JEE–MAIN EXAMINATION – JANUARY 2026

(HELD ON WEDNESDAY 21st JANUARY 2026) **TIME : 3:00 PM TO 6:00 PM**

PHYSICS **TEST PAPER WITH SOLUTION**

SECTION-A

26. Consider two identical metallic spheres of radius R each having charge Q and mass m. Their centers have an initial separation of $4R$. Both the spheres are given an initial speed of u towards each other. The minimum value of u, so that they can just touch each other is :

(Take $k = \frac{1}{4\pi \in_0}$ and assume $kQ^2 > Gm^2$ where G is the Gravitational constant)

(1) $\sqrt{\frac{kQ^2}{4mR}\left(1-\frac{Gm^2}{kQ^2}\right)}$ (2) $\sqrt{\frac{kQ^2}{4mR}\left(1+\frac{Gm^2}{kQ^2}\right)}$

(3) $\sqrt{\frac{kQ^2}{2mR}\left(1-\frac{Gm^2}{kQ^2}\right)}$ (4) $\sqrt{\frac{kQ^2}{2mR}\left(1-\frac{Gm^2}{2kQ^2}\right)}$

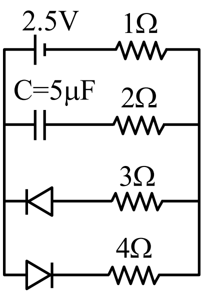
Ans. (1)

Sol. Using energy conservation

$$(2)\left(\frac{1}{2}mu^2\right)-\frac{Gm^2}{4r}+\frac{KQ^2}{4r}=-\frac{Gm^2}{2r}+\frac{KQ^2}{2r}$$

$$u=\sqrt{\frac{1}{4mr}\left(KQ^2-Gm^2\right)}$$

27. The charge stored by the capacitor C in the given circuit in the steady state is .... μC.

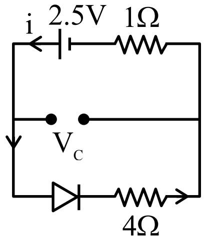


(1) 12.5 (2) 10

(3) 7.5 (4) 5

Ans. (2)

Sol.



in steady state

$i = 2.5/5 = 0.5$ A

$V_C = 4 \times 0.5$

$V_C = 2$V

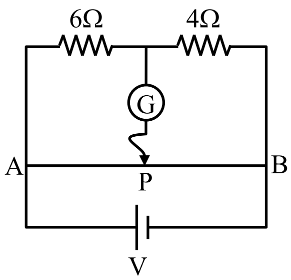
charge

$Q = CV_C$

$= 5 \times 2$

$= 10\ \mu$C

28. The total length of potentiometer wire AB is 50 cm in the arrangement as shown in figure. If P is the point where the galvanometer shows zero reading then the length AP is .... cm.



(1) 15 (2) 30

(3) 25 (4) 20

Ans. (2)

Sol. $\frac{6}{R_{AP}}=\frac{4}{R_{PB}}$;

$\ell_{AP}+\ell_{PB}=50$ ....(i)

$\frac{R_{AP}}{R_{PB}}=\frac{\ell_{AP}}{\ell_{PB}}=\frac{3}{2}$

$\ell_{AP}=\frac{3}{5}\times 50 = 30$ cm

29. A capacitor C is first charged fully with potential difference of V_0 and disconnected from the battery. The charged capacitor is connected across an inductor having inductance L. In t s 25% of the initial energy in the capacitor is transferred to the inductor. The value of t is_______s.

(1) $\frac{\pi\sqrt{LC}}{3}$ (2) $\frac{\pi\sqrt{LC}}{6}$

(3) $\frac{\pi\sqrt{LC}}{2}$ (4) $\pi\sqrt{\frac{LC}{2}}$

Ans. **(2)**

Sol. $U_{c_f} = 75\% U_{c_i}$

$$Q_F^2 = \frac{3}{4}Q_I^2$$

$$Q_i \cos \omega t = \frac{\sqrt{3}}{2}Q_i \Rightarrow t = \frac{T}{12}$$

$$t = \frac{\pi}{6}\sqrt{LC}$$

30. The r.m.s speed of oxygen molecules at 47°C is equal to that of the hydrogen molecules kept at______°C. (Mass of oxygen molecule/mass of hydrogen molecule=32/2)

