JEE–MAIN EXAMINATION – JANUARY 2026

(HELD ON THURSDAY 22nd JANUARY 2026) **TIME : 3:00 PM TO 6:00 PM**

PHYSICS — TEST PAPER WITH SOLUTION

SECTION-A

26. If $\in$, E and t represent the free space permittivity, electric field and time respectively, then the unit of $\frac{\in E}{t}$ will be :

(1) Am (2) Am^2

(3) A/m^2 (4) A/m

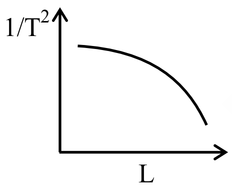
Ans. **(3)**

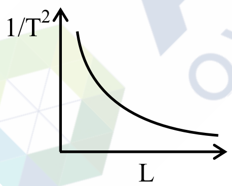
Sol. $\frac{\varepsilon E}{t} = \frac{\varepsilon}{t}\frac{1}{4\pi\varepsilon}\frac{q}{r^2}$

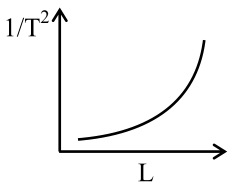
$\Rightarrow \frac{AT}{TL^2} = \left(AL^{-2}\right)$

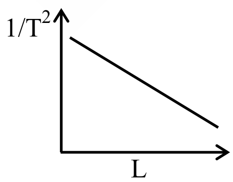
$\Rightarrow A/m^2$

27. Using a simple pendulum experiment g is determined by measuring its time period T. Which of the following plots represent the correct relation between the pendulum length L and time period T ?

(1) 

(2) 

(3) 

(4) 

Ans. **(2)**

Sol. $T = 2\pi\sqrt{\frac{\ell}{g}}$ $T^2 = \frac{4\pi^2\ell}{g}$

$\frac{1}{T^2} = \frac{g}{4\pi^2\ell}$

28. Consider two boxes containing ideal gases A and B such that their temperatures, pressures and number densities are same. The molecular size of A is half of that of B and mass of molecule A is four times that of B. If the collision frequency in gas B is 32×10^{18}/s then collision frequency in gas A is _____/s.

(1) 32×10^8 (2) 4×10^8

(3) 2×10^8 (4) 8×10^8

Ans. **(2)**

Sol. Collision frequency (z) $= \sqrt{2}\pi d^2 N\sqrt{\frac{8RT}{\pi M}}$

Temp, N are same

$Z \propto \frac{d^2}{\sqrt{M}}$

$d_A = \frac{d_B}{2}$

$M_A = 4M_B$

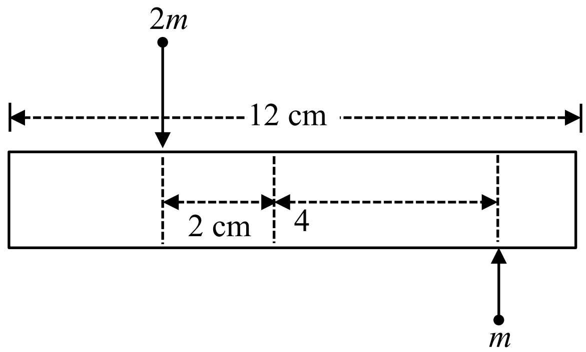
$\frac{Z_A}{Z_B} = \frac{d_A^2}{\sqrt{M_A}} \times \frac{\sqrt{M_B}}{d_B^2} = \left(\sqrt{\frac{M_B}{M_A}}\right)\left(\frac{d_A}{d_B}\right)^2$

$= \left(\sqrt{\frac{1}{4}}\right)\left(\frac{1}{2}\right)^2$

$\frac{Z_A}{Z_B} = \frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$

$\Rightarrow Z_A = \frac{32 \times 10^8}{8} = 4 \times 10^8 / s$

29. A uniform bar of length 12 cm and mass 20 m lies on a smooth horizontal table. Two point masses m and 2 m are moving in opposite directions with same speed of v and in the same plane as the bar, as shown in figure. These masses strike the bar simultaneously and get stuck to it. After collision the entire system is rotating with angular frequency ω. The ratio of v and ω is :

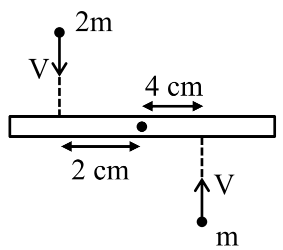


(1) 33 (2) $2\sqrt{88}$

(3) 66 (4) 32

Ans. **(1)**

Sol.



