$$

$$= \frac{12 + 3\pi + 4}{6\lambda\pi r}$$

$$R_4 = \frac{6\lambda\pi r}{16 + 3\pi}$$

Question ID : 8606541388

37.   Match **List – I** with **List – II**.

List – I

Relation

List – II

Law

A. $\oint \vec{E} \cdot \vec{dl} = -\dfrac{d}{dt} \oint \vec{B} \cdot \vec{da}$

I. Ampere's circuital law

B. $\oint \vec{B} \cdot \vec{dl} = \mu_0 \left(I + \varepsilon_0 \dfrac{d\phi_E}{dt} \right)$

II. Faraday's laws of electromagnetic induction

C. $\oint \vec{E} \cdot \vec{da} = \dfrac{1}{\varepsilon_0} \int_v \rho dv$

III. Ampere - Maxwell law

D. $\oint \vec{B} \cdot \vec{dl} = \mu_0 I$

IV. Gauss's law of electrostatics

Choose the correct answer from the options given below :

क

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

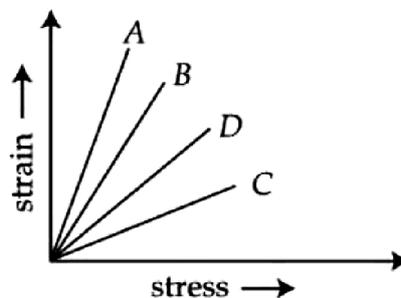(3) A-II, B-III, C-IV, D-I   (4) A-I, B-IV, C-III, D-II

Ans.   Official answer NTA (3)

Sol.   Theory based

Question ID : 8606541382

38.   The strain-stress plot for materials A, B, C and D is shown in the figure. Which material has the largest Young's modulus ?

क

(1) B   (2) C   (3) A   (4) D

Ans. Official answer NTA (2)

Sol. $Y = \dfrac{stres}{strain}$

$Y \propto \dfrac{1}{slope}$

C has highest Young modulus

Question ID : 8606541381

39. Two blocks with masses 100 g and 200 g are attached to the ends of springs A and B as shown in figure. The energy stored in A is E. The energy stored in B, when spring constants k_A, k_B of A and B, respectively satisfy the relation $4k_A = 3k_B$, is :

क

(1) 3E (2) 2E (3) 4E (4) $\dfrac{4}{3}E$

Ans. Official answer NTA (1)

Sol. $E = \dfrac{1}{2}Kx^2 \quad [Kx = mg]$

$E = \dfrac{1}{2}K\dfrac{m^2g^2}{K^2}$

$E = \dfrac{1}{2}\dfrac{m^2g^2}{K}$

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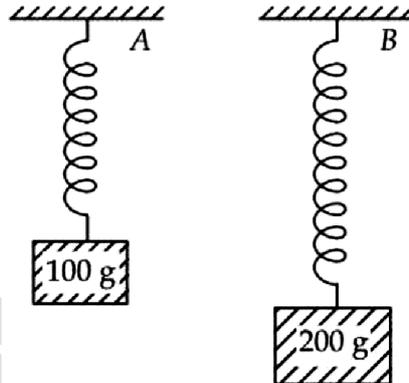**Website :** www.matrixedu.in ; Email : smd@matrixacademy.co.in

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$$\frac{E_A}{E_B} = \frac{\dfrac{m^2g^2}{2K_A}}{\dfrac{(2m)^2g^2}{2K_B}} = \frac{1}{4}\frac{K_B}{K_A}$$

$$4E \times \frac{3}{4} = E_B$$

$$3E = E_B$$

Question ID : 8606541379

40. The moment of inertia of a square loop made of four uniform solid cylinders, each having radius R and length L (R < L) about an axis passing through the mid points of opposite sides, is (Take the mass of the entire loop as M) :

क

(1) $\dfrac{3}{8}MR^2 + \dfrac{7}{12}ML^2$ (2) $\dfrac{3}{4}MR^2 + \dfrac{1}{6}ML^2$ (3) $\dfrac{3}{4}MR^2 + \dfrac{7}{12}ML^2$ (4) $\dfrac{3}{8}MR^2 + \dfrac{1}{6}ML^2$

Ans. Official answer NTA (4)

Sol. Let man of each rod is
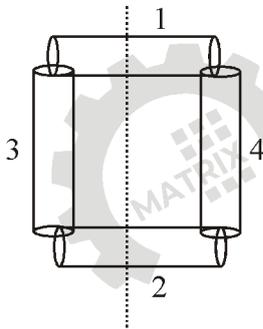
$$I = \left(\frac{M_1R^2}{4} + \frac{M_1\ell^2}{12}\right) \times 2 \dots \text{ for rod (1) \& (2)}$$

$$\left(\frac{M_1R^2}{2} + \frac{M_1\ell^2}{4}\right) \times 2 \dots \text{ for rod (3) \& (4)}$$

$$I = \frac{3}{2}M_1R^2 + \frac{2}{3}M_1\ell^2$$

$$= \frac{3}{2}\frac{M}{4}R^2 + \frac{2}{3}\frac{M}{4}\ell^2$$

$$= \frac{3}{8}MR^2 + \frac{M\ell^2}{6}$$

Question ID : 8606541383

41. In a perfectly inelastic collision, two spheres made of the same material with masses 15 kg and 25 kg, moving in opposite directions with speeds of 10 m/s and 30 m/s, respective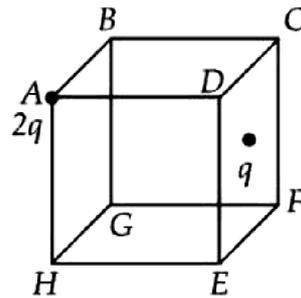ly, strike each other and stick together. The rise in temperature (in °C), if all the heat produced during the collision is retained by these spheres, is :