(1) –235 (2) –100

(3) –253 (4) –20

Ans. **(3)**

Sol. $V_{rms} = \sqrt{\frac{3RT}{M}}$

$$V_{rmsO_2} = V_{msH_2}$$

$$T_{O_2} = 273 + 47 = 320K$$

$$\sqrt{\frac{3RT_{O_2}}{M_{O_2}}} = \sqrt{\frac{3R\,T_{H_2}}{M_{H_2}}}$$

$$\frac{T_2}{M_{O_2}} = \frac{T_{H_2}}{M_{H_2}}$$

$$\frac{320}{32} = \frac{T_{H_2}}{2}$$

$$T_{H_2} = 20K$$

$$T_{H_2} = -253°C$$

31. Two cars A and B each of mass 10^3 kg are moving on parallel tracks separated by a distance of 10 m, in same direction with speeds 72 km/h and 36 km/h. The magnitude of angular momentum of car A with respect to car B is ___ J.s.

(1) 3.6×10^5 (2) 10^5

(3) 3×10^5 (4) 2×10^5

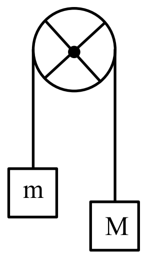
Ans. **(2)**

Sol. $L = m.V_{rel}\, r_\perp$

$$= 1000 \times \left(36 \times \frac{5}{18}\right) \times 10$$

$$= 10^5 \text{ kg m}^2/\text{s}$$

32. The pulley shown in figure is made using a thin rim and two rods of length equal to diameter of the rim. The rim and each rod have a mass of M. Two blocks of mass of M and m are attached to two ends of a light string passing over the pulley, which is hinged to rotate freely in vertical plane about its centre. The magnitudes of the acceleration experienced by the blocks is____ (assume no slipping of string on pulley.)



(1) $\frac{(M-m)g}{\left[\left(\frac{13}{6}\right)M+m\right]}$

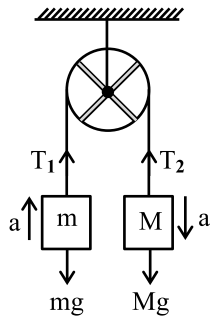
(2) $\frac{(M-m)g}{M+m}$

(3) $\frac{(M-m)g}{\left[\left(\frac{8}{3}\right)M+m\right]}$

(4) $\frac{(M-m)g}{2M+m}$

Ans. **(3)**

Sol.



$Mg - T_2 = Ma$ ...(1)

$T_1 - mg = ma$ ...(2)

$(T_2 - T_1)r = I\frac{a}{r}$ ...(3)

(1) + (2) + (3)

$$(M-m)g = \left(M + m + \frac{I}{r^2}\right)a$$

Here $I = Mr^2 + \frac{M\times(2r)^2}{12}\times 2$

$$= \left(1+\frac{2}{3}\right)Mr^2$$

$$= \frac{5}{3}Mr^2$$

$$(M-m)g = \left[M + m + \frac{5M}{3}\right]a$$

$$a = \frac{(M-m)g}{\left[M+m+\frac{5M}{3}\right]}$$

33. The kinetic energy of a simple harmonic oscillator is oscillating with angular frequency of 176 rad/s. The frequency of this simple harmonic oscillator is_____Hz. $\left[\text{take } \pi = \frac{22}{7}\right]$

(1) 14 (2) 88

(3) 28 (4) 176

Ans. (1)

Sol. ω = 176 rad/sec

$$f_k = \frac{\omega}{2\pi} = \frac{176}{2\times 22}\times 7$$

$$= \frac{176}{44}\times 7$$

= 4 × 7 = 28 Hz

So frequency of oscillator

$$= \frac{f_k}{2} = 14 \text{ Hz}$$

34. Given below are two statements:

Statement I : In a Young's double slit experiment, the angular separation of fringes will increase as the screen is moved away from the plane of the slits

Statement II : In a Young's double slit experiment, the angular separation of fringes will increase when monochromatic source is replaced by another monochromatic source of higher wavelength

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

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

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

Ans. (3)

Sol. Angular fringe width = $\frac{\lambda}{d}$

35. A battery with EMF E and internal resistance r is connected across a resistance R. The power consumption in R will be maximum when :

(1) $R = 2r$ (2) $R = \frac{r}{2}$

(3) $R = \sqrt{2}r$ (4) $R = r$

Ans. (4)

