JEE–MAIN EXAMINATION – JANUARY 2026

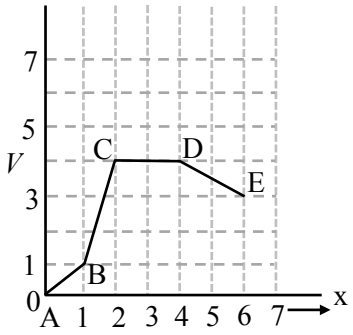
(HELD ON WEDNESDAY 21st JANUARY 2026) **TIME : 9:00 AM TO 12:00 NOON**

PHYSICS

TEST PAPER WITH SOLUTION

SECTION-A

26. Potential energy (V) versus distance (x) is given by the graph, Rank various regions as per the magnitudes of the force (F) acting on a particle from high to low.



(1) $F_{BC} > F_{CD} > F_{DE} > F_{AB}$
(2) $F_{CD} > F_{AB} > F_{BC} > F_{DE}$
(3) $F_{CD} > F_{DE} > F_{AB} > F_{BC}$
(4) $F_{BC} > F_{AB} > F_{DE} > F_{CD}$

Ans. **(4)**

Sol. Slope of potential energy v/s position curve gives negative of force.

$\therefore \quad F_{BC} > F_{AB} > F_{DE} > F_{CD}$

Correct option (4)

27. A gas based geyser heats water flowing at the rate of 5.0 litres per minute from 27°C to 87°C.

The rate of consumption of the gas is ____ g/s.

(Take heat of combustion of gas = 5.0×10^4 J/g) specific heat capacity of water = 4200 J/kg. °C

(1) 2.1 (2) 4.2
(3) 0.42 (4) 0.21

Ans. **(3)**

Sol. Water flow rate = 5 ℓ/min = $\frac{5}{60}$ kg/s

$\therefore$ Power of heater $= \frac{dm}{dt} S\Delta T = \frac{1}{12} \times 4200 \times 60 W$

$\therefore$ Let rate of consumption of gas be x g/s.

$\therefore \quad x \times 5.0 \times 10^4 = \frac{1}{12} \times 4200 \times 60$

$\Rightarrow \quad x = 4200 \times 10^{-4} = 0.42$ g/s

Correct option (3)

28. A conducting circular loop of area 1.0 m^2 is placed perpendicular to a magnetic field which varies as B = sin(100 t) Tesla. If the resistance of the loop is 100 Ω , then the average thermal energy dissipated in the loop in one period is _____J.

(1) $\frac{\pi}{2}$ (2) 2π
(3) π (4) π^2

Ans. **(3)**

Sol. Area of the loop = 1 m^2

B = sin(100 t)

$\therefore \quad \phi = BA = \sin(100t)$

$\therefore \quad \frac{d\phi}{dt} = 100\cos(100t)$

$\therefore \quad P = \frac{V^2}{R} = \frac{10^4 \cos^2(100t)}{100}$

$\therefore$ Thermal energy dissipated in 1 time period

$= \int_0^T P dt = \int_0^T 100\cos^2(100t) dt$

$T = \frac{2\pi}{100} = \frac{\pi}{50}$ sec

$\therefore \quad Q = 100 \int_0^{\pi/50} \cos^2(100t) dt$

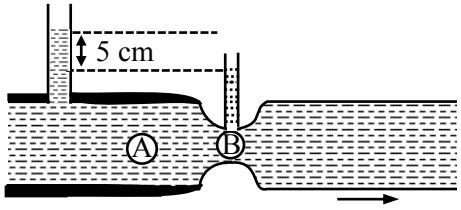
$= 100 \int_0^{\pi/50} \frac{1+\cos 200t}{2} dt$

$= 100\left[\frac{\pi}{100}\right] = \pi$

Correct option (3)

29. Water flows through a horizontal tube as shown in the figure. The difference in height between the water columns in vertical tubes is 5 cm and the area of cross-sections at A and B are 6 cm^2 and 3 cm^2 respectively.