(specific heat of sphere material 31 cal/kg.°C and 1 cal = 4.2 J)

क

(1) 1.15   (2) 1.95   (3) 1.44   (4) 1.75

Ans. Official answer NTA (3)

Sol. $KE_{lost} = \frac{1}{2}\mu v_r^2 \left(1 - e^2\right)$

    reduced mass

For e = 0

$$\frac{1}{2}\mu v_r^2 = 15c\Delta\theta + 25c\Delta\theta$$

$$\frac{1}{2} \times \frac{15 \times 25}{15 + 25}(30 + 10)^2 = 40 \times 31 \times 4.2\Delta\theta$$

$$\frac{1}{2} \times \frac{15 \times 25}{1} \times \frac{1}{31 \times 4.2} = \Delta\theta = 1.44$$

Question ID : 8606541389

42. Two point charges 2q and q are placed at vertex A and centre of face CDEF of the cube as shown in figure. The electric flux passing through the cube is :

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(1) $\dfrac{q}{\varepsilon_0}$ 　　　(2) $\dfrac{3q}{4\varepsilon_0}$ 　　　(3) $\dfrac{3q}{\varepsilon_0}$ 　　　(4) $\dfrac{3q}{2\varepsilon_0}$

Ans. Official answer NTA (2)

Sol. $\phi = \left(\dfrac{2q}{8\varepsilon_\text{o}}\right) + \left(\dfrac{q}{2\varepsilon_\text{o}}\right) \rightarrow$ for face centre

vertex change

$\phi = \dfrac{3q}{4\varepsilon_0}$

Question ID : 8606541387

43. Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Consider a ferromagnetic material :

Assertion (A) : The individual atoms in a ferromagnetic material possess a magnetic dipole moment and interact with one another in such a way that they spontaneously align themselves forming domains.

Reason (R) : At high enough temperature, the domain structure of ferromagnetic material disintegrates. Thus, magnetization will disappear at high enough temperature known as Curie temperature.

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

क

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**

(2) **(A)** is false but **(R)** is true

(3) **(A)** is true but **(R)** is false

(4) Both **(A)** and **(R)** are true but **(R)** is not the correct explanation of **(A)**

Ans. Official answer NTA (4)

Sol. Theory based

Ferromagnetic material has domains

At temperature greater than curie temperature ferromagnetic material becoms paramagnetic material.

Question ID : 8606541393

44. The de Broglie wavelength of an oxygen molecule at 27°C is x × 10⁻¹² m. The value of x is (take Planck's constant = 6.63 × 10⁻³⁴ J.s, Boltzmann constant = 1.38 × 10⁻²³ J/K, mass of oxygen molecule = 5.31 × 10⁻²⁶ kg)

क

(1) 26   (2) 30   (3) 24   (4) 20

Ans. Official answer NTA (1)

Sol. $\lambda = \dfrac{h}{\sqrt{3mkT}}$ for gas molecule

$$\lambda = \dfrac{6.63 \times 10^{-34}}{\sqrt{3 \times 1.38 \times 10^{-23} \times 5.31 \times 10^{-26} \times 300}}$$

$\lambda = 25.8 \times 10^{-12}$ m

x = 25.8

x ≈ 26

Question ID : 8606541394

45. In hydrogen atom spectrum, (R → Rydberg's constant)

(A) the maximum wavelength of the radiation of Lyman series is $\dfrac{4}{3R}$

(B) the Balmer series lies in the visible region of the spectrum

(C) the minimum wavelength of the radiation of Paschen series is $\dfrac{9}{R}$

(D) the minimum wavelength of Lyman series is $\dfrac{5}{4R}$

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

क

(1) B, D Only   (2) A, B Only   (3) A, B and C Only   (4) A, B and D Only

Ans. Official answer NTA (3)

Sol. (i) Maximum wavelength Lyman series $\dfrac{1}{\lambda} = R\left(1 - \dfrac{1}{4}\right)$, $\lambda = \dfrac{4}{3R}$

(ii) Balmer lies in visibe region

(iii) Minimum wavelength Paschen series $\dfrac{1}{\lambda} = R\left(\dfrac{1}{9} - \dfrac{1}{\infty}\right)$, $\lambda = \dfrac{9}{R}$

(iv) Minimum wavelength Lyman series $\dfrac{1}{\lambda} = R\left(1 - \dfrac{1}{\infty}\right)$, $\lambda = \dfrac{1}{R}$

Question ID : 8606541397

46. In two separate Young's double-slit experimental set-ups and two monochromatic light sources of different wavelengths are used to get fringes of equal width. The ratios of the slits separations and that of the wavelengths of light used are 2 : 1 and 1 : 2 respectively. The corresponding ratio of the distances between the slits and the respective screens (D_1/D_2) is _____.