Using angular momentum conservation about COM of rod :

$L_i = L_f$

$$m\times V\times 4 + 2m\times V\times 2 = \left(\frac{20m(12)^2}{12} + m\times 4^2 + 2m\times 2^2\right)\omega$$

$8mV = (240m + 24\ m)\omega$

$8V = 264\ \omega$

$\frac{V}{\omega} = 33$

30. Three small identical bubbles of water having same charge on each coalesce to form a bigger bubble. Then the ratio of the potentials on one initial bubble and that on the resultant bigger bubble is :

(1) $1 : 3^{1/3}$ (2) $1 : 2^{2/3}$

(3) $3^{2/3} : 1$ (4) $1 : 3^{2/3}$

Ans. **(4)**

Sol. Using volume conservation

$$3\left(\frac{4}{3}\pi r^3\right) = \left(\frac{4}{3}\pi R^3\right)$$

$R = 3^{1/3}\ r$

$$\frac{V_i}{V_f} = \frac{\frac{kq}{r}}{\frac{k3q}{R}} = \frac{R}{3r} = \frac{3^{1/3} r}{3r} = \frac{1}{3^{2/3}}$$

31. In parallax method for the determination of focal length of a concave mirror, the object should always be placed :

(1) between the focus (F) and the centre of curvature (C) of the mirror ONLY

(2) at any point beyond the focus (F) of the mirror

(3) beyond the centre of the curvature (C) of the mirror ONLY

(4) between the pole (P) and the focus (F) of the concave mirror ONLY

Ans. **(2)**

Sol. Image should be real. So object should be placed beyond focus.

32. The smallest wavelength of Lyman series is 91 nm. The difference between the largest wavelengths of *Paschen* and *Balmer* series is nearly ____ nm.

(1) 1875 (2) 1550

(3) 1217 (4) 1784

Ans. **(3)**

Sol.

n = 4 ————————

n = 3 ———————— paschen

n = 2 ———————— Balmer

n = 1 ———————— Lyman

Smallest wavelength of lyman

$$\frac{1}{\lambda} = R\left(\frac{1}{12} - \frac{1}{\infty^2}\right)$$

$$R = \frac{1}{\lambda} = \frac{1}{91}\text{nm}^{-1}$$

λ_{max} for balmer series

$n_1 = 2 \rightarrow n_2 = 3$

$$\frac{1}{\lambda_B} = R\left(\frac{1}{4} - \frac{1}{9}\right)$$

$$\frac{1}{\lambda_B} = \frac{1}{91}\left(\frac{5}{36}\right)$$

$$\lambda_B = \left(\frac{91\times 36}{5}\right) = 655.2\text{nm}$$

λ_{max} paschen

$n_1 = 3 \quad \rightarrow \quad n_2 = 4$

$$\frac{1}{\lambda_p} = \frac{1}{91}\left(\frac{1}{3^2} - \frac{1}{4^2}\right) = \frac{1}{91}\times\frac{7}{144}$$

$$\lambda_p = \left(\frac{91\times 144}{7}\right) = 1872\text{nm}$$

$$\Delta\lambda = \lambda_p - \lambda_B = 1872 - 655.2$$

$$\Delta\lambda = 1216.8$$

$$\Delta\lambda \approx 1217$$

33. In an open organ pipe ν_3 and ν_6 are 3rd and 6th harmonic frequencies, respectively.

If $\nu_6 - \nu_3 = 2200$ Hz then length of the pipe is ______ mm.

(Take velocity of sound in air is 330 m/s.)