The rate of flow will be_____cm^3/s. (take g = 10 m/s^2)



(1) $\frac{200}{\sqrt{3}}$ (2) $200\sqrt{6}$

(3) $200\sqrt{3}$ (4) $100\sqrt{3}$

Ans. (3)

Sol. From continuity equation

$A_AV_A = A_BV_B \Rightarrow 6V_A = 3V_B \Rightarrow V_B = 2V_A$

Applying Bernoullis equation between A & B,

$$P_A + \frac{1}{2}\rho V_A^2 = P_B + \frac{1}{2}\rho V_B^2$$

$$\Rightarrow \quad \rho g \times 0.05 = \frac{1}{2}\rho\left[V_B^2 - V_A^2\right] = \frac{1}{2}\rho\left(3V_A^2\right)$$

$$\Rightarrow \quad V_A = \sqrt{\frac{2g\times 0.05}{3}}\, m/s = \frac{1}{\sqrt{3}} m/s = \frac{100}{\sqrt{3}} cm/s$$

$$\Rightarrow \quad \text{Volume flow rate} = A_AV_A = \frac{6\times 100}{\sqrt{3}}\ cm^3/sec$$

$$= 200\ \sqrt{3}\ cm^3/sec$$

Correct option (3)

30. In an experiment the values of two spring constants were measured as $k_1 = (10 \pm 0.2)$ N/m and $k_2 = (20 \pm 0.3)$ N/m. If these springs are connected in parallel, then the percentage error in equivalent spring constant is :

(1) 2.67% (2) 2.33%

(3) 1.33% (4) 1.67%

Ans. (4)

Sol. For parallel combination of spring,

$K_{eq} = K_1 + K_2 = 30$ N/m

$\Delta K_{eq} = \Delta K_1 + \Delta K_2 = 0.2 + 0.3 = 0.5$ N/m

$$\therefore \quad \%\text{Error in } K = \frac{0.5}{30}\times 100 = 1.67\%$$

Correct option (4)

31. A 4 kg mass moves under the influence of a force $\vec{F} = (4t^3\hat{i} - 3t\hat{j})$ N where t is the time in second.

If mass starts from origin at t = 0, the velocity and position after t = 2s will be :

(1) $\vec{v} = 3\hat{i} + \frac{3}{2}\hat{j}$ $\vec{r} = \frac{6}{5}\hat{i} + \hat{j}$

(2) $\vec{v} = 4\hat{i} - \frac{3}{2}\hat{j}$ $\vec{r} = \frac{8}{5}\hat{i} - \hat{j}$

(3) $\vec{v} = 4\hat{i} + \frac{5}{2}\hat{j}$ $\vec{r} = \frac{8}{5}\hat{i} + 2\hat{j}$

(4) $\vec{v} = 4\hat{i} - \frac{3}{2}\hat{j}$ $\vec{r} = \frac{6}{5}\hat{i} - \hat{j}$

Ans. (2)

Sol. $\vec{F} = 4t^3\hat{i} - 3t\hat{j}$

$$\vec{a} = \frac{\vec{F}}{m} = t^3\hat{i} - \frac{3}{4}t\hat{j}$$

$a_x = t^3$

$\frac{dv_x}{dt} = t^3$

$\int_{v_x=0}^{v_{x_2}} dv_x = \int_{t=0}^{t=2} t^3\, dt$

$v_{x_2} - 0 = \left[\frac{t^4}{4}\right]_0^2$

$v_{x_2} = 4$

$a_y = \frac{-3}{4}t$

$\frac{dv_y}{dt} = -\frac{3}{4}$

$\int_0^{v_{y_2}} dv_y = \int_0^2 \frac{-3}{4}t\, dt$

$v_{y_2} = \frac{-3}{4}\left[\frac{t^2}{2}\right]_0^2$

$v_{y_2} = \frac{-3}{2}$

$$\vec{v}_2 = 4\hat{i} - \frac{3}{2}\hat{j}$$

$v_x = \frac{t^4}{4}$

$\int_0^{x_2} dx = \int_0^2 \frac{t^4}{4}\, dt$

$x_2 - 0 = \left[\frac{t^5}{20}\right]_0^2$

$x_2 = \frac{8}{5}$

$v_y = \frac{-3}{8}t^2$

$\int_0^{y_2} dx = \frac{-3}{8}t^2 dt$

$y_2 - 0 = \frac{-3}{8}\left[\frac{t^3}{3}\right]_0^2$

$y_2 = -1$

$$\vec{r} = \frac{8}{5}\hat{i} - \hat{j}$$

Correct option (2)

