JEE–MAIN EXAMINATION – JANUARY 2026

(HELD ON WEDNESDAY 28th JANUARY 2026) **TIME : 9:00 AM TO 12:00 NOON**

PHYSICS | **TEST PAPER WITH SOLUTION**

SECTION-A

26. 10 kg of ice at –10°C is added to 100 kg of water to lower its temperature from 25°C. Consider no heat exchange to surroundings. The decrement to the temperature of water is _________ °C.

(specific heat of ice = 2100 J/Kg.°C, specific heat of water = 4200 J/Kg.°C, latent heat of fusion of ice = 3.36×10^5 J/Kg)

(1) 10 (2) 15

(3) 6.67 (4) 11.6

Ans. **(1)**

Sol. $10 \times 3.36 \times 10^5 + 10 \times 2100 \times 10 + 10 \times 4200 \times (T-0)$

$= 100 \times 4200 \times (25 - T)$

$\Rightarrow T = 15°C$

$\Delta T = 25 - 15 = 10°C$

27. The electric current in the circuit is given as $i = i_o(t/T)$. The r.m.s current for the period $t = 0$ to $t = T$ is _________

(1) $\frac{i_0}{\sqrt{2}}$ (2) i_0

(3) $\frac{i_0}{\sqrt{6}}$ (4) $\frac{i_0}{\sqrt{3}}$

Ans. **(4)**

Sol. $$i_{rms}^2 = \frac{\int_0^T \left(i_0^2 t^2 / T^2\right) dt}{\int_0^T dt} = \frac{i_0^2}{T^3} \cdot \frac{T^3}{3} = \frac{i_0^2}{3}$$

$$i_{rms} = \frac{i_0}{\sqrt{3}}$$

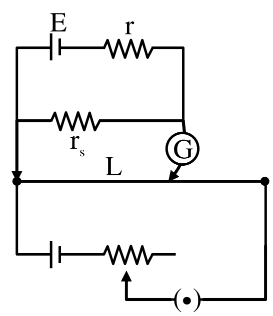
28. In the potentiometer, when the cell in the secondary circuit is shunted with 4 Ω resistance, the balance is obtained at the length 120 cm of wire. Now when the same cell in shunted with 12 Ω resistance, the balance is shifted to a length of 180 cm. The internal resistance of cell is ___ Ω.

(1) 3 (2) 4

(3) 12 (4) 6

Ans. **(2)**

Sol. Let E is emf and r is internal resistance of cell.



$$\frac{E \cdot 4}{r+4} = 120K$$

$$\frac{E \cdot 12}{r+12} = 180K$$

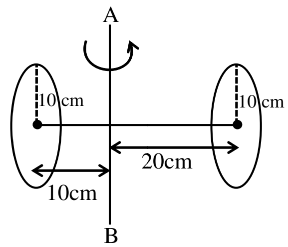
$$\Rightarrow \frac{1}{3}\frac{r+12}{r+4} = \frac{2}{3}$$

$r + 12 = 2(r + 4)$

$\Rightarrow r = 4$

29. Two circular discs of radius each 10 cm are joined at their centres by a rod of length 30 cm and mass 600 gm as shown in figure.

If the mass of each disc is 600 gm and applied torque between two discs is 43×10^5 dyne cm, the angular acceleration of the discs about the given axis AB is _______ rad/s^2.



(1) 22 (2) 11
(3) 100 (4) 27

Ans. (2)

Sol. $\alpha = \frac{\tau}{I}$

$$I = \frac{1}{4}mR^2 + mR^2 + \frac{1}{4}mR^2 + m(2R)^2 + \frac{m(3R)^2}{12} + m\left(\frac{R}{2}\right)^2$$

$$= \left(\frac{3}{2} + 4 + 1\right)mR^2 = \frac{13}{2}mR^2 = \frac{13}{2} \times 600 \times 10^2 = 39 \times 10^4$$

$$\alpha = \frac{43 \times 10^5}{39 \times 10^4} \text{rad/s}^2 = \frac{430}{39} \text{rad/s}^2 \approx 11 \text{rad/s}^2$$

30. Water drops fall from a tap on the floor, 5 m below, at regular intervals of time, the first drop strikes the floor when the sixth drop begins to fall. The height at which the fourth drop will be from ground, at the instant when the first drop strikes the ground is _______ m.