(1) 275 (2) 225

(3) 200 (4) 250

Ans. (2)

Sol. $f = n\left(\frac{V_0}{2L}\right)$

$$\frac{6V_0}{2L} - \frac{3V_0}{2L} = 2200$$

$$\frac{3V_0}{2L} = 2200$$

$$\frac{3\times 330}{2\times L} = 2200$$

$$L = \frac{3\times 330}{2\times 2200}$$

$$L = 0.225 \text{ m}$$

$$L = 225 \text{ mm}$$

34. When a part of a straight capillary tube is placed vertically in a liquid, the liquid raises upto certain height h. If the inner radius of the capillary tube, density of the liquid and surface tension of the liquid decrease by 1 % each, then the height of the liquid in the tube will change by _____%.

(1) –1 (2) +3

(3) –3 (4) +1

Ans. (4)

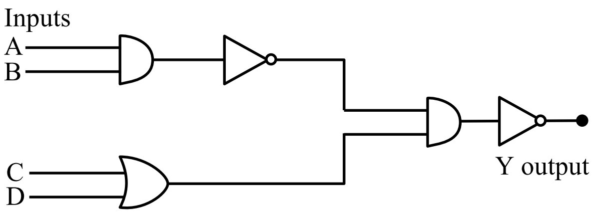
Sol. $h = \frac{2T\cos\theta}{\rho g r}$

$$\frac{\Delta h}{h}\% = \frac{\Delta T}{T}\% - \frac{\Delta\rho}{\rho}\% - \frac{\Delta r}{r}\%$$

$$\frac{\Delta h}{h}\% = 1 + 1 + 1$$

$$\frac{\Delta h}{h} = +1\%$$

35. The correct truth table for the given input data of the following logic gate is :



(1)

Inputs				Output
A	B	C	D	Y
1	1	0	1	1
0	0	1	1	0
1	0	1	0	1
1	1	1	1	0

(2)

Inputs				Output
A	B	C	D	Y
1	1	0	1	1
0	0	1	1	0
1	0	1	0	0
1	1	1	1	1

(3)

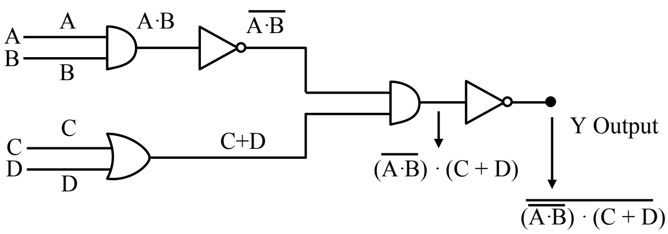
Inputs				Output
A	B	C	D	Y
1	1	0	1	0
0	0	1	1	0
1	0	1	0	1
1	1	1	1	1

(4)

Inputs				Output
A	B	C	D	Y
1	1	0	1	0
0	0	1	1	1
1	0	1	0	1
1	1	1	1	1

Ans. (2)

Sol.



$$Y = \overline{\overline{(A.B)}.(C+D)} = \overline{\overline{A\cdot B}} + \overline{(C+D)}$$

$$Y = (A.B) + \overline{(C+D)}$$

36. An electric power line having total resistance of 2 Ω, delivers 1 kW of power of 250 V. The percentage efficiency of transmission line is ____ .

(A) 96.9
(B) 86.5
(C) 100
(D) 92.5

Ans. (1)

Sol. $P_{out} = 1000\ W$

$P = VI$

$1000 = 250 \times I$

$I = 4A$

$P_{loss} = I^2R = (4)^2 \times 2 = 3200$

$P_{net} = 1000 + 32 = 103200$

$$\eta = \left(\frac{P_{out}}{P_{net}}\right) \times 100 = \frac{1000}{1032} \times 100 = 96.9\%$$

37. The wavelength of light, while it is passing through water is 540 nm. The refractive index of water is $\frac{4}{3}$. The wavelength of the same light when it is passing through a transparent medium having refractive index of $\frac{3}{2}$ is __________nm.