32. Consider a modified Bernoulli equation.

$$\left(P+\frac{A}{Bt^2}\right)+\rho g(h+Bt)+\frac{1}{2}\rho V^2=\text{constant}$$

If t has the dimension of time then the dimensions of A and B are _____, _____respectively.

(1) $[ML^0T^{-1}]$ and $[M^0LT]$

(2) $[ML^0T^{-1}]$ and $[M^0LT^{-1}]$

(3) $[ML^0T^{-2}]$ and $[M^0LT^{-2}]$

(4) $[ML^0T^{-2}]$ and $[M^0LT^{-1}]$

Ans. (2)

Sol. $\Rightarrow [P]=\left[\frac{A}{Bt^2}\right]$ .....(1)

$\Rightarrow [h]=[Bt]$ .....(2)

$\Rightarrow [B]=\left[\frac{h}{t}\right]=\left[\frac{L}{T}\right]=[LT^{-1}]$

Putting B is equation (1)

$$[ML^{-1}T^{-2}]=\left[\frac{A}{LT^{-1}\times T^2}\right]$$

$$[A]=\left[ML^0T^{-1}\right]$$

Correct option (2)

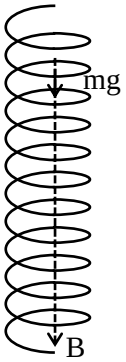
33. A current carrying is placed vertically and a particle of mass m with charge Q is released from rest. The particle moves along the axis of solenoid. If g is acceleration due to gravity then the acceleration (a) of the charged particle will satisfy :

(1) a = g (2) a > g

(3) a = 0 (4) 0 < a < g

Ans. (1)

Sol. Since the solenoid is placed vertically, the magnetic field inside the solenoid will be either along – y or +y axis.



$\Rightarrow$ Particle will gain velocity along –y axis.

$\Rightarrow \vec{F}_B=q\left(\vec{v}\times\vec{B}\right)$

$\Rightarrow \vec{F}_B=0$

$\Rightarrow \vec{F}_{net}=m\vec{g}$

$\Rightarrow a_{net}=g$

Correct option (1)

34. A parallel plate capacitor has capacitance C, when there is vacuum within the parallel plates.

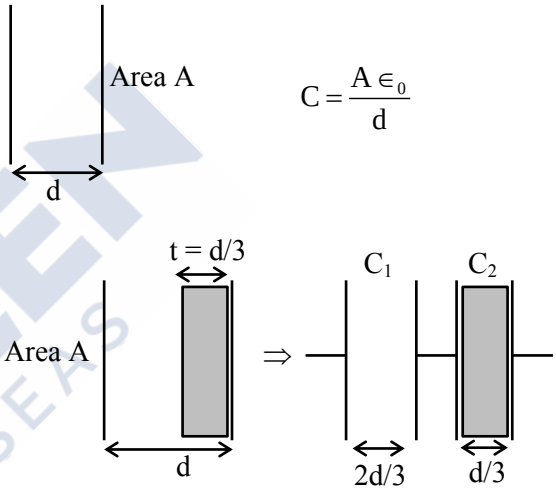
A sheet having thickness $\left(\frac{1}{3}\right)^{rd}$ of the separation between the plates and relative permittivity K is introduced between the plates. The new capacitance of the system is :

(1) $\frac{3KC}{2K+1}$ (2) $\frac{CK}{2+K}$

(3) $\frac{3CK^2}{(2K+1)^2}$ (4) $\frac{4KC}{3K-1}$

Ans. (1)

Sol.



$$C_1=\frac{3A\in_0}{2d} \qquad C_2=\frac{3A\in_0\times K}{d}$$

$$C_1=\frac{3}{2}C \qquad C_2=3KC$$

$$Ceq=\frac{C_1C_2}{C_1+C_2}=\frac{\frac{3}{2}C\times 3KC}{\frac{3}{2}C+3KC}$$

$$Ceq=\frac{\frac{9}{2}KC^2}{\frac{3}{2}C(2K+1)}=\frac{3KC}{2K+1}$$

Correct option (1)

35. The electric field a plane electromagnetic wave is given by :

$E_y = 69 \sin[0.6 \times 10^3 x - 1.8 \times 10^{11} t]$ V/m.