($g = 10$ m/s^2)

(1) 2.5 (2) 4.0
(3) 4.2 (4) 3.8

Ans. (3)

Sol. Time to reach ground $= \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 5}{10}} = 1\text{sec}$

Five drops per second

Time between each drop = 0.2 sec.

Time of fall for 4th drop is 1 – 0.6 = 0.4 sec

Height fall of 4th drop is $= \frac{1}{2} \times 10 \times 0.4^2 = 0.8\text{m}$

Height from ground = 5 – 0.8 = 4.2 m

31. An atom $^{8}_{3}X$ is bombarded by shower of fundamental particles and in 10 s this atom absorbed 10 electrons, 10 protons and 9 neutrons. The percentage growth in the surface area of the nucleons is recorded by :

(1) 250% (2) 150%
(3) 225% (4) 900%

NTA Ans. (3)

Allen Ans. (BONUS)

Sol. Surface area $x \propto A^{2/3}$

$X_i = 8^{2/3}$ K = 4K

$X_f = (8 + 10 + 9)^{2/3}$ K = 9 K

% increase in surface area of nucleus

$$x_i = \frac{9K - 4K}{4K} \times 100 = 125\%$$

32. The electric field of an electromagnetic wave travelling through a medium is given by

$\vec{E}(x,t) = 25\sin(2.0 \times 10^{15} t - 10^7 x)\hat{n}$

then the refractive index of the medium is _____ .

(All given measurement are in SI units)

(1) 1.2 (2) 2
(3) 1.5 (4) 1.7

Ans. (3)

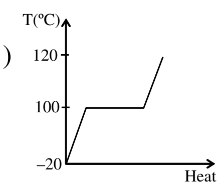
Sol. $\omega = 2 \times 10^{15}$ rad/s

$k = 10^7$ m^{-1}

$$V = \frac{2\pi}{k} \cdot \frac{\omega}{2\pi} = \frac{\omega}{k} = \frac{2 \times 10^{15}}{10^7} = 2 \times 10^8 = \frac{C}{1.5}$$

$\Rightarrow \mu = 1.5$

33. Which of the following best represents the temperature versus heat supplied graph for water, in the range of –20°C to 120°C ?

(1)


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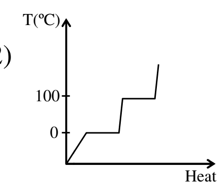

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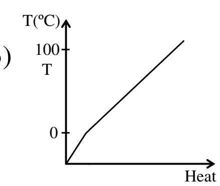

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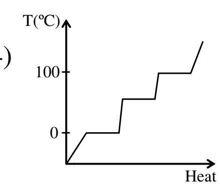
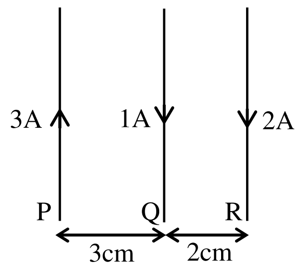


Ans. (2)

Sol. 2

34. Three long straight wires carrying current are arranged mutually parallel as shown in the figure. The force experienced by 15 cm length of wire *Q* is ______ .



($\mu_0 = 4\pi \times 10^{-7}$ T.m/A)

(1) 6×10^{-7} N towards *P*

(2) 6×10^{-6} N towards *R*

(3) 6×10^{-7} N towards *R*

(4) 6×10^{-6} N towards *P*

Ans. **(2)**

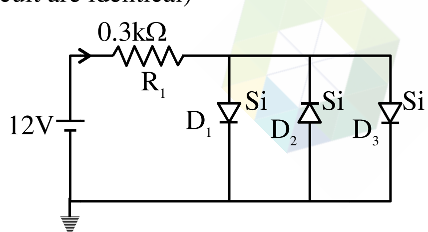
Sol. $F_{net} = \frac{\mu_0}{2\pi} I_0 \left(\frac{I_1}{d_1} + \frac{I_2}{d_2} \right) \ell$

$F_{net} = 2 \times 10^{-7} \times 1 \left(\frac{3}{3} + \frac{2}{2} \right) \times \frac{15 \times 10^{-2}}{10^{-2}}$

$= 4 \times 15 \times 10^{-7}$

$F_{net} = 6 \times 10^{-6}$ N

35. Assuming in forward bias condition there is a voltage drop of 0.7 V across a silicon diode, the current through diode D_1 in the circuit is ______ mA. (Assume all diodes in the given circuit are identical)



