

MEMORY BASED QUESTIONS JEE–MAIN EXAMINATION – JANUARY 2026

(HELD ON WEDNESDAY 21st JANUARY 2026)

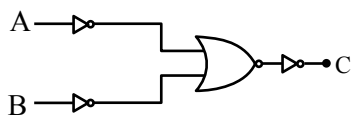
TIME : 9:00 AM TO 12:00 NOON

PHYSICS

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SECTION-A

1. Which logic gate is given in the figure?



- (1) XOR (2) NOR
(3) NAND (4) OR

Ans. (3)

Sol.

A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

(NAND)

2. Given energy density equation for unsteady flow

$$\left(P + \frac{A}{Bt^2} \right) + \frac{1}{2} \rho v^2 + \rho g(h + Bt)$$

Find dimension of A and B.

- (1) $[A] = MT^{-1}$, $[B] = LT^{-1}$
 (2) $[A] = MT^{-2}$, $[B] = LT^{-1}$
 (3) $[A] = MT^{-1}$, $[B] = LT^{-2}$
 (4) $[A] = M^2T^{-1}$, $[B] = LT^{-1}$

Ans. (1)

Sol. $[h] = [B][t]$

$$[L] = [B][T]$$

$$[B] = [L][T]^{-1}$$

$$[B] = LT^{-1} \quad \text{unit : m/s}$$

$$[P] = \left[\frac{A}{Bt^2} \right]$$

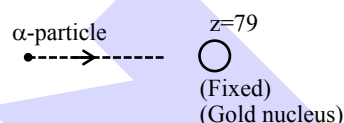
$$[ML^{-1}T^{-2}] = \frac{[A]}{[LT^{-1}][T^2]}$$

$$[A] = [ML^{-1}T^{-2}] [LT^{-1}] [T^2]$$

$$= [MT^{-1}]$$

$$[A] = MT^{-1} \quad \text{unit Kg/s}$$

3. An α -particle is projected from infinity towards a fixed gold nucleus with energy 7.7 MeV. Find minimum distance between α -particle and gold nucleus:



- (1) $0.4 \times 10^{-13} \text{ m}$ (2) $0.3 \times 10^{-13} \text{ m}$
 (3) $0.5 \times 10^{-13} \text{ m}$ (4) $0.7 \times 10^{-13} \text{ m}$

Ans. (2)

Sol. Energy conservation

$$K_i + U_i = K_f + U_f$$

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

$$= 0 + \frac{9 \times 10^9 \times 2 \times (1.6 \times 10^{-19}) \times 79 \times 1.6 \times 10^{-19}}{r}$$

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

$$= \frac{9 \times 10^9 \times 2 \times (1.6 \times 10^{-19}) \times 79 \times (1.6 \times 10^{-19})}{r}$$

$$r = \frac{9 \times 10^9 \times 2 \times 1.6 \times 10^{-19} \times 79}{7.7 \times 10^6}$$

$$= 295.5 \times 10^{-16}$$

$$= 0.2955 \times 10^{-13}$$

$$= 0.3 \times 10^{-13} \text{ m}$$

4. From a ring of area 1 m^2 and resistance 100Ω , a magnetic field $B = \sin(100t) \text{ T}$ is passing perpendicular to the ring. Find heat produce in one time period in joule :

- (1) 4π (2) 3π (3) 2π (4) π

Ans. (4)



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Sol. $\phi = NAB = (1)(1)[\sin(100t)]$
 $\phi = \sin(100t)$
 $e = -\frac{d\phi}{dt} = -\frac{d}{dt}[\sin(100t)] = -100\cos(100t)$
 $e = -100 \cos(100t)$ volt
 current : $i = \frac{E}{R} = \frac{-100\cos(100t)}{100} = -\cos(100t)$
 Heat : $\int i^2 R dt = \int [\cos^2(100t)] 100 dt$
 $= 100 \int_0^T \cos^2(100t) dt$

For 1 time period : $\langle \cos^2(100t) \rangle = \frac{1}{2}$

$$= 100 \times \frac{T}{2} = 50T = 50 \left(\frac{2\pi}{\omega} \right) = \pi$$

5. A charge $q_1 = 10^{-6}C$ is at $(0, 0, 0)$. Another charge $q_2 = 2\mu C$ is taken from A $(4, 4, 2)$ to B $(2, 2, 1)$.

Find work done by external :

(1) $3 \times 10^{-7} J$ (2) $2 \times 10^{-7} J$

(3) $3 \times 10^{-5} J$ (4) $4 \times 10^{-7} J$

Ans. (1)

Sol. $V_A = \frac{Kq_1}{r_A} = \frac{K \times 10^{-10}}{\sqrt{16+16+4}}$
 $= \frac{9 \times 10^9 \times 10^{-10}}{6} = \frac{3}{2} \times 10^{-1} \text{ Volt}$

$$V_B = \frac{Kq_1}{r_B} = \frac{9 \times 10^9 \times 10^{-10}}{3} = 3 \times 10^{-1} \text{ Volt}$$

$$W = q_2(V_B - V_A) = 2 \times 10^{-6} (3 - 1.5) \times 10^{-1}$$

$$W = 3 \times 10^{-7} \text{ Joule}$$

6. An electromagnetic wave has electric field component

$$E_z = (63 \text{ V/m}) \sin(\omega t - kx)$$

The corresponding magnetic field component should be :

(1) $B_y = -2.1 \times 10^{-7} \sin(\omega t - kx)$

(2) $B_y = 2.1 \times 10^{-7} \sin(\omega t + kx)$

(3) $B_z = 63 \sin(\omega t - kx)$

(4) $B_z = 2.1 \times 10^{-7} \sin(\omega t + kx)$

Ans. (1)

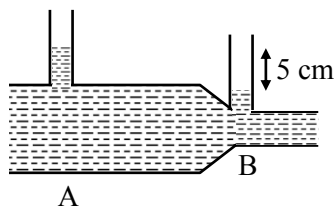
Sol. $E \rightarrow \hat{k}, C \rightarrow \hat{i}$

$$\hat{C} \times \hat{E} = \hat{B} = -\hat{j}$$

$$B_0 = \frac{E_0}{C} = \frac{63}{3 \times 10^8} = 2.1 \times 10^{-7}$$

$$B_y = -(2.1 \times 10^{-7}) \sin(\omega t - kx)$$

7.



As shown in the figure find volume flow rate at cross section-B. Given area at A is 6 cm^2 and at B is 3 cm^2 :

(1) $2\sqrt{2} \text{ m}^3/\text{s}$ (2) $2\sqrt{3} \text{ m}^3/\text{s}$

(3) $3\sqrt{2} \text{ m}^3/\text{s}$ (4) $3\sqrt{3} \text{ m}^3/\text{s}$

Ans. (2)

Sol. $\rho gh = \frac{1}{2} \rho (v_B^2 - v_A^2)$

$$v_B = 2v_A$$

$$\rho gh = \frac{1}{2} \rho (3v_A^2)$$

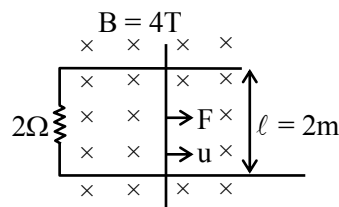
$$v_A = \sqrt{\frac{2gh}{3}}$$

vol-flow rate : (6) $\sqrt{\frac{2gh}{3}}$

$$\Rightarrow \sqrt{\frac{2gh \times 36}{3}} = \sqrt{\frac{2 \times 10 \times 5 \times 36}{100 \times 3}}$$

$$\text{Vol. flow rate} = 2\sqrt{3} \text{ m}^3/\text{s}$$

8. As shown in the figure find force required to move rod with constant velocity 15 m/s in uniform magnetic field :



(1) 480 N

(2) 500 N

(3) 380 N

(4) 280 N

Ans. (1)