Sol. For maximum power drawn across load

Resistance $R_{Load} = R_{internal}$

$\boxed{R = r}$

36. Keeping the significant figures in view, the sum of the physical quantities 52.01m, 153.2 m and 0.123 m is :

(1) 205 m (2) 205.333 m

(3) 205.33 m (4) 205.3 m

Ans. (4)

Sol. L = 52.01 +153.2 + 0.123

= 205.333

= 205.3

37. A spherical body of radius r and density σ falls freely through a viscous liquid having density ρ and viscosity η and attains a terminal velocity v_0. Estimated maximum error in the quantity η is : (Ignore errors associated with σ, ρ and g, gravitational acceleration)

(1) $2\frac{\Delta r}{r} - \frac{\Delta v_0}{v_0}$ (2) $\frac{2\Delta r}{r} + \frac{\Delta v_0}{v_0}$

(3) $2\left[\frac{\Delta r}{r} + \frac{\Delta v_0}{v_0}\right]$ (4) $2\left[\frac{\Delta r}{r} - \frac{\Delta v_0}{v_0}\right]$

Ans. (2)

Sol. $v_0 = \frac{2}{9}\frac{r^2 g}{n}(\rho_B - \rho_L)$

$n = \frac{2}{9}\frac{r^2 g}{v_0}(\rho_B - \rho_L)$

$\frac{\Delta n}{n} = \frac{2\Delta r}{r} + \frac{\Delta v_0}{v_0}$

38. Surface tension of two liquids (having same densities), T_1 and T_2, are measured using capillary rise method utilizing two tubes with inner radii of r_1 and r_2 where $r_1 > r_2$. The measured liquid heights in these tubes are h_1 and h_2 respectively. [Ignore the weight of the liquid about the lowest point of miniscus]. The heights h_1 and h_2 and surface tensions T_1 and T_2 satisfy the relation :

(1) $h_1 < h_2$ and $T_1 = T_2$

(2) $h_1 = h_2$ and $T_1 = T_2$

(3) $h_1 > h_2$ and $T_1 = T_2$

(4) $h_1 > h_2$ and $T_1 < T_2$

Ans. (1)

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

$h \propto \frac{1}{r}$

If $r_1 > r_2 \Rightarrow h_2 > h_1$

39. A river of width 200 m is flowing from west to east with a speed of 18 km/h. A boat, moving with speed of 36 km/h in still water, is made to travel one-round trip (bank to bank of the river). Minimum time taken by the boat for this journey and also the displacement along the river bank are ______ and _____ respectively.

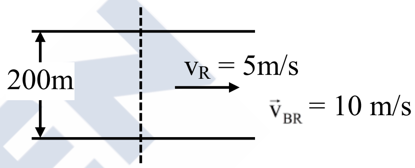
(1) 20 s and 100 m

(2) 40 s and 0 m

(3) 40 s and 200 m

(4) 40 s and 100 m

Ans. (3)



Sol.

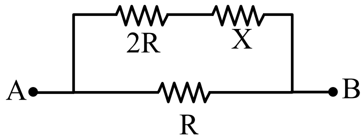
Minimum time :

$t_{min} = \frac{200}{10} = 20\text{sec}$

For round trip = 40 sec.

Displacement along river bank = 40 × 5 = 200 m

40. Two known resistance of R Ω and 2R Ω and and one unknown resistance X Ω are connected in a circuit as shown in the figure. If the equivalent resistance between points A and B in the circuit is X Ω, then the value of X is ________ Ω.



(1) $(\sqrt{3}-1)R$ (2) R

(3) $2(\sqrt{3}-1)R$ (4) $(\sqrt{3}+1)R$

Ans. (1)

Sol. $\frac{(2R+x).(R)}{3R+x} = x$

$x^2 + 2Rx - 2R^2 = 0$

$x = (\sqrt{3}-1)R$

41. The energy of an electron in an orbit of the Bohr's atom is $-0.04E_0$eV where E_0 is the ground state energy. If L is the angular momentum of the electron in this orbit and h is the Planck's constant, then $\frac{2\pi L}{h}$ is ________ :

(1) 2 (2) 4

(3) 5 (4) 6

Ans. (3)