(1) 20.15
(2) 11.7
(3) 17.6
(4) 18.8

Ans. **(4)**

Sol. $12 - 0.3 \times 10^3 I - 0.7 = 0$

$\frac{11.3}{0.3 \times 10^3} = I$

37.66×10^{-3} A = I

Current through diode D_1, $I_1 = I/2$

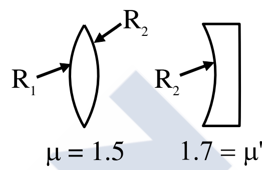
$I_1 = 18.83$ mA

36. The magnitudes of power of a biconvex lens (refractive index 1.5) and that of a plano-concave lens (refractive index = 1.7) are same. If the curvature of plano-concave lens exactly matches with the curvature of back surface of the biconvex lens, then ratio of radius of curvature of front and back surface of the biconvex lens is ________ .

(1) 5 : 2
(2) 5 : 12
(3) 12 : 5
(4) 2 : 5

Ans. **(1)**

Sol.



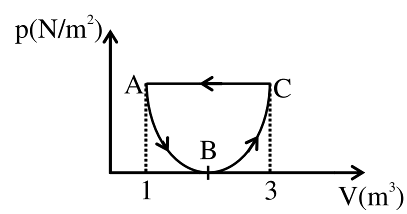
$|P_A| = |P_B|$

$0.5\left(\frac{1}{R_1} + \frac{1}{R_2}\right) = \frac{0.7}{R_2}$

$\frac{5}{R_1} = \frac{2}{R_2}$

$\frac{R_1}{R_2} = \frac{5}{2}$

37. In the following *p*-*V* diagram the equation of state along the curved path is given by $(V - 2)^2 = 4ap$ where *a* is a constant. The total work done in the closed path is



(1) $-\frac{1}{a}$
(2) $+\frac{1}{3a}$
(3) $\frac{1}{2a}$
(4) $-\frac{1}{3a}$

Ans. **(4)**

Sol. w = Area of parabola

$=\frac{2}{3}$ (Area of rectangle AC31A)

$=\frac{2}{3}P_0(3-1)=\frac{4P_0}{3}$

When V = 1

$(1-2)^2 = 4aP_0$

$P_0=\frac{1}{4a}$

$w=\frac{4}{3}P_0=\frac{4}{3}\frac{1}{4a}=\frac{1}{3a}$

$\boxed{w_{gas}=\frac{-1}{3a}}$

38. For the two cells having same EMF E and internal resistance *r*, the current passing through the external resistor 6 Ω is same when both the cells are connected either in parallel or in series. The value of internal resistance *r* is _________ Ω.

(1) 3 (2) 4

(3) 9 (4) 6

Ans. (4)

Sol. In series, $i_1=\frac{2E}{6+2r}$

In parallel, $i_2=\frac{E}{6+\frac{r}{2}}$

$i_1=i_2 \Rightarrow \frac{2E}{6+2r}=\frac{E}{6+\frac{r}{2}}$

12 + r = 6 + 2r

$\boxed{r=6\Omega}$

39. Two wires *A* and *B* made of different materials of length 6.0 cm and 5.4 cm, respectively and area of cross sections 3.0 × 10^{-5} m^2 and 4.5 × 10^{-5} m^2, respectively are stretched by the same magnitude under a given load. The ratio of the Young's modulus of *A* to that of *B* is x : 3. The value of x is ______ .

(1) 1 (2) 4

(3) 2 (4) 5

Ans. (4)

Sol. $T=\frac{F/A}{\Delta\ell/\ell}\Rightarrow Y=\frac{F\ell}{A\Delta\ell}$

$\frac{Y_A}{Y_B}=\frac{\ell_A}{\ell_B}\left(\frac{A_B}{A_A}\right)$

$=\frac{6}{5.4}\left(\frac{4.5\times10^{-5}}{3\times10^{-5}}\right)=\frac{9}{5.4}=\frac{5}{3}\Rightarrow\frac{x}{3}=\frac{5}{3}$

$\boxed{x=5}$

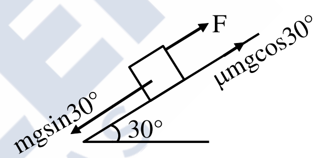
40. A block of mass 5 kg is moving on an inclined plane which makes an angle of 30° with the horizontal. Friction coefficient between the block and inclined plane surface is $\frac{\sqrt{3}}{2}$. The force to be applied on the block so that the block will move down without acceleration is _____ N.