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$$v_1 = \sqrt{\frac{T}{\mu_1}} = \sqrt{\frac{500}{2 \times 10^{-4}}}$$

$$v_1 = 10^2 \times 10 \sqrt{\frac{5}{2}}$$

$$v_2 = \sqrt{\frac{T}{\mu_2}} = \sqrt{\frac{500}{4 \times 10^{-4}}}$$

$$v_2 = 10^2 \times 10 \sqrt{\frac{5/4}{4}}$$

$$\frac{t_1}{t_2} = \frac{v_2}{v_1} = \frac{\sqrt{5/4}}{\sqrt{5/2}} = \sqrt{\frac{2}{4}} = \frac{1}{\sqrt{2}} \text{ Ans.}$$

12. A light wave described by $E = 60 (\sin (3 \times 10^{15})t + \sin (12 \times 10^{15})t)$ (in SI unit) fall on a metal surface of work function 2.8 eV. The maximum kinetic energy of ejected photon is approximate (in eV)

(Given : $h = 6.6 \times 10^{-34}$ J-S)

- (1) 5.1 eV (2) 6.1 eV
 (3) 4.1 eV (4) 3.1 eV

Ans. (1)

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

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

$\phi = 2.8$ eV

$v = \frac{\omega}{2\pi}$

$$v_{\max} = \frac{12 \times 10^{15}}{2\pi} \approx 1.91 \times 10^{15} \text{ Hz}$$

$$E_{\text{photon}} = hv = 6.6 \times 10^{-34} \times 1.91 \times 10^{15}$$

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

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

$$k_{\max} = E_{\max} - \phi = 7.9 - 2.8$$

$$k_{\max} = 5.1 \text{ eV}$$

13. Two equal rods are joined to form a single rod of 120 cm. Find final rod length when temperature is raised from 30°C to 100°C. Given :

$$\alpha_A = 1.2 \times 10^{-5}/^\circ\text{C}$$

$$\alpha_B = 24 \times 10^{-6}/^\circ\text{C}$$

- (1) 121.15 cm
 (2) 122.15 cm
 (3) 120.15 cm
 (4) 119.15 cm

Ans. (3)

Sol. $l_{\text{final}} = l_0 (1 + \alpha_A \Delta T) + l_0 (1 + \alpha_B \Delta T)$

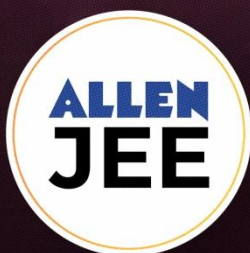
$$= 60 (2 + (\alpha_A + \alpha_B)\Delta T)$$

$$= 60 (2 + (12 \times 10^{-6} + 24 \times 10^{-6})70)$$

$$= 60 (2 + 0.0025)$$

$$\text{final} = 120.15 \text{ cm}$$

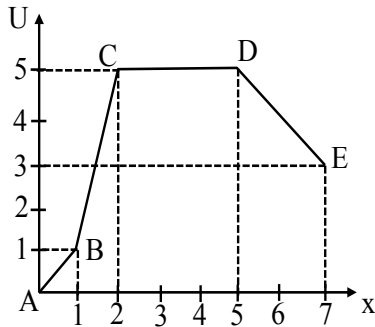
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14. A graph of potential energy as position is given below. Give the order of magnitude of forces.



- (1) $|F_{CD}| < |F_{AB}| = |F_{DE}| < |F_{BC}|$
- (2) $|F_{CD}| < |F_{AB}| > |F_{DE}| < |F_{BC}|$
- (3) $|F_{CD}| < |F_{AB}| < |F_{DE}| < |F_{BC}|$
- (4) $|F_{CD}| = |F_{AB}| = |F_{DE}| < |F_{BC}|$

Ans. (1)

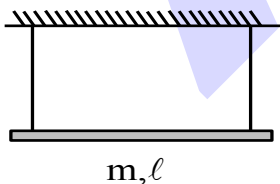
Sol. $|F_{AB}| = \left| \frac{-dU}{dx} \right| = \frac{1-0}{1-0} = 1$

$|F_{BC}| = \left| \frac{-dU}{dx} \right| = \frac{5-1}{2-1} = 4$

$|F_{CD}| = \left| \frac{-dU}{dx} \right| = 0$

$|F_{DE}| = \left| \frac{-dU}{dx} \right| = \left| \frac{3-5}{7-5} \right| = 1$

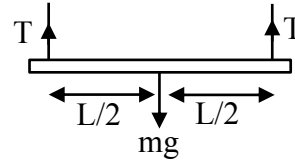
15. A rod of mass m and length ℓ is attached to two ideal strings. Find tension in left string just after right of string is cut.



- (1) $\frac{mg}{2}$
- (2) $\frac{mg}{4}$
- (3) $\frac{2}{3}mg$
- (4) $\frac{mg}{5}$

Ans. (2)

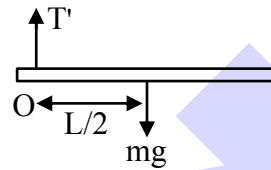
Sol. Before



$2T = mg$

$T = \frac{mg}{2}$

After :



$mg \frac{L}{2} = I_0 \alpha$

$mg \frac{L}{2} = \frac{mL^2}{3} \alpha$

$\frac{3g}{2L} = \alpha$

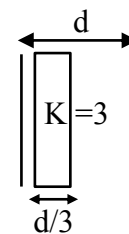
$mg - T' = ma_t$

$T' = mg - m \left(\alpha \frac{L}{2} \right)$

$T' = mg - m \left(\frac{3g}{4} \right)$

$T' = \frac{mg}{4}$

16. A capacitor of capacitance 'C' is given. Find the capacitance after dielectric is inserted as shown.



- (1) $\frac{9}{7}C$
- (2) $\frac{3}{7}C$
- (3) $\frac{6}{7}C$
- (4) $\frac{5}{7}C$

Ans. (2)

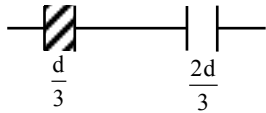


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Sol.



$$C_1 = \frac{3A \epsilon_0 k}{d}, C_2 = \frac{3A \epsilon_0}{2d}$$

$$\frac{1}{C'} = \frac{d}{3A \epsilon_0 k} + \frac{2d}{3A \epsilon_0}$$

$$= \frac{d}{3A \epsilon_0} \left(\frac{1}{k} + 2 \right)$$

$$C' = \frac{3A \epsilon_0 k}{(1+2k)d} = \frac{3k}{1+2k} \cdot C$$

$$k = 3$$

$$C' = \frac{9}{7} C$$

17. A magnet is dropped inside a coil as shown in figure. Its acceleration as it falls through the coil is 'a'. Choose the correct option.



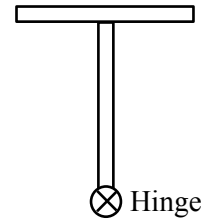
- (1) $a = g$ (2) $a > g$
 (3) $a < g$ (4) $a = 0$

Ans. (3)

Sol. The coil will oppose the motion of magnet due to induced current as result of change in magnetic flux.

$$\therefore a < g$$

18. Two rods are joined together as shown. If moment of inertia about Hinge is $\frac{x}{12} m \ell^2$. Find x. (Both rods have mass m and length ℓ)



- (1) 10 (2) 12
 (3) 13 (4) 17

Ans. (4)

Sol. $I_{\text{hinge}} = I_1 + I_2$

$$= \frac{m \ell^2}{3} + \left(\frac{m \ell^2}{12} + m(\ell)^2 \right)$$

$$= \frac{m \ell^2}{3} + \frac{13m \ell^2}{12}$$

$$= \frac{4m \ell^2 + 13m \ell^2}{12}$$

$$I = \frac{17}{12} m \ell^2$$

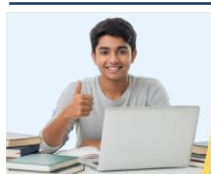
$$\frac{x}{12} m \ell^2 = \frac{17}{12} m \ell^2$$

$$x = 17$$

19. Find energy required for a satellite to go from $r = 1.5 R_E$ to $r = 3R_E$. (Given : Mass of satellite is 100 kg. Radius of Earth $R_E = 6 \times 10^6$ m and acceleration due to gravity $g = 10 \text{ m/s}^2$).

- (1) 10^9 J
 (2) 10^{11} J
 (3) 10^{10} J
 (4) 10^8 J

Ans. (1)



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Sol. $E = \frac{-GMm}{2r}$ $r_1 = 1.5 R_E = \frac{3}{2} R_E$

$E_1 = \frac{-GMm}{2r_1}$ $r_2 = 3R_E$

$E_2 = -\frac{GMm}{2r_2}$

$E_1 = \frac{-GMm}{2\left(\frac{3}{2} R_E\right)} = \frac{-GMm}{3R_E}$

$E_2 = \frac{-GMm}{2(3R_E)} = \frac{-GMm}{6R_E}$

Energy Req : $E_2 - E_1 = \frac{-GMm}{6R_E} - \left(\frac{-GMm}{3R_E}\right)$

$= \frac{GMm}{R_E} \left[\frac{1}{3} - \frac{1}{6}\right] = \left[\frac{GMm}{6R_E}\right]$

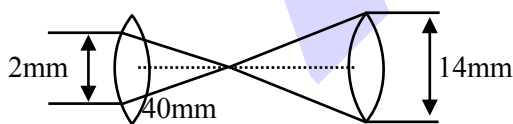
$= \frac{mgR_E}{6} = 10^9 \text{ J}$ $\left[g = \frac{Gm}{(R_E)^2}\right]$

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

- (1) 270 mm (2) 260 mm
- (3) 290 mm (4) 280 mm

Ans. (4)

Sol.



Similar triangle

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

$f = 280 \text{ mm}$

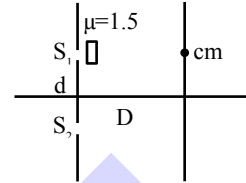
SECTION-B

21. In YDSE arrangement

$d = 0.1 \text{ cm}$

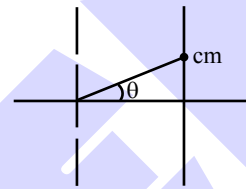
$D = 50 \text{ cm}$

If a thin film placed as in the figure in front of S_1 central maxima forms 0.2 cm above centre. The thickness of film should be (in μm):



Ans. (8)

Sol.



$\sin\theta = \tan\theta = \frac{0.2}{50} = \frac{1}{250}$

$\Delta x_{cm} = 0$

$\Delta x_{cm} = (\mu-1)t - d\sin\theta = 0$

$0.5t = 0.1 \times 10^{-2} \times \frac{1}{250}$

$= 10^{-3} \times 4 \times 10^{-3} = 4 \times 10^{-6}$

$t = 8 \times 10^{-6} = 8 \mu\text{m}$

22. Initial temperature of 10 moles O_2 is 30°C . Find change in internal energy (in calorie) if final temperature becomes 40°C . Given $C_p = \frac{7\text{cal}}{\text{mole}^\circ\text{C}}$,

$R = \frac{2\text{cal}}{\text{mole}^\circ\text{C}}$

Ans. (500)

Sol. $\Delta U = nC_v\Delta T = n(C_p - R)(T_f - T_i)$

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

$= 10 \times 5 \times 10$

$\Delta U = 500 \text{ Calorie}$



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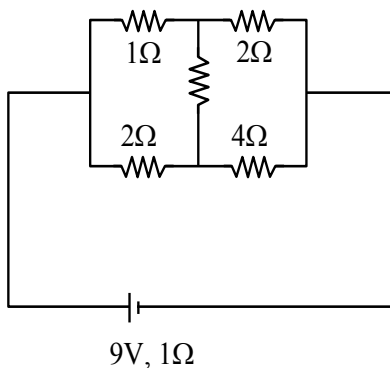
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23. Compound microscope has $f_o = 2$ cm, $f_e = 4$ cm and tube length $\ell = 32$ cm. For normal adjustment find magnification.

Ans. (100)

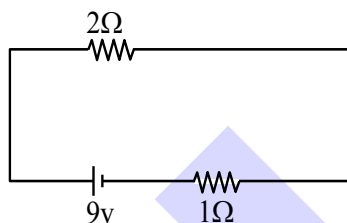
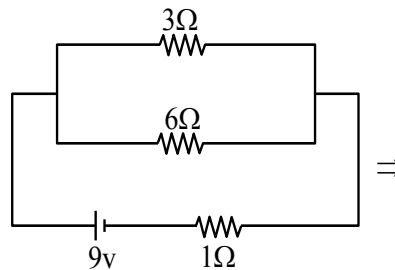
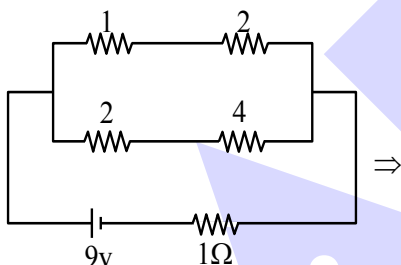
Sol. $m \approx \frac{\ell D}{f_o f_e}$
 $m \approx \frac{32}{2} \times \frac{25}{4}$
 $m \approx 100$

24. Find heat (in joule) dissipated in 1 minute in external circuit.



Ans. (1620)

Sol. It is wheatstone bridge



Req. $i = \frac{v}{R_{eq}} = \frac{9}{3} = 3$ amp

Heat : $i^2 R t = (9)(3)(60) = 1620$ J

25. There are two springs of spring constant $k_1 = (20 \pm 0.3)$ N/m and $k_2 = (30 \pm 0.2)$ N/m. If they are connected in parallel then percentage error in equivalent spring constant of combination is _____ %.

Ans. (1)

Sol. $\Delta k = \Delta k_1 + \Delta k_2 = 0.5$

$K_{eq} = 50$ N/m

% error = $\frac{0.5}{50} \times 100 = 1$



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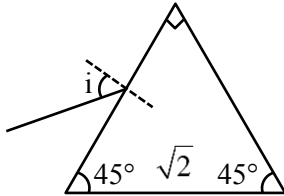
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TIME : 3:00 PM TO 6:00 PM

PHYSICS

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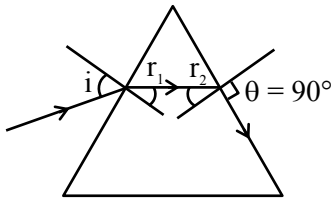
1. Refractive index of prism is $\sqrt{2}$. What should be angle of incidence for a light ray such that the emerging ray grazes out the surface :



- (1) 60° (2) 30°
 (3) 90° (4) 45°

Ans. (3)

Sol.



$$\sqrt{2} \sin r_2 = 1 \sin 90^\circ$$

$$r_2 = 45^\circ$$

$$r_1 + r_2 = A$$

$$r_1 = 45^\circ$$

$$1 \sin i = \sqrt{2} \sin 45^\circ$$

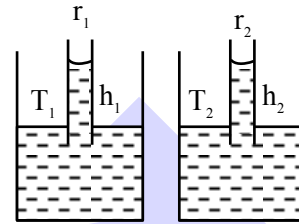
$$i = 90^\circ$$

2. For YDSE experiment, for angular fringe width :
Statement-1 :- If distance between slits and screen increases then width increases.
Statement-2 :- Angular fringe width depends on frequency of source.
 (1) **Statement 1** is true & **Statement 2** is false
 (2) **Statement 1** is false & **Statement 2** is true
 (3) Both are true
 (4) Both are false

Ans. (2)

Sol. Angular fring width is given by λ/d .

3. Two capillaries are dipped in two different liquids having meniscus radius R_1, R_2 ($R_1 > R_2$) and surface Tension T_1 & T_2 . If density of liquids are same :



- (1) $h_1 = h_2$ then $T_1 = T_2$
 (2) $h_1 > h_2$ then $T_1 = T_2$
 (3) $h_1 > h_2$ then $T_1 < T_2$
 (4) $h_1 < h_2$ then $T_1 = T_2$

Ans. (4)

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

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

Given $R_1 > R_2$
 then $h_1 < h_2$

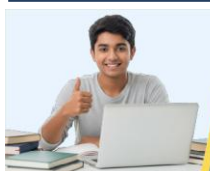
4. A particle is performing S.H.M. with frequency f_0 . If frequency of oscillations of its kinetic energy is 176 Hz, find out f_0

Ans. (88 Hz)

Sol. as we know $f_{KE} = 2f_0$

$$f_0 = \frac{f_{KE}}{2} = \frac{176}{2}$$

$$= 88 \text{ Hz}$$

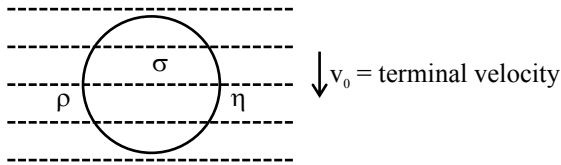


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10. Figure shows a ball falling in a viscous medium with coefficient of viscosity η . If error in measurement of radius is Δr & that is measurement of terminal velocity is Δv_0 . Density of ball & liquid is exactly known, then fractional error in measurement of η (coefficient of viscosity)



(1) $\frac{\Delta\eta}{\eta} = \frac{2\Delta r}{r} + \frac{\Delta v_0}{v_0}$ (2) $\frac{\Delta\eta}{\eta} = \frac{2\Delta r}{r} - \frac{\Delta v_0}{v_0}$
 (3) $\frac{\Delta\eta}{\eta} = 2\left(\frac{\Delta r}{r} + \frac{\Delta v_0}{v_0}\right)$ (4) $\frac{\Delta\eta}{\eta} = 2\left(\frac{\Delta r}{r} - \frac{\Delta v_0}{v_0}\right)$

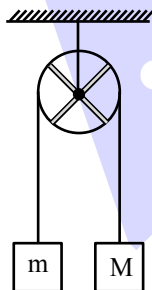
Ans. (1)

Sol. $v_0 = \frac{2}{9}(\rho_s - \rho_l) \frac{r^2 g}{\eta}$ (Here v_0 is terminal velocity)

$\Rightarrow \eta = \frac{2}{9}(\rho_s - \rho_l) \frac{r^2 g}{v_0}$

$\therefore \frac{\Delta\eta}{\eta} = \frac{2\Delta r}{r} + \frac{\Delta v_0}{v_0}$

11. A ring and two rods each of mass M are able to rotate freely about its centre as shown. Find acceleration of each block? There is no slipping between string and pulley.



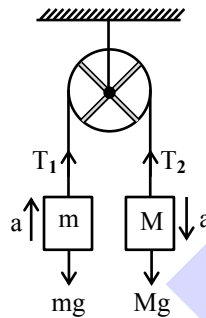
(1) $\frac{(M-m)g}{5M+m}$
 (2) $\frac{2(M-m)g}{8M+m}$

(3) $\frac{3(M-m)g}{8M+3m}$

(4) $\frac{2(M-m)g}{5M+2m}$

Ans. (3)

Sol.



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

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

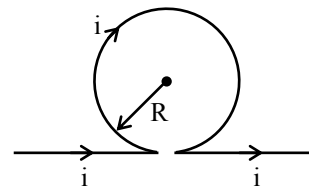
$(T_2 - T_1)r = I \frac{a}{r}$... (3)

(1) + (2) + (3)

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

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

12. Current i is flowing in the long wire as shown in figure. Find magnetic field at centre of circle.



(1) $B = \frac{\mu_0 i}{R} + \frac{\mu_0 i}{2\pi R}$

(2) $B = \frac{\mu_0 i}{2R} + \frac{\mu_0 i}{\pi R}$

(3) $B = \frac{\mu_0 i}{2R} + \frac{\mu_0 i}{2\pi R}$

(4) $B = \frac{\mu_0 i}{R} + \frac{\mu_0 i}{\pi R}$

Ans. (3)

Sol. $B = \frac{\mu_0 i}{2R} + \frac{\mu_0 i}{2\pi R}$

13. If position of a particle is given $x = t^2 + t + 1$. Mass of particle is 2 kg. Find work done by force from $t = 2$ sec to $t = 3$ sec.

(1) 24 Joule

(2) 21 Joule

(3) 28 Joule

(4) 20 Joule

Ans. (1)



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Sol. $v = \frac{dx}{dt} = 2t + 1$

$a = 2 ; F = ma$

$F = 2 \times 2 = 4N$

$x_{(t=2\text{sec})} = 2^2 + 2 + 1 = 7$

$x_{(t=3\text{sec})} = 3^2 + 3 + 1 = 13$

Displacement = $\Delta x = 13 - 7 = 6$

Work done by force = $F \times x$

= $4 \times 6 = 24 J$

14. Terminal velocity of a spherical ball of radius 6mm in a liquid is given as 20 cm/sec. Find terminal velocity (in cm/s) of a ball of 3mm radius in same liquid.

- (1) 5 (2) 10
(3) 7 (4) 9

Ans. (1)

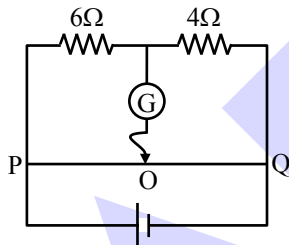
Sol. We know :

Terminal velocity \propto (radius)²

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

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

15. The total length of potential wire PQ is 50 cm in the arrangement shown in the figure. Find out balance length PO (in cm).



- (1) 25 (2) 20
(3) 30 (4) 35

Ans. (3)

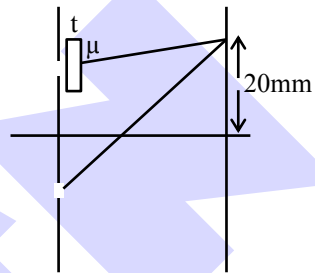
Sol. $\frac{6}{4} = \frac{x}{50-x}$

$$\frac{3}{2} = \frac{x}{50-x}$$

$$150 - 3x = 2x$$

$$x = \frac{150}{5} = 30 \text{ cm}$$

16. In YDSE experiment, central maxima shift by 20 mm if a slab of thickness 20 μm and refractive index μ is placed in front of one of the slits. If distance between slits is 4 × 10⁻⁴ m and screen is placed 1m away from slits. Then refractive index is α/10. Find α.



Ans. 14

Sol. $\frac{Y}{D} \cdot t = t(\mu - 1)$

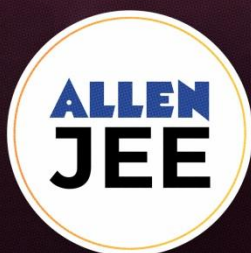
$$\mu = \left(\frac{Yd}{Dt} + 1\right)$$

$$= \left(\frac{20 \times 10^{-3} \times 4 \times 10^{-4}}{1 \times 20 \times 10^{-6}}\right) + 1$$

$$= \frac{4}{10} + 1$$

$$\Rightarrow \mu = \frac{14}{10}$$

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17. A medium having conductivity 10 siemen/meter. Electromagnetic waves of frequency 100 MHz are passed through this medium. Find ratio of maximum displacement current & conduction current. (Given : $\epsilon_r = 2$)

- (1) 400 (2) 600
(3) 900 (4) 1000

Ans. (3)

Sol. $i_c = A \cdot \sigma E = A \sigma E_0 \sin(\omega t - kx)$

$$i_d = A \epsilon_r \epsilon_0 \frac{\partial E}{\partial t}$$

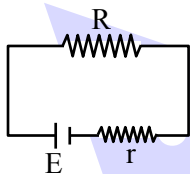
$$= A \epsilon_r \epsilon_0 E_0 \omega \cos(\omega t - kx)$$

$$\frac{i_{c \max}}{i_{d \max}} = \frac{\sigma}{\epsilon_r \epsilon_0 \omega}$$

$$= \frac{10}{2 \times 8.85 \times 10^{-12} \times 100 \times 10^6}$$

$$= 900$$

18. In a circuit, there is a battery with internal resistance r and emf E , which is connected to external load resistance R as shown. Find value of R so that maximum power dissipates across R :



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

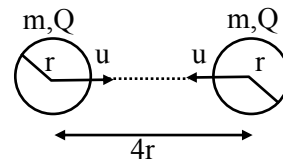
Ans. (1)

Sol. For maximum power drawn across load Resistance

$$R_{\text{Load}} = R_{\text{internal}}$$

$$\boxed{R = r}$$

19. Two spheres of same mass m radius r and charge at separation $4r$ are moving with same speed u towards each other as shown in figure:



Find the u_{\min} so that they collide

- (1) $\sqrt{\frac{KQ^2 - Gm^2}{4mr}}$ (2) $\sqrt{\frac{KQ^2 - Gm^2}{2mr}}$
(3) $\sqrt{\frac{KQ^2 - Gm^2}{8mr}}$ (4) $\sqrt{\frac{2KQ^2 - Gm^2}{8mr}}$

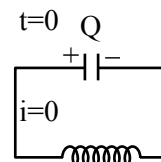
Ans. (1)

Sol. Using energy conservation

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

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

20. In an L-C circuit at $t = 0$ capacitor is fully charged and zero current in circuit. At $t = t_0$, 25% energy of capacitor goes into inductor then value of t_0 is :



- (1) $\frac{\pi}{3} \sqrt{LC}$ (2) $\frac{\pi}{6} \sqrt{LC}$
(3) $\frac{3}{2} \pi \sqrt{LC}$ (4) $\frac{\pi}{2} \sqrt{LC}$

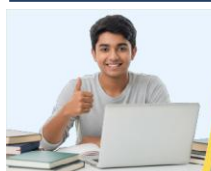
Ans. (2)

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

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

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

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

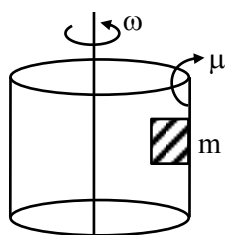


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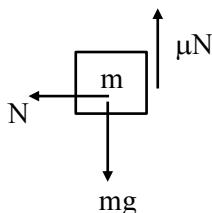
21. Find ω such that block does not slip on the surface of cylinder :



- (1) $\sqrt{\frac{g}{\mu r}}$ (2) $\frac{g}{\mu r}$
 (3) $\sqrt{\frac{gr}{\mu}}$ (4) $r\sqrt{\frac{g}{\mu}}$

Ans. (1)

Sol.



$$N = m\omega^2 r \text{ and } mg = \mu N$$

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

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

22. For a diatomic gas undergoing an isobaric process, work done is 100 Joules then calculate heat supplied during the process :

- (1) 350 (2) 400
 (3) 450 (4) 700

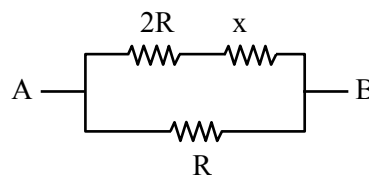
Ans. (1)

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

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

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

23. For the given network, the net resistance across AB = x. Then find the value of x :



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

Ans. (4)

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

$$2R^2 + xR = 3Rx + x^2$$

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

$$x = \frac{-2R \pm \sqrt{4R^2 + 8R^2}}{2}$$

$$= \frac{-2R \pm 2\sqrt{3}R}{2}$$

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

24. V_{rms} of O_2 gas at $47^\circ C$ is equal to V_{rms} of H_2 at what temp in celsius:

- (1) $-253^\circ C$ (2) $-20^\circ C$
 (3) $+20^\circ C$ (4) $+253^\circ C$

Ans. (1)

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

$$V_{rmsO_2} = V_{rmsH_2}$$

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

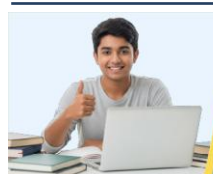
$$\sqrt{\frac{3RT_{O_2}}{M_{O_2}}} = \sqrt{\frac{3RT_{H_2}}{M_{H_2}}}$$

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

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

$$T_{H_2} = 20K$$

$$T_{H_2} = -253^\circ C$$



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25. Energy of an electron in Bohr's model is $-0.04E_0$ eV, where E_0 is ground state energy. If L is angular momentum of electron & h is Planck's constant then $\frac{2\pi L}{h}$ is:

Ans. (5)

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

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

$$\text{Energy } E = -\frac{13.6}{n^2} \cdot z^2 = -0.04 \times \left(\frac{+13.6}{1} \cdot z^2 \right)$$

$$n^2 = 25$$

$$\boxed{n = 5}$$

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MEMORY BASED QUESTIONS JEE-MAIN EXAMINATION – JANUARY 2026

(HELD ON THURSDAY 22nd JANUARY 2026)

TIME : 9:00 AM TO 12:00 NOON

PHYSICS

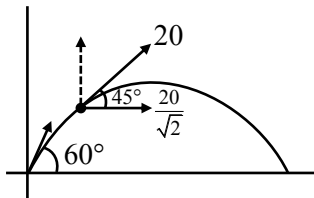
TEST PAPER WITH SOLUTION

1. A particle is projected at an angle of 60° with the ground. When projectile makes an angle 45° with the horizontal, its speed becomes 20 m/s, then initial velocity is :

- (1) $20\sqrt{2}$ m/s
- (2) $10\sqrt{2}$ m/s
- (3) $5\sqrt{5}$ m/s
- (4) $10\sqrt{5}$ m/s

Ans. (1)

Sol.



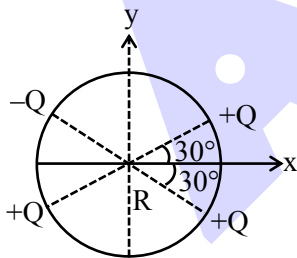
$$u \cos 60^\circ = \frac{20}{\sqrt{2}}$$

$$\frac{u}{2} = \frac{20}{\sqrt{2}}$$

$$u = \frac{40}{\sqrt{2}}$$

$$u = 20\sqrt{2} \text{ m/s}$$

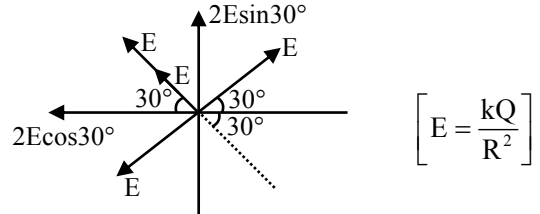
2. Find electric field intensity \vec{E} at centre of circle :



- (1) $\frac{KQ}{R^2} \hat{i} + \frac{KQ}{R^2} \hat{j}$
- (2) $-\frac{\sqrt{3}KQ}{R^2} \hat{i} + \frac{KQ}{R^2} \hat{j}$
- (3) $\frac{KQ}{R^2} \hat{i} + \frac{\sqrt{3}KQ}{R^2} \hat{j}$
- (4) $\frac{\sqrt{3}KQ}{R^2} \hat{i} + \frac{\sqrt{3}KQ}{R^2} \hat{j}$

Ans. (2)

Sol.

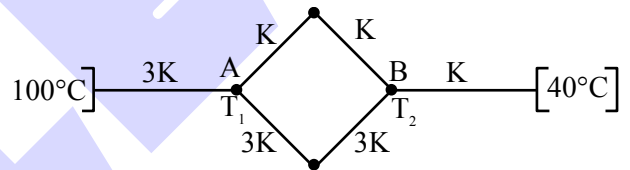


$$\left[E = \frac{kQ}{R^2} \right]$$

$$\vec{E}_{\text{net}} = 2E \cos 30^\circ (-\hat{i}) + 2E \sin 30^\circ (\hat{j})$$

$$-\frac{\sqrt{3}kQ}{R^2} (\hat{i}) + \frac{kQ}{R^2} (\hat{j})$$

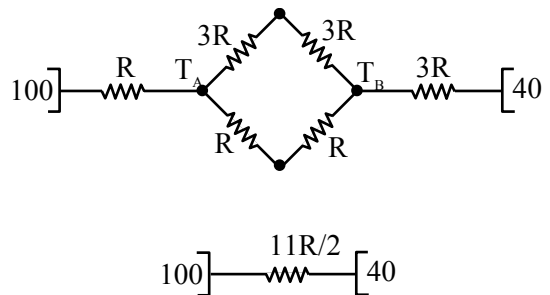
3. As shown in the figure, six rods of same geometry are connected, and maintained at temperatures 100°C and 40°C. The temperature at points A and B are :



- (1) $T_A = 73^\circ\text{C}, T_B = 89^\circ\text{C}$
- (2) $T_A = 85^\circ\text{C}, T_B = 75^\circ\text{C}$
- (3) $T_A = 89^\circ\text{C}, T_B = 73^\circ\text{C}$
- (4) $T_A = 74^\circ\text{C}, T_B = 88^\circ\text{C}$

Ans. (3)

Sol. Let $\left[R = \frac{\ell}{3KA} \right]$



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$$\left[H = \frac{100 - 40}{\frac{11R}{2}} \right] \dots (1)$$

$$= \frac{100 - T_A}{R} \dots (2)$$

$$120 = 1100 - 11T_A$$

using (1) and (2)

$$T_A = 89^\circ\text{C}$$

$$= \frac{T_B - 40}{3R}$$

using (1) and (3)

$$T_B = 73^\circ\text{C}$$

4. A convex lens of focal length 5 cm and a concave lens of focal length 4 cm are placed in contact and a point object is placed at 10 cm from system. In this arrangement magnification is m_1 . Now keeping system as it is concave lens is moved 1 cm away and now magnification becomes m_2 . Find m_1/m_2 :

(1) 5/6

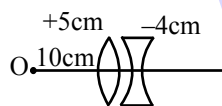
(2) 4/7

(3) 6

(4) 7

Ans. (1)

Sol. Initial configuration



$$\frac{1}{f} = \frac{1}{5} - \frac{1}{4} = -\frac{1}{20}$$

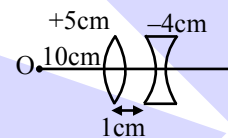
$$f = -20 \text{ cm}$$

$$u = -10 \text{ cm}$$

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$v = \frac{uf}{u+f}$$

New configuration



1st refraction

$$u = -10 \text{ cm}, f = +5 \text{ cm}$$

$$v = \frac{uf}{u+f} = +10 \text{ cm}$$

$$m = -1$$

2nd refraction

$$m_1 = \frac{v}{u} = \frac{f}{u+f}$$

$$u = +9 \text{ cm } f = -4 \text{ cm}$$

$$m' = \frac{f}{u+f} = \frac{-4}{5}$$

$$= \frac{-20}{-10-20}$$

$$m_2 = mm' = (-1)\left(-\frac{4}{5}\right) = \frac{4}{5}$$

$$= +\frac{2}{3}$$

$$\frac{m_1}{m_2} = \frac{2}{3} \times \frac{5}{4} = \frac{5}{6}$$

5. Escape velocity from a planet of radius R and density ρ is given as 10 km/s. Find the escape velocity from a planet of radius $\frac{R}{10}$ and density

$$\frac{\rho}{10} :$$

(1) $10\sqrt{100}$ m/s

(2) $110\sqrt{10}$ m/s

(3) $100\sqrt{10}$ m/s

(4) $90\sqrt{10}$ m/s

Ans. (3)

Sol. $V_e = 10 \text{ km/s} = 10^4 \text{ m/s}$

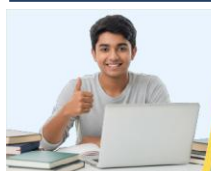
$$\Rightarrow \sqrt{\frac{2GM}{R}} = 10^4$$

$$\sqrt{\frac{2G\left(\rho \frac{4}{3}\pi R^3\right)}{R}} = 10^4$$

$$\Rightarrow \sqrt{\frac{8}{3}G\rho\pi R^2} = 10^4 \dots (i)$$

$$v'_e = \sqrt{\frac{2GM'}{R'}} = \sqrt{\frac{2G\rho \frac{4\pi}{3}\left(\frac{R}{10}\right)^3}{\frac{R}{10}}}$$

$$v'_e = \sqrt{\frac{8G\rho\pi R^2}{3 \cdot 10^3}} = \frac{v_e}{\sqrt{10^3}}$$



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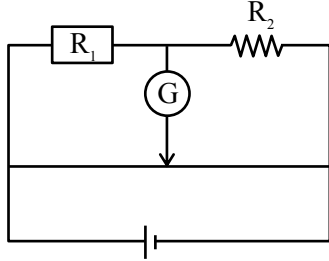
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$$v'_e = \frac{10^4}{\sqrt{10^3}} = 10^{(4-3/2)} = 10^{5/2}$$

$$v'_e = 100\sqrt{10} \text{ m/s}$$

6. Figure shows a meter bridge



Initially null point was achieved at a distance of 40 cm. When a resistance 16Ω is attached in parallel with R_2 , new balance point was achieved at 50 cm. Then find value of R_1 and R_2 :

(1) $R_1 = 8\Omega, R_2 = \frac{16}{3} \Omega$

(2) $R_1 = 16\Omega, R_2 = 8\Omega$

(3) $R_1 = \frac{16}{3} \Omega, R_2 = 8\Omega$

(4) $R_1 = 8\Omega, R_2 = 16\Omega$

Ans. (3)

Sol. Initially :

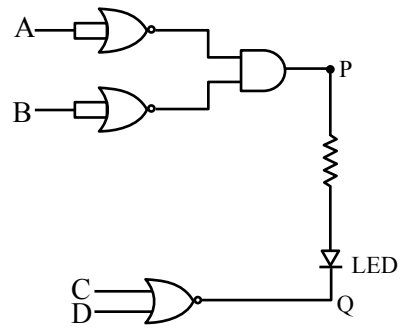
$$\frac{R_1}{R_2} = \frac{40}{60} = \frac{2}{3} \Rightarrow R_1 = \frac{2}{3} R_2$$

Again

$$\frac{R_1}{16 + R_2} = 1 \Rightarrow \frac{2}{3} R_2 = \frac{16 + R_2}{16 + R_2} \Rightarrow R_2 = 8\Omega$$

$$\therefore R_1 = \frac{16}{3} \Omega$$

7. In the figure the LED will glow for input of A, B, C, D : (0 is low potential and 1 is high potential)



(1) 0 0 1 0

(2) 0 0 0 0

(3) 1 1 0 0

(4) 1 0 0 0

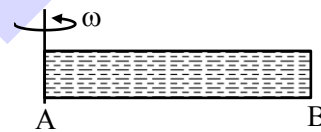
Ans. (1)

Sol. LED will glow in forward biasing :

P higher potential – 1

Q lower potential – 0

8. A closed tube filled with ideal gas is rotating with ' ω ' along axis passing through end A. Find pressure at other end B (M is molar mass of the gas, ℓ is length of tube and T is the temperature of gas) :



Given pressure at 'A' is P_A :

(1) $P_A e^{\frac{\omega^2 \ell^2 M}{2RT}}$

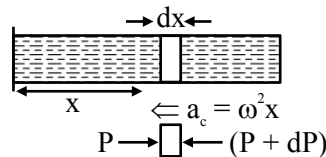
(2) $P_A e^{\frac{\omega^2 \ell^2 M}{RT}}$

(3) $P_A e^{\frac{\omega^2 \ell^2 M}{3RT}}$

(4) $P_A e^{\frac{\omega^2 \ell^2 M}{4RT}}$

Ans. (1)

Sol.



$$A[(P + dP) - P] = (dm) (\omega^2 x)$$

$$dP = \frac{(dm)}{A} \omega^2 x$$



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$$dP = \frac{(\rho)(A)(dx)\omega^2 x}{A}$$

also $[PM = \rho RT]$

$$\rho = \frac{PM}{RT}$$

$$dP = \left(\frac{PM}{RT}\right) \omega^2 x dx$$

$$\int_{P_A}^{P_B} \frac{dP}{P} = \frac{\omega^2 M}{RT} \int_0^\ell x dx$$

$$\ell \ln\left(\frac{P_B}{P_A}\right) = \frac{\omega^2 \ell^2 M}{2RT}$$

$$P_B = P_A e^{\frac{\omega^2 \ell^2 M}{2RT}}$$

9. For an ideal gas in a reversible process ($\Delta Q = 0$), volume becomes 8 times and temperature becomes $\frac{1}{4}$ times the initial value. Identify the gas :

- (1) CO_2
- (2) O_2
- (3) NH_3
- (4) He

Ans. (4)

Sol. $PV^\gamma = \text{constant}$

$$TV^{\gamma-1} = \text{constant}$$

$$TV^{\gamma-1} = \left(\frac{T}{4}\right)(8V)^{(\gamma-1)}$$

$$4 = 8^{(\gamma-1)}$$

$$2^2 = 2^{3\gamma-3}$$

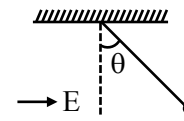
$$2 = 3(\gamma-1)$$

$$\gamma = \frac{5}{3}$$

Gas is a monoatomic gas

Answer is He.

10. A simple pendulum with bob of mass m carrying charge q is in equilibrium in presence of horizontal electric field E , then tension in the thread is :



(1) $T = \sqrt{(qE)^2 + (mg)^2}$

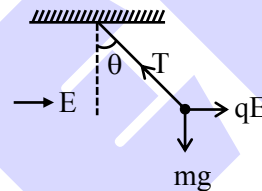
(2) $T = mg + qE \tan \theta$

(3) $T = \sqrt{(qE)^2 - (mg)^2}$

(4) $T = mg - qE \tan \theta$

Ans. (1)

Sol.



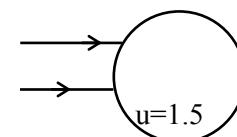
$$T = \sqrt{(qE)^2 + (mg)^2}$$

11. There is a glass sphere of refractive index 1.5, on which a parallel beam of light falls. Find distance of final converging point of final emergent ray from centre of the sphere. Radius of sphere is 50 cm :

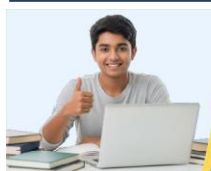
- (1) 75 cm
- (2) 70 cm
- (3) 80 cm
- (4) 65 cm

Ans. (1)

Sol.



1st refraction



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$$\frac{1.5}{v} - \frac{1}{\infty} = \frac{1.5-1}{+50}$$

$$\frac{1.5}{v} = \frac{1}{100} \Rightarrow v = 150\text{cm or}$$

= 50 cm from 2nd surface

2nd refraction

$$\frac{1}{v} - \frac{1.5}{+50} = \frac{1-1.5}{-50}$$

$$= -2$$

$$\frac{1}{v} = \frac{1}{100} + \frac{3}{100}$$

$$= \frac{4}{100}$$

$$v = 25 \text{ cm}$$

∴ Distance from centre = 75 cm

12. **Statement-1** : Liquid pressure is only exerted on solid surface in contact and is exerted in between the layers of liquid.

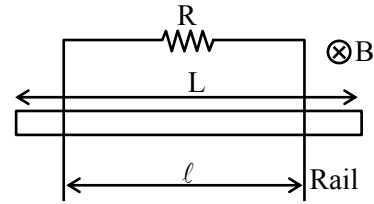
Statement-2 : Surface tension arises due to difference in potential energy of molecules in bulk of liquid and at surface.

- (1) Both **Statement-1** and **Statement-2** are incorrect.
- (2) **Statement-1** is correct but **Statement-2** is incorrect.
- (3) **Statement-1** is incorrect but **Statement-2** is correct.
- (4) Both **Statement-1** and **Statement-2** are correct.

Ans. (4)

Sol. Theory

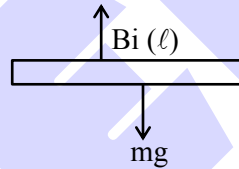
13. A rod of mass 'm' and length 'L' is released on a rail placed in uniform magnetic field B. What will be the terminal velocity of rod :



- (1) $\frac{mgR}{B^2L^2}$
- (2) $\frac{mgR}{B^2\ell^2}$
- (3) $\frac{mgR}{B\ell^2}$
- (4) $\frac{mg}{B^2\ell^2R}$

Ans. (2)

Sol. Terminal velocity



$$i = \frac{(B)(v)(\ell)}{R}$$

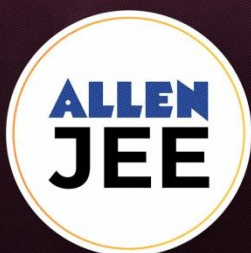
$$B(i)(\ell) = mg$$

$$B \left[\frac{Bv\ell}{R} \right] \ell = mg$$

$$\frac{B^2\ell^2v}{R} = mg$$

$$v = \frac{mgR}{B^2\ell^2}$$

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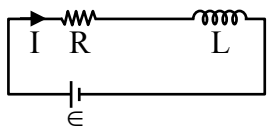


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14. Find energy density at the instant current is $\frac{1}{e}$ times maximum value. If value is $\alpha \frac{\pi}{e^2}$. Find α .

(Given : $\epsilon = 10$ volt, $R = 10\Omega$, $L = 10$ mH, $\frac{N}{\ell} = 10000$.)



Ans. 20

Sol. $I_0 = I = I_0(1 - e^{-Rt/L})$, where $I_0 = \epsilon/R$

$$\text{Energy density} = \frac{1}{2} \frac{B^2}{\mu_0} = \frac{1}{2\mu_0} (\mu_0 nI)^2$$

$$= \frac{1}{2} \mu_0 n^2 I^2$$

$$= \frac{1}{2} \mu_0 n^2 \frac{I_0^2}{e^2}$$

$$= \frac{1}{2} (4\pi)(10^{-7})(10000)^2 \left(\frac{10}{10}\right)^2 \frac{1}{e^2}$$

$$= 2 \times 10^{+1} \times \left(\frac{\pi}{e^2}\right)$$

$$\frac{\alpha\pi}{e^2} = 20 \left(\frac{\pi}{e^2}\right) \Rightarrow \alpha = 20$$

15. The energy required to excite electron from first Bohr's orbit of Hydrogen atom to second Bohr's orbit in J is :

- (1) 1.634×10^{-18} J (2) 1.2×10^{-18} J
 (3) 0.2×10^{-18} J (4) 1.2×10^{-20} J

Ans. (1)

Sol. $E_n = \frac{-13.6}{n^2} \text{eV}$

$$\Rightarrow n = 1; E_1 = -13.6 \text{ eV}$$

$$\Rightarrow n = 2; E_2 = \frac{-13.6}{2^2} = -3.4 \text{ eV}$$

$$\Delta E = E_2 - E_1 = -3.4 - (-13.6)$$

$$= 10.2 \text{ eV}$$

$$\Delta E = 10.2 \times 1.6 \times 10^{-19}$$

$$\Delta E = 1.634 \times 10^{-18} \text{ J}$$

16. A photon is incident on particle having mass $m = 15.356$ amu. What should be the frequency of photon so that particle of mass 'm' breaks into four α -particles :

(given : $m_\alpha = 4.004$ amu ; $h = 6.6 \times 10^{-34}$ Js)

- (1) 14.9×10^{19} kHz
 (2) 12.9×10^{19} kHz
 (3) 9.9×10^{19} kHz
 (4) 10.9×10^{19} kHz

Ans. (1)

Sol. $h\nu = (4 \times 4.004 - 15.356) \text{ amu} \times c^2$

$$\nu = \frac{0.66}{h} \times 931 \times 10^6 \text{ eV}$$

$$\nu = 14.9 \times 10^{19} \text{ kHz}$$

17. Match the following :

(1)	Spring constant	(i)	$ML^2T^{-2}K^{-1}$
(2)	Thermal Conductivity	(ii)	$MLT^{-3}K^{-1}$
(3)	Boltzman constant	(iii)	ML^0T^{-2}
(4)	Inductance	(iv)	$ML^2T^{-2}A^{-2}$

- (1) (1) \rightarrow (ii), (2) \rightarrow (iii), (3) \rightarrow (i), (4) \rightarrow (iv)
 (2) (1) \rightarrow (iii), (2) \rightarrow (i), (3) \rightarrow (ii), (4) \rightarrow (iv)
 (3) (1) \rightarrow (i), (2) \rightarrow (ii), (3) \rightarrow (iii), (4) \rightarrow (iv)
 (4) (1) \rightarrow (iii), (2) \rightarrow (ii), (3) \rightarrow (i), (4) \rightarrow (iv)

Ans. (4)

Sol. $F = K \cdot x$

$$K = F/x$$

$$[K] = \frac{[MLT^{-2}]}{[L]} = MT^{-2} \quad \text{(iii)}$$

(A) \rightarrow (iii)

(B) Thermal conductivity : $[MLT^{-3}K^{-1}] \rightarrow$ (ii)

(C) Boltzman constant : $[ML^2T^{-2}K^{-1}] \rightarrow$ (i)

(D) Inductance : $[ML^2T^{-2}A^{-2}] \rightarrow$ (iv)



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18. An α -particle is projected towards a fixed gold nucleus ($Z = 79$) with kinetic energy 7.9 MeV. If particle is just able to touch the nucleus boundary. Find diameter of nucleus :
- (1) 57.6 fm (2) 45.6 fm
 (3) 36.6 fm (4) 20.6 fm

Ans. (1)

Sol. $K_i + U_i = K_f + U_f$

$$7.9 \text{ MeV} + 0 = 0 + \frac{K \cdot Qq}{r}$$

$$7.9 \times 10^6 \times e = \frac{9 \times 10^9 \times 79e \cdot 2e}{r}$$

$$r = 9 \times 10^3 \times 10 \times 2 \times 1.6 \times 10^{-19}$$

$$= 28.8 \times 10^{-15} = 2.88 \times 10^{-14} \text{ m}$$

$$d = 2r = 5.76 \times 10^{-14} \text{ m}$$

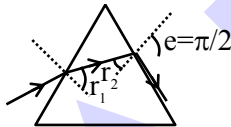
$$= 57.6 \text{ fm}$$

19. A ray of light is incident at angle of incidence 'i' on an equilateral prism. If the ray emerges grazing the second surface, find angle of refraction (in degree) at first surface. Refraction index is $\sqrt{2}$.

Ans. (15)

Sol. Equilateral prism.

$$A = 60^\circ$$



$$\mu \sin r_2 = 1 \cdot \sin e = 1$$

$$\sin r_2 = \frac{1}{\mu} = \frac{1}{\sqrt{2}}$$

$$r_2 = 45^\circ$$

$$\therefore r_1 = A - r_2 = 15^\circ$$

20. Two discs having same moment of inertia about their axis. Their thicknesses are t_1 and t_2 and they have same density. If $R_1/R_2 = 1/2$, then find t_1/t_2 :

- (1) 1/16 (2) 16
 (3) 1/4 (4) 4

Ans. (2)

Sol. $I_1 = I_2$

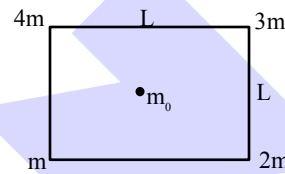
$$\frac{M_1 R_1^2}{2} = \frac{M_2 R_2^2}{2}$$

$$\rho \frac{\pi R_1^2 t_1 R_1^2}{2} = \rho \frac{\pi R_2^2 t_2 R_2^2}{2}$$

$$\frac{t_1}{t_2} = \frac{R_2^4}{R_1^4} = 2^4$$

$$\frac{t_1}{t_2} = 16$$

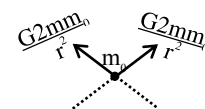