Sol. Angular momentum $L = \frac{nh}{2\pi}$

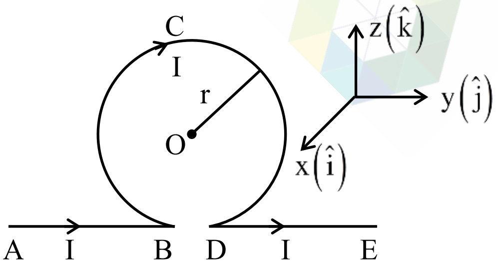
$n = \frac{2\pi L}{h}$

Energy $E = -\frac{13.6}{n^2}.z^2$

$E \Rightarrow -\frac{E_0}{n^2} = -0.04E_0$

$n^2 = 25,\ n = 5$

42. An infinitely long straight wire carrying current I is bent in a planer shape as shown in the diagram. The radius of the circular part is r. The magnetic field at the centre O of the circular loop is :

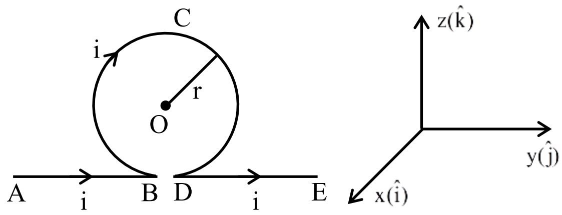


(1) $\frac{\mu_0}{2\pi}\frac{I}{r}(\pi+1)\hat{i}$ (2) $-\frac{\mu_0}{2\pi}\frac{I}{r}(\pi-1)\hat{i}$

(3) $\frac{\mu_0}{2\pi}\frac{I}{r}(\pi-1)\hat{i}$ (4) $-\frac{\mu_0}{2\pi}\frac{I}{r}(\pi+1)\hat{i}$

Ans. (2)

Sol.



$\vec{B}_0 = \vec{B}_{AB} + \vec{B}_{DE} + \vec{B}_{BCD}$

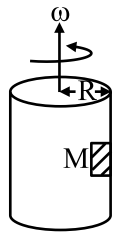
$= \frac{\mu_0 i}{4\pi r}\hat{i} + \frac{\mu_0 i}{4\pi r}\hat{i} - \frac{\mu_0 i}{2r}\hat{i}$

$= \frac{\mu_0 i}{2\pi r}\hat{i} - \frac{\mu_0 i}{2r}\hat{i}$

$= \frac{\mu_0 i}{2\pi r}(1-\pi)\hat{i}$

$= -\frac{\mu_0 i}{2\pi r}(\pi-1)\hat{i}$

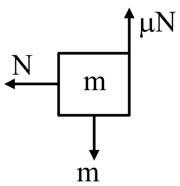
43. A large drum having radius R is spinning around its axis with angular velocity ω, as shown in figure. The minimum value of ω so that a body of mass M remains stuck to the inner wall of the drum, taking the coefficient of friction between the drum surface and mass M is μ, is :



(1) $\sqrt{\frac{\mu g}{R}}$ (2) $\sqrt{\frac{2g}{\mu R}}$

(3) $\sqrt{\frac{g}{2\mu R}}$ (4) $\sqrt{\frac{g}{\mu R}}$

Ans. (4)



Sol.

$N = m\omega^2 r$, $mg = \mu N$

$\mu \times m\omega^2 r = mg$

$\omega = \sqrt{\frac{g}{\mu r}}$

44. A body of mass 2 kg is moving along x-direction such that its displacement as function of time is given by $x(t) = \alpha t^2 + \beta t + \gamma m$, where $\alpha = 1\ m/s^2$, $\beta = 1$ m/s and $\gamma = 1$m. The work done on the body during the time interval t = 2 s to t = 3 s, is ________ J.

(1) 49 (2) 42

(3) 24 (4) 12

Ans. **(3)**

Sol. $x(t) = t^2 + t + 1$

$v(t) = 2t + 1$

$a(t) = 2$

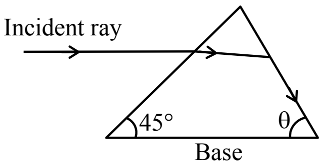
F = 4N.

Displacement = x(3) – x(2)

= 13 – 7 = 6M

W = F.S = 4 × 6 = 24 J

45. As shown in the diagram, when the incident ray is parallel to base of the prism, the emergent ray grazes along the second surface.