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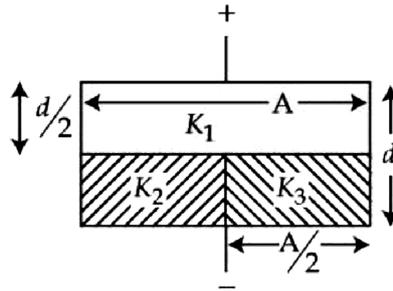**Ans.** Official answer NTA (4)

Sol. $\beta_1 = \beta_2$

$$\dfrac{\lambda_1 D_1}{d_1} = \dfrac{\lambda_2 D_2}{d_2}$$

$$\dfrac{D_1}{D_2} = \dfrac{\lambda_2}{\lambda_1} \dfrac{d_1}{d_2} = \dfrac{2}{1} \times \dfrac{2}{1}$$

$$\dfrac{D_1}{D_2} = \dfrac{4}{1}$$

Question ID : 8606541400

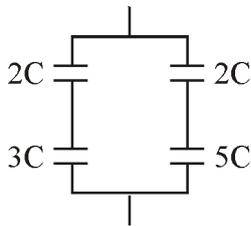47. The space between the plates of a parallel plate capacitor of capacitance C (without any dielectric) is now filled with three dielectric slabs of dielectric constants $K_1 = 2$, $K_2 = 3$ and $K_3 = 5$ (as shown in figure). If new capacitance is $\dfrac{n}{3}C$ then the value of n is _____.

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Ans. Official answer NTA (8)

Sol.

$$C_{eq.} = \frac{2c \times 3c}{5c} + \frac{2c \times 5c}{7c}$$
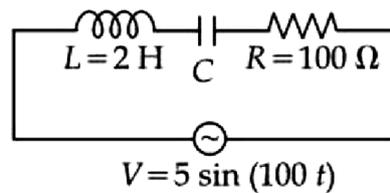
$$= \frac{(42 + 50)c}{35}$$

$$\frac{92c}{35} = \frac{nc}{3}$$

$$n = \frac{92 \times 3}{35} = 7.88$$

n = 8... nearest integer

Question ID : 8606541396

48. Using a variable frequency a.c. voltage source the maximum current measured in the given LCR circuit is 50 mA for V = 5 sin(100t). The values of L and R are shown in the figure. The capacitance of the capacitor (C) used is _____ μF.

क

Ans. Official answer NTA (50)

Sol. $\omega^2 = \dfrac{1}{LC}$

$100 \times 100 = \dfrac{1}{2C}$

$C = \dfrac{10^6}{2 \times 100 \times 100} \mu F$

$C = 50 \ \mu F$

Question ID : 8606541398

49. The equation of the electric field of an electromagnetic wave propagating through free space is given by : $E = \sqrt{377} \sin(6.27 \times 10^3 t - 2.09 \times 10^{-5} x) N/C$. The average power of the electromagnetic wave is $\left(\dfrac{1}{\alpha}\right) W/m^2$. The value of α is _____.

$\left(\text{Take} \sqrt{\dfrac{\mu_0}{\varepsilon_0}} = 377 \text{ in SI units}\right)$

क

Ans. Official answer NTA (2)

Sol. $\dfrac{Watt}{m^2} \Rightarrow$ Clearly it is asking about intensity

$I = \dfrac{1}{2}\varepsilon_o E_0^2 C = \dfrac{1}{2}\varepsilon_o 377 \dfrac{1}{\sqrt{\mu_0 \varepsilon_0}}$

$= \dfrac{1}{2}377\sqrt{\dfrac{\varepsilon_0}{\mu_0}} = \dfrac{377}{2} \times \dfrac{1}{377}$

$I = \dfrac{1}{2} = \dfrac{1}{\alpha}$

$\alpha = 2$

Question ID : 8606541399

50. A simple pendulum made of mass 10 g and a metallic wire of length 10 cm is suspended vertically in a

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uniform magnetic field of 2 T. The magnetic field direction is perpendicular to the plane of oscillations of the pendulum. If the pendulum is released from an angle of 60° with vertical, then maximum induced EMF between the point of suspension and point of oscillation is _____ mV. (Take g = 10 m/s^2)

क

Ans. Official answer NTA (100)

Sol. Energy consenation

$$mg\ell\left(1 - \cos 60\right) = \frac{1}{2}m\ell^2\omega^2$$

$$\sqrt{\frac{g}{\ell}} = \omega$$

$$\text{emf} = \frac{Bw\ell^2}{2}$$

$$= 2 \times \sqrt{\frac{g}{\ell}} \times \frac{\ell^2}{2}$$

$$= \sqrt{100} \times \frac{1}{100} = \frac{1}{10} = 100 mv$$

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