(1) 380
(2) 840
(3) 480
(4) 540

Ans. (3)

Sol. $\frac{\mu_1}{\mu_2} = \frac{v_2}{v_1} = \frac{\lambda_2}{\lambda_1} \Big| \ v = f\lambda$

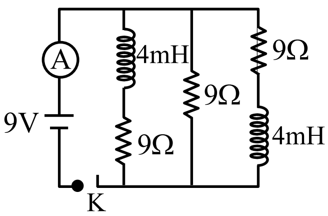
$$\frac{\mu_1}{\mu_2} = \frac{\lambda_2}{\lambda_1}$$

$$\frac{\mu_B}{3/2} = \frac{\lambda}{540}$$

$$\lambda = \left(\frac{4 \times 2}{3 \times 3} \times 540\right)$$

$\lambda = 480$ nm

38. Figure shows the circuit that contains three resistances (9 Ω each) and two inductors (4 mH each). The reading of ammeter at the moment switch K is turned ON, is _________A.



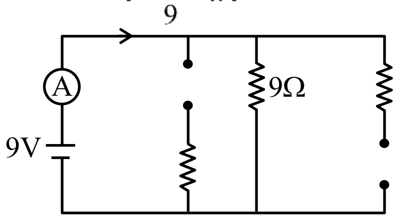
(1) 1 (2) zero

(3) 3 (4) 2

Ans. (1)

Sol. Just after closing the switch, inductor will behave as open circuit,

$$I=\frac{9}{9}=1A$$



39. Given below are two statements :

Statement I : A satellite is moving around earth in the orbit very close to the earth surface. The time period of revolution of satellite depends upon the density of earth.

Statement II : The time period of revolution of the satellite is $T=2\pi\sqrt{\frac{R_e}{g}}$ (for satellite very close to the earth surface), where R_e radius of earth and g acceleration due to gravity.

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

(1) Both **Statement I** and **Statement II** are false

(2) Both **Statement I** and **Statement II** are true

(3) **Statement I** is true but **Statement II** is false

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

Ans. (2)

Sol. $T=2\pi\sqrt{\frac{R^3}{GM}}$

$\because M=\rho\cdot\frac{4}{3}\pi R^3$

$\therefore T=2gp\sqrt{\frac{1}{G\rho\frac{4}{3}\pi}}$

Statement I is correct.

And $\therefore \frac{GM}{R^2}=g$

$\therefore T=2\pi\sqrt{\frac{R}{g}}$

Statement II is correct

Ans. (2)

40. Which of the following are true for a single slit diffraction?

(A) Width of central maxima increases with increase in wavelength keeping slit width constant.

(B) Width of central maxima increases with decrease in wavelength keeping slit width constant.

(C) Width of central maxima increases with decrease in slit width at constant wavelength.

(D) Width of central maxima increases with increase in slit width at constant wavelength.

(E) Brightness of central maxima increases for decrease in wavelength at constant slit width.

Options :

(1) A, D, E only (2) A, D only

(3) B, D only (4) B, C only

NTA Ans. (1)

Allen Ans. (Bonus)

Sol. $\beta_{cm} = \dfrac{2\lambda D}{a}$

(A) Correct $\beta \propto \lambda$

(B) Incorrect

(C) Correct $\beta \propto \dfrac{1}{d}$

(D) Incorrect

(E) Correct

Statement A, C & E are correct.

No option matching

41. Given below are two statements :

Statement I : An object moves from position r_1 to position r_2 under a conservative force field $\vec{F}$.

The work done by the force is $W = -\int_{r_1}^{r_2} \vec{F}\cdot\vec{dr}$.

Statement II : Any object moving from one location to another location can follow infinite number of paths. Therefore, the amount of work done by the object changes with the path it follows for a conservative force.