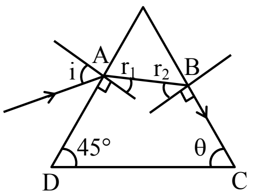
If refractive index of the material of prism is $\sqrt{2}$, the angle θ of prism is.

(1) 60° (2) 75°

(3) 90° (4) 45°

Ans. **(1)**

Sol.



For grazing emergence

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

By Snell's Law at incident surface

$$1 \times \frac{1}{\sqrt{2}} = \sqrt{2}\sin r_1$$

$r_1 = 30$

$r_1 + r_2 = A$

A = 75

75 + 45 + θ = 180°

θ = 60°

SECTION-B

46. An electromagnetic wave of frequency 100 MHz propagates through a medium of conductivity, σ = 10 mho/m. The ratio of maximum conducting current density to maximum displacement current density is ________.

$$\left[\text{Take } \frac{1}{4\pi\epsilon_0} = 9\times10^9 Nm^2/C^2\right]$$

Ans. **(1800)**

Sol. A

$j_c = \sigma E$

$E \Rightarrow E_0 \sin(\omega t - kx)$

$j_c = \sigma E_0 \sin(\omega t - kx)$

$\Rightarrow (j_c)_{max} = \sigma E_0$ ….(i)

$$J_d \Rightarrow \frac{i_d}{A} = \frac{1}{A}\times\varepsilon_0\frac{AdE}{dt}$$

$\Rightarrow \varepsilon_0 \times E_0\omega\cos(\omega t - kx)$

$(j_d)_{max} \Rightarrow \varepsilon_0 E_0 \omega$ ….(ii)

(i)/(ii)

$$\frac{(j_c)_{max}}{(j_d)_{max}} = \frac{\sigma E_0}{\varepsilon_0 \omega E_0} \Rightarrow \frac{\sigma}{\varepsilon_0\omega}$$

$$\Rightarrow \frac{10\times4\pi\times9\times10^9}{2\pi\times100\times10^6}$$

$\Rightarrow 1800$

47. The terminal velocity of a metallic ball of radius 6 mm in a viscous fluid is 20 cm/s. The terminal velocity of another ball of same material and having radius 3 mm in the same fluid will be ________ cm/s.

Ans. **(5)**

Sol. We know :

Terminal velocity ∝ $(\text{radius})^2$

$$\frac{(v_T)_1}{(v_T)_2} = \left(\frac{6}{3}\right)^2$$

$$(v_T)_2 = \frac{(v_T)_1}{4} = 5 \text{ cm/sec}$$

48. A particle having electric charge 3×10^{-19} C and mass 6×10^{-27} kg is accelerated by applying an electric potential of 1.21 V. Wavelength of the matter wave associated with the particle is $\alpha \times 10^{-12}$ m. The value of α is _________.

(Take Planck's constant = 6.6×10^{-34} J.s)

Ans. **(10)**

Sol. $\lambda = \dfrac{h}{\sqrt{2mqV}}$

$$\lambda = \frac{6.6 \times 10^{-34}}{\sqrt{2 \times 18 \times 10^{-46} \times 1.21}}$$

$\lambda = 10^{-11}$ m = 10×10^{-12} m

$\alpha = 10$

49. In a Young's double slit experiment set up, the two slits are kept 0.4. mm apart and screen is placed at 1 m from slits. If a thin transparent sheet of thickness 20 μm is introduced in front of one of the slits then centre bring fringe shifts by 20 mm on the screen. The refractive index of transparent sheet is given by $\frac{\alpha}{10}$, where α is ________.

Ans. **(14)**

Sol. $y_{shift} = \dfrac{(\mu - 1)t.D}{d}$

$$20910^{-3} = \frac{(\mu - 1) \times 20 \times 10^{-6} \times 1}{0.4 \times 10^{-3}}$$

$(\mu - 1) \Rightarrow 0.4$

$\mu \Rightarrow 1.4$

$\frac{\alpha}{10} = 1.4$, $\alpha = 14$

50. A diatomic gas ($\gamma = 1.4$) does 100 J of work when it is expanded isobarically. Then the heat given to the gas __________ J.

Ans. **(350)**

Sol. $w = 100\ J = nR\Delta T$ for isobaric process.

$$Q = nC_p\Delta T = \left(\frac{f}{2} + 1\right) nR\Delta T$$

$$= \frac{7}{2}.(100) = 350 \text{ Joule.}$$