The expression for magnetic field associated with this electromagnetic wave is_____T.

(1) $B_z = 2.3 \times 10^{-7} \sin[0.6 \times 10^3 x - 1.8 \times 10^{11} t]$

(2) $B_z = 2.3 \times 10^{-7} \sin[0.6 \times 10^3 x + 1.8 \times 10^{11} t]$

(3) $B_y = 69 \sin[0.6 \times 10^3 x + 1.8 \times 10^{11} t]$

(4) $B_y = 2.3 \times 10^{-7} \sin[0.6 \times 10^3 x - 1.8 \times 10^{11} t]$

Ans. **(1)**

Sol. $\hat{B} = \hat{c} \times \hat{E}$

$\Rightarrow$ $\hat{c} = \hat{i}$ because phase of electric field is function of x.

$\Rightarrow$ $\hat{E} = \hat{j}$ (given)

$\Rightarrow$ $\hat{B} = \hat{i} \times \hat{j} = \hat{k}$

$$|B| = \frac{|E|}{c} = \frac{69 \times 0.6 \times 10^3}{1.8 \times 10^{11}} = \frac{69}{3 \times 10^8}$$

$|B| = 2.9 \times 10^{-7}$

$\vec{B}_2 = 2.9 \times 10^{-7} \sin(0.6 \times 10^3 x - 1.8 \times 10^{11} t)$

(phase is same as that of electric field)

Correct option (1)

36. In a double slit experiment the distance between the slits is 0.1 cm and the screen is placed at 50 cm from the slits plane. When one slit is covered with a transparent sheet having thickness t and refractive index n(= 1.5), the central fringe shifts by 0.2 cm. The value of t is ____ cm.

(1) 8×10^{-4} (2) 6.0×10^{-3}

(3) 5.6×10^{-4} (4) 5.0×10^{-3}

Ans. **(1)**

Sol. $d\sin\theta = (\mu - 1)t$

$$d\left[\frac{x}{D}\right] = (\mu - 1)t$$

$$t = \frac{xd}{D(\mu - 1)}$$

$$= \frac{(0.2)\,(0.1)}{50(1.5 - 1)}$$

$t = 8 \times 10^{-4}$ cm

Correct option (1)

37. A light wave described by $E = 60\sin(3 \times 10^{15})t + \sin(12 \times 10^{15})t]$ (in SI units) falls on a metal surface of work function 2.8 eV. The maximum kinetic energy of ejected photoelectron is (approximately) _____ eV. ($h = 6.6 \times 10^{-34}$ J-s. and $e = 1.6 \times 10^{-19}$C)

(1) 5.1 (2) 3.8

(3) 6.0 (4) 7.8

Ans. **(1)**

Sol. $\omega_1 = 3 \times 10^{15}$ rad/sec

$\omega_2 = 12 \times 10^{15}$ rad/sec

$\because$ $\nu = \frac{\omega}{2\pi}$

$E_{photon} = h\nu = 6.6 \times 10^{-34} \times 1.91 \times 10^{15}$

$= 1.26 \times 10^{-18}$ J

$$E_{max} = \frac{1.26 \times 10^{-18}}{1.6 \times 10^{-19}} \simeq 7.9 \text{ eV}$$

$K_{max} = E_{max} - \phi_0$

$= 7.9 - 2.8$

$K_{max} = 5.1$ eV

Correct option (1)

38. If an alpha particle with energy 7.7 MeV is bombarded on a thin gold foil, the closest distance from nucleus it can reach is _____ m.