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

(1) Both **Statement I** and **Statement II** are true

(2) **Statement I** is false but **Statement II** is true

(3) **Statement I** is true but **Statement II** is false

(4) Both **Statement I** and **Statement II** are false

NTA Ans. (3)

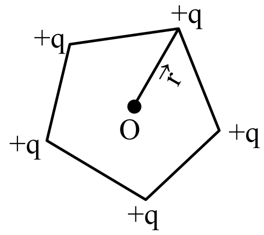
Allen Ans. (4)

Sol. Statement-I : Incorrect

Correct equation is $W = \int_{r_1}^{r_2} \vec{F}\cdot d\vec{r}$

Statement-II : Incorrect

42. Five positive charges each having charge q are placed at the vertices of a pentagon as shown in the figure. The electric potential (V) and the electric field $(\vec{E})$ at the center O of the pentagon due to these five positive charges are :



(1) $V = \dfrac{5q}{4\pi\varepsilon_0 r}$ and $\vec{E} = 0$

(2) $V = \dfrac{5q}{4\pi\varepsilon_0 r}$ and $\vec{E} = \dfrac{5\sqrt{3}q}{8\pi\varepsilon_0 r^2}\hat{r}$

(3) $V = \dfrac{5q}{4\pi\varepsilon_0 r}$ and $\vec{E} = \dfrac{5q}{4\pi\varepsilon_0 r^2}\hat{r}$

(4) $V = 0$ and $\vec{E} = 0$

Ans. (1)

Sol. Electric potential $\rightarrow V = \dfrac{5kq}{R}$

As regular polygon $\rightarrow \vec{E} = 0$

43. A laser beam has intensity of 4.0×10^{14} W/m^2. The amplitude of magnetic field associated with beam is ________ T. (Take $\epsilon_0 = 8.85 \times 10^{-12}$ C^2/Nm^2 and $c = 3 \times 10^8$ m/s)

(1) 2.0 (2) 18.3

(3) 5.5 (4) 1.83

Ans. (4)

Sol. $I = \dfrac{1}{2}\epsilon_0 E_0^2 \cdot C$

$\therefore E_0 = \sqrt{\dfrac{2I}{\epsilon_0 C}}$

$\& \ \dfrac{E_0}{B_0} = C$

$\therefore B_0 = \dfrac{E_0}{C} = \dfrac{1}{C}\sqrt{\dfrac{2I}{\epsilon_0 C}}$

$\therefore B_0 = \dfrac{1}{3\times10^8}\sqrt{\dfrac{2\times4\times10^{14}}{8.85\times10^{-12}\times3\times10^8}}$

$B_0 = \dfrac{10}{3}\sqrt{\dfrac{8}{8.85\times3}}$

$B_0 = 1.83$ T

44. Light is incident on a metallic plate having work function 110×10^{-20} J. If the produced photoelectrons have zero kinetic energy then the angular frequency of the incident light is ________ rad/s. ($h = 6.63 \times 10^{-34}$ J.s)

(1) 1.04×10^{16} (2) 1.04×10^{13}

(3) 1.66×10^{16} (4) 1.66×10^{15}

Ans. **(1)**

Sol. $\phi = h\nu$

$$\nu = \frac{\phi}{h}$$

$$\omega = 2\pi\nu = \frac{2\pi\phi}{h} = \frac{2\times 3.14\times 110\times 10^{-2}}{6.63\times 10^{-34}}$$

$\omega = 1.04 \times 10^{16}$ rad/sec

45. Given below are two statements :

Statement I : For a mechanical system of many particles total kinetic energy is the sum of kinetic energies of all the particles.

Statement II : The total kinetic energy can be the sum of kinetic energy of the center of mass w.r.t. to the origin and the kinetic energy of all the particles w.r.t. the center of mass as the reference.

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

(1) Both **Statement I** and **Statement II** are true

(2) **Statement I** is true but **Statement II** is false

(3) **Statement I** is false but **Statement II** is true

(4) Both **Statement I** and **Statement II** are false

Ans. **(1)**

Sol. $KE = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2$

$$KE = \frac{1}{2}(m_1+m_2)v_{cm}^2 + \frac{1}{2}\frac{m_1m_2}{m_1+m_2}|\vec{v}_1 - \vec{v}_2|^2$$

So Ans. is (1)

SECTION-B

46. A conducting circular loop is rotated about its diameter at a constant angular speed of 100 rad/s in a magnetic field of 0.5T perpendicular to the axis of rotation. When the loop is rotated by 30° from the horizontal position, the induced EMF is 15.4 mV. The radius of the loop is ______ mm.