(1) 25 (2) 12.5

(3) 7.5 (4) 15

Ans. (2)

Sol.



mgsin30° = F + μmgcos30°

$F=5\times10\times\frac{1}{2}-\frac{\sqrt{3}}{2}\times5\times10\times\frac{\sqrt{3}}{2}$

$F=25-\frac{75}{2}=25-37.5$

F = – 12.5 N

∴ force will be downward on incline of magnitude 12.5 N

41. Given below are two statements :

Statement-I : A plane wave after passing through prism remains as plane wave but passing through small pin hole may become spherical wave.

Statement-II : The curvature of a spherical wave emerging from a slit will increase for increasing slit width.

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. (3)

Sol. Increasing the slit width 'a' decreases the diffraction angle ($\theta=\lambda/a$) and reduces the spreading of the wave. A narrower slit produces a more pronounced spherical wave (high curvature) while a wider slit leads to a flatter, less curved wave.

42. When both jaws of vernier callipers touch each other, zero mark of the vernier scale is right to zero mark of main scale, 4^{th} mark on vernier scale coincides with certain mark on the main scale. While measuring the length of a cylinder, observer observes 15 divisions on main scale and 5^{th} division of vernier scale coincides with a min scale division. Measured length of cylinder is _______ mm. (Least count of Vernier calliper = 0.1 mm)

(1) 15.4   (2) 15.1
(3) 15.5   (4) 15.9

Ans. **(2)**

Sol. Reading = MSR + (VSR × LC) – (zero Error)
= 15 mm + (5 × 0.1 mm) – (4 × 0.1 mm)
Reading = 15.1 mm
$\therefore \boxed{\ell = 15.1\text{mm}}$

43. The magnetic field at the centre of a current carrying circular loop of radius R is 16 μT. The magnetic field at a distance $x=\sqrt{3}R$ on its axis from the centre is _______ μT.

(1) $2\sqrt{2}$ (2) 4
(3) 2   (4) 8

Ans. **(3)**

Sol. $\frac{\mu_0 I}{2R} = 16\mu T$

$$\frac{\mu_0 I R^2}{2\left(x^2+R^2\right)^{3/2}} = \frac{\mu_0 I R^2}{2\times 8R^3} = 2\mu T$$

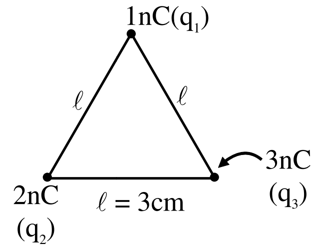
44. Two point charges of 1 nC and 2 nC are placed at the two corners of equilateral triangle of side 3 cm. The work done in bringing a charge of 3 nC from infinity to the third corner of the triangle is ______ μJ.

$$\frac{1}{4\pi\epsilon_0} = 9\times 10^9\,\text{N.m}^2/\text{C}^2$$

(1) 2.7   (2) 5.4
(3) 3.3   (4) 27

Ans. **(1)**

Sol.



$$W = \left(\frac{kq_1}{\ell} + \frac{kq_2}{\ell}\right)q_3$$

$$= \frac{9\times 10^9}{3\times 10^{-2}}\left(3\times 10^{-9}\right)\times 3\times 10^{-9}$$

$= 27 \times 10^{-7}$ J = 2.7 μJ

45. A particle of mass m falls from rest through a resistive medium having resistive force, F = –kv, where v is the velocity of the particle and k is a constant. Which of the following graphs represents velocity (v) versus time(t) ?

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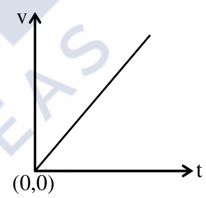

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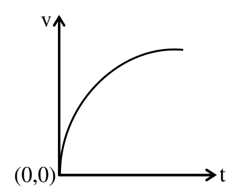

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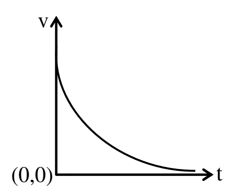

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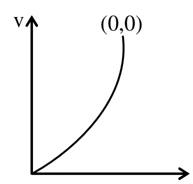


Ans. **(2)**

Sol. $m\cdot\frac{dv}{dt} = mg - kv$

$$\int_0^v \frac{dv}{mg-kv} = \int_0^t \frac{dt}{m}$$

$$\frac{-1}{k}\ell n\left(\frac{mg-kv}{mg}\right) = \frac{t}{m}$$

$$v = \frac{mg}{k}\left(1-e^{-kt/m}\right)$$

SECTION-B

46. The displacement of a particle, executing simple harmonic motion with time period *T*, is expressed as $x(t)$ = A sin ωt, where *A* is the amplitude. The maximum value of potential energy of this oscillator is found at $t = T/2\beta$. The value of β is ________.

Ans. **(2)**

Sol. Potential energy is maximum at extreme position

The particle starting at mean position reaches extreme position in time $\frac{T}{4}$.

47. The ratio of de Broglie wavelength of a deutron with kinetic energy *E* to that of an alpha particle with kinetic energy 2*E*, is *n* : 1. The value of *n* is ________.

(Assume mass of proton = mass of neutron) :

Ans. **(2)**

Sol. $\lambda = \frac{h}{mv} = \frac{h}{\sqrt{2m \cdot KE}}$

$$\frac{\lambda_d}{\lambda_\alpha} = \sqrt{\frac{m_\alpha \cdot KE_\alpha}{m_d \cdot KE_d}} = \sqrt{\frac{4m \cdot 2E}{2m \cdot E}} = 2:1$$

48. A solid sphere of radius 10 cm is rotating about an axis which is at a distance 15 cm from its centre. The radius of gyration about this axis is $\sqrt{n}$ cm. The value of *n* is

Ans. **(265)**

Sol. Let radius of gyration is k

$$\Rightarrow mk^2 = \frac{2}{3}mR^2 + md^2$$

$$k^2 = \frac{2}{3}\times 10^2 + 15^2 = 265$$

$$\left(\sqrt{n}\right)^2 = 265 \Rightarrow n = 265$$

49. A convex lens of refractive index 1.5 and focal length f = 18 cm is immersed in water. The difference in focal lengths of the given lens when it is in water and in air is α × f . The value of α is ________.

(refractive index of water = 4/3)

Ans. **(3)**

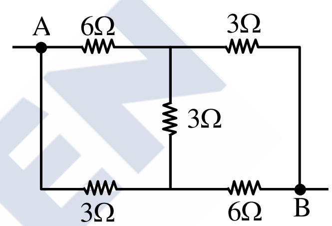
Sol. $\frac{1}{f_{Air}} = \left(\frac{1.5-1}{1}\right)\left(\frac{1}{R_1}+\frac{1}{R_2}\right)$

$$\frac{1}{f_{water}} = \left(\frac{1.5-4/3}{4/3}\right)\left(\frac{1}{R_1}+\frac{1}{R_2}\right)$$

$$\Rightarrow \frac{f_{water}}{f_{air}} = \frac{0.5}{0.5/4} = 4$$

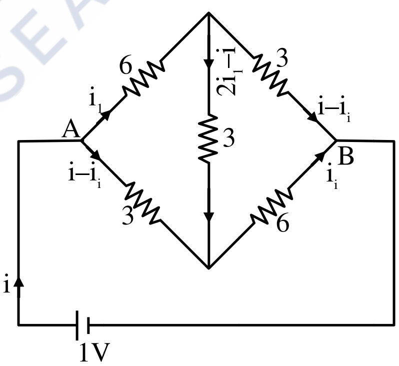
$$\Rightarrow f_{water} - f_{air} = 3f$$

50. The equivalent resistance between the points *A* and *B* in the following circuit is $\frac{x}{5}\Omega$. The value of *x* is ________.



Ans. **(21)**

Sol.



$$6i_1 + 3(2i_1 - i) = 3(i - i_1)$$

$$\Rightarrow 15i_1 = 6i \Rightarrow i_1 = \frac{2}{5}i \quad \text{\_\_\_\_ (1)}$$

$$3(i - i_1) + 6i_1 = 1$$

$$3i + 3i_1 = 1$$

$$\left(3+\frac{6}{5}\right)i = 1$$

$$\Rightarrow i = \frac{5}{21}A = \frac{1V}{R_{eq}} \Rightarrow R_{eq} = \frac{21}{5}\Omega$$