(Atomic number of gold = 79 and $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9$ in SI units)

(1) 2.95×10^{-14} (2) 2.95×10^{-16}

(3) 3.85×10^{-16} (4) 3.85×10^{-14}

Ans. **(1)**

Sol. Energy conservation

$K_i + U_i = K_f + U_f$

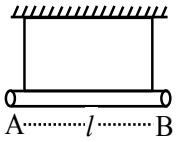
$7.7 \times 10^6 \times 1.6 \times 10^{-19} + 0$

$$= 0 + \frac{9 \times 10^9 (1.6 \times 10^{-19})(79 \times 1.6 \times 10^{-19})}{r}$$

$r = 2.95 \times 10^{-14}$

Correct option (1).

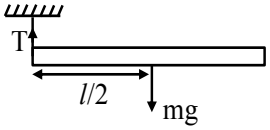
39. A uniform rod of mass m and length l suspended by means of two identical inextensible light strings as shown in figure. Tension in one string immediately after the other string is cut, is _____. (g acceleration due to gravity)



(1) mg/2 (2) mg/4
(3) mg/3 (4) mg

Ans. (2)

Sol.



$$mg\frac{l}{2}=\frac{ml^2}{3}\alpha$$

$$\alpha=\frac{3g}{2l} \quad ...(1)$$

$mg - T = ma_c$

$T = mg - ma_c$

$$= mg - m\left(\frac{l}{2}\alpha\right)$$

$$= mg - m\left(\frac{l}{2}.\frac{3g}{2l}\right)$$

$$T=\frac{mg}{4}$$

Correct option (2)

40. An aluminium and steel rods having same lengths and cross-sections are joined to make total length of 120 cm at 30°C. The coefficient of linear expansion of aluminium and steel are 24×10^{-6}/°C and 1.2×10^{-5}/°C, respectively. The length of this composite rod when its temperature is raised to 100°C, is _____ cm.

(1) 120.20 (2) 120.15
(3) 120.03 (4) 120.06

Ans. (2)

Sol. $\ell_{final} = \ell_0(1+\alpha_A\Delta T) + \ell_0(1+\alpha_B\Delta T)$

$$= \ell_0\left[2+(\alpha_A+\alpha_B)\Delta T\right]$$

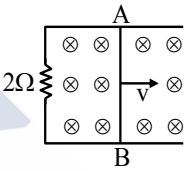
$$= 60\left[2+(36\times10^{-6})\times70\right]$$

$$= 60\left[2+0.0025\right]$$

$$= 120.15 \text{ cm}$$

Correct option (2)

41. A 1 m long metal rod AB completes the circuit as shown in figure. The area of circuit is perpendicular to the magnetic field of 0.10 T. If the resistance of the total circuit is 2Ω then the force needed to move the rod towards right with constant speed (v) of 1.5 m/s is _____ N.



(1) 7.5×10^{-2} (2) 5.7×10^{-3}
(3) 5.7×10^{-2} (4) 7.5×10^{-3}

Ans. (4)

Sol. To maintain constant speed

$F_{ext} = F_B$

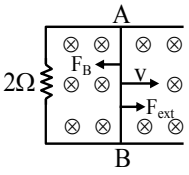
$\Rightarrow F_{ext} = ilB$

$$= \left(\frac{vBl}{R}\right)lB$$

$$= \frac{B^2l^2v}{R}$$

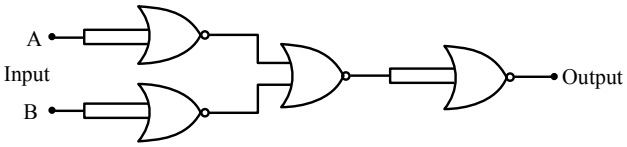
$$= \frac{(0.1)^2\times(1)^2\times1.5}{2}$$

$$= 7.5 \times 10^{-3} \text{ N}$$



Correct option (4)

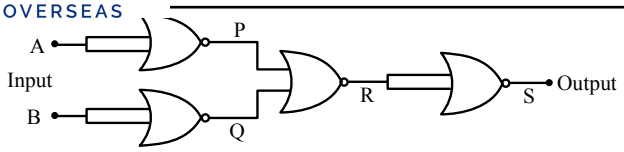
42. The given circuit works as :



(1) AND gate (2) NOR gate
(3) NAND gate (4) OR gate

Ans. (3)

Sol.



$P = \overline{A}$

$Q = \overline{B}$

$R = \overline{\overline{A} + \overline{B}} = \overline{\overline{AB}} = AB$

$S = \overline{AB}$ $\Rightarrow$ NAND Gate

Correct option (3)

43. Two strings (A, B) having linear densities $\mu_A = 2 \times 10^{-4}$ kg/m and $\mu_B = 4 \times 10^{-4}$ kg/m and lengths $L_A = 2.5$ m and $L_B = 1.5$ m respectively are joined. Free ends of A and B are tied to two rigid supports C and D, respectively creating a tension of 500 N in the wire. Two identical pulses, sent from C and D ends, take time t_1 and t_2, respectively, to reach the joint. The ratio t_1/t_2 is :

(1) 1.08 (2) 1.90

(3) 1.67 (4) 1.18

Ans. (4)

Sol. Given $L_A = 2.5$ m,

$L_B = 1.5$ m,

$T = 500$ N

$$v_A = \sqrt{\frac{T}{\mu_A}} = \sqrt{\frac{500}{2\times10^{-4}}} = 5\sqrt{10}\times10^2 \text{ m/s}$$

$$v_B = \sqrt{\frac{T}{\mu_B}} = \sqrt{\frac{500}{4\times10^{-4}}} = 5\sqrt{5}\times10^2 \text{ m/s}$$

$$t_1 = \frac{L_A}{v_A} = \frac{2.5}{5\sqrt{10}}\times10^{-2}\text{s}$$

$$t_2 = \frac{L_B}{v_B} = \frac{1.5}{5\sqrt{5}}\times10^{-2}\text{s}$$

$$\therefore \quad \frac{t_1}{t_2} = \frac{2.5}{5\sqrt{10}}\times\frac{5\sqrt{5}}{1.5} = \frac{5}{3}\times\frac{1}{\sqrt{2}} = \frac{1.66}{1.41} = 1.18$$

Correct Option (4)

44. Initially a satellite of 100 kg is in a circular orbit of radius $1.5R_E$. This satellite can be moved to a circular orbit of radius $3R_E$ by supplying $\alpha \times 10^6$J of energy. The value of α is _____.

(Take Radius of Earth $R_E = 6 \times 10^6$ m and $g = 10$ m/s^2)

(1) 150 (2) 500

(3) 100 (4) 1000

Ans. (4)

Sol. Energy of a satellite in a circular orbit is given as

$$E = \frac{-GM_Em}{2r}; \; r = \text{radius of circular orbit}$$

Required energy to be supplied = $\Delta E = E_f - E_i$

$$\Delta E = \left(\frac{-GM_Em}{2(3R_E)}\right) - \left(\frac{-GM_Em}{2(1.5R_E)}\right)$$

$$= \frac{GM_Em}{6R_E}$$

Now, $g = \frac{GM_E}{R_E^2} \Rightarrow \frac{GM_E}{R_E} = gR_E$

$$\therefore \quad \Delta E = \frac{1}{6}gmR_E$$

$$= \frac{1}{6}\times10\times100\times6\times10^6$$

$$= 1000 \times 10^6$$

$\alpha = 1000$

Correct option (4)

45. A point charge of 10^{-8} C is placed at origin. The work done in moving a point charge 2 μC from point A(4, 4, 2) m to B(2, 2, 1) m is _____J.

$(\frac{1}{4\pi\epsilon_0} = 9 \times 10^9$ in SI units)

(1) 45×10^{-6}

(2) 0

(3) 30×10^{-6}

(4) 15×10^{-6}

Ans. (3)

Sol. Work done by external agent :

$W_{ext} = \Delta U$;

$\Delta U \rightarrow$ Change in potential energy in taking the charge from initial to final configuration

$$\Rightarrow \quad W_{ext} = \frac{1}{4\pi\epsilon_0}\frac{q_1q_2}{r_f} - \frac{1}{4\pi\epsilon_0}\frac{q_1q_2}{r_i}$$

Now, $r_f = \sqrt{(2-0)^2+(2-0)^2+(1-0)^2} = 3$ m

$r_i = \sqrt{(4-0)^2+(4-0)^2+(2-0)^2} = 6$ m

$\therefore \quad W_{ext} = (9\times10^9)\times(10^{-8}\times2\times10^{-6})\left[\frac{1}{3}-\frac{1}{6}\right]$

$= 3 \times 10^{-5}$

$= 30 \times 10^{-6}$ J

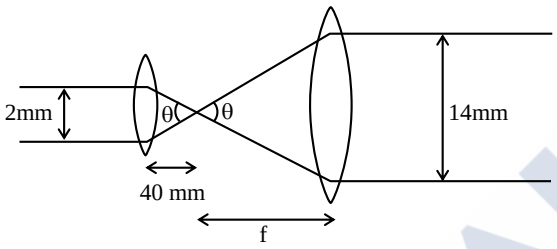
Correct Option (3)

SECTION - B

46. A collimated beam of light of diameter 2 mm is propagating along x-axis. The beam is required to be expanded in a collimated beam of diameter 14 mm using a system of two convex lenses. If first lens has focal length 40 mm, then the focal length of second lens is _____ mm.

Ans. (280)

Sol.

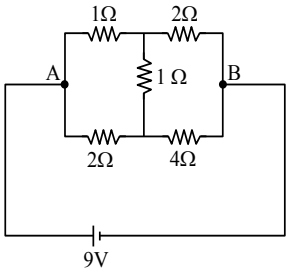


$\frac{40}{2} = \frac{f}{14}$

$\Rightarrow f = 280$ mm

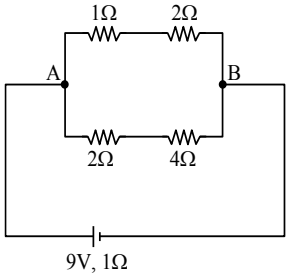
Correct Answer : 280

47. The heat generated in 1 minute between points A and B in the given circuit, when a battery of 9V with internal resistance of 1 Ω is connected across these points is _____ J.

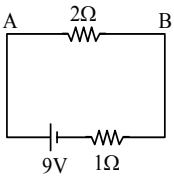


Ans. (1080)

Sol.



Balanced Wheatstone bridge



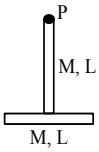
$i = \frac{9}{3} = 3A$

$\therefore \quad H_{AB} = i^2 R_{AB} t$

$= (3)^2 \times 2 \times 60 = 1080$ J

Correct Answer : 1080

48. Two identical thin rods of mass M kg and length L m are connected as shown in figure. Moment of inertia of the combined rod system about an axis passing through point P and perpendicular to the plane of the rods is $\frac{x}{2}$ ML^2 kg m^2. The value of x is _____.

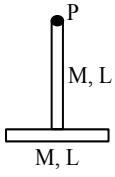


Ans. (17)

Sol. $I = \frac{ML^2}{3} + \left(\frac{ML^2}{12} + ML^2\right)$

$= \frac{4ML^2 + ML^2 + 12ML^2}{12}$

$I = \frac{17}{12} ML^2$



$\therefore \quad x = 17$

Correct Answer : 17

49. 10 mole of oxygen is heated at constant volume from 30°C to 40°C. The change in the internal energy of the gas is _____ cal. (The molecular specific heat of oxygen at constant pressure, $C_p = 7$ cal./mol °C and $R = 2$ cal./mol °C.)

Ans. **(500)**

Sol. $\Delta U = nC_v\Delta T$

$= n(C_p - R)\Delta T$

$= 10(7 - 2)\ (40 - 30)$

$\Delta U = 500$

Correct Answer : 500

50. In a microscope the objective is having focal length f_0 = 2 cm and eye-piece is having focal length f_e = 4 cm. The tube length is 32 cm. The magnification produced by this microscope for normal adjustment is _____.

Ans. **(100)**

Sol. $m \simeq \frac{lD}{f_0 f_e}$

$= \frac{32}{2} \times \frac{25}{4}$

$m = 100$

Correct Answer : 100