$\left(\text{Take } \pi = \frac{22}{7}\right)$

Ans. **(14)**

Sol. $E = B\omega A\sin\omega t$

$$15.4\times 10^{-3} = \frac{1}{2}\times 100\times \frac{22}{7}r^2\times\frac{1}{2}$$

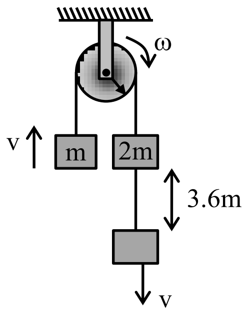
$$r = \sqrt{\frac{15.4\times 28\times 10^{-5}}{22}}$$

R = 14 mm

47. Two masses m and 2m are connected by a light string going over a pulley (disc) of mass 30m with radius r = 0.1 m. The pulley is mounted in a vertical plane and it is free to rotate about its axis. The 2m mass is released from rest and its speed when it has descended through a height of 3.6 m is _______ m/s. (Assume string does not slip and $g = 10$ m/s^2)

Ans. **(2)**

Sol.



Using energy conservation

$$\frac{1}{2}mv^2 + \frac{1}{2}2mv^2 + \frac{1}{2}\frac{30mR^2}{2}\times\frac{v^2}{R^2} = mgh$$

$9\,mv^2 = mgh$

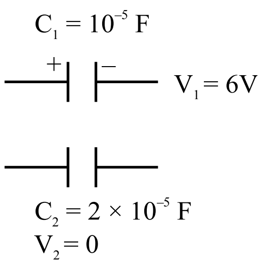
$$v = \sqrt{\frac{gh}{9}} = \sqrt{\frac{10\times 3.6}{9}}$$

$v = \sqrt{4} = 2$ m/s

48. A capacitor *P* with capacitance 10×10^{-6} F is fully charged with a potential difference of 6.0 V and disconnected from the battery. The charged capacitor *P* is connected across another capacitor *Q* with capacitance 20×10^{-6} F. The charge on capacitor *Q* when equilibrium is established will be $\alpha \times 10^{-5}$ C (assume capacitor *Q* does not have any charge initially), the value of α is _______ .

Ans. **(4)**

Sol.



$$V = \frac{C_1V_1 + C_2V_2}{C_1 + C_2} = \frac{10^{-5} \times 6 + 0}{3 \times 10^{-5}}$$

V = 2 volt

$Q_2 = C_2V = 2 \times 10^{-5} \times 2 = 4 \times 10^{-5}$ C

49. A cylindrical conductor of length 2m and area of cross-section 0.2 mm^2 carries an electric current of 1.6 A when its ends are connected to a 2V battery. Mobility of electrons in the conductor is $\alpha \times 10^{-3}$ m^2/V.s. The value of α is :

(electron concentration = $5 \times 10^{28}/m^3$ and electron charge = 1.6×10^{-19} C)

Ans. **(1)**

Sol. $V_\ell = \mu E = \mu \times \frac{V}{\ell}$

$I = neAV_d$

$$V_d = \frac{I}{neA}$$

$$\mu = \frac{I\ell}{NneA}$$

$$\mu = \frac{1.6 \times 3}{2 \times 5 \times 10^{26} \times 1.6 \times 10^{-19} \times 2 \times 10^{-7}}$$

$\mu = 1 \times 10^{-3}$ m^2/v·s

$\alpha = 1$

50. An insulated cylinder of volume 60 cm^3 is filled with a gas at 27°C and 2 atmospheric pressure. Then the gas is compressed making the final volume as 20 cm^3 while allowing the temperature to rise to 77°C. The final pressure is _______ atmospheric pressure.

Ans. **(7)**

Sol. PV = nRT

$$\frac{P_1V_1}{RT_1} = \frac{P_2V_2}{RT_2}$$

$$\frac{2 \times 10^5 \times 60}{300} = \frac{P_2 \times 20}{350}$$

$$P_2 = \frac{2 \times 10^5 \times 7 \times 3}{6}$$

$P_2 = 7 \times 10^5 = 7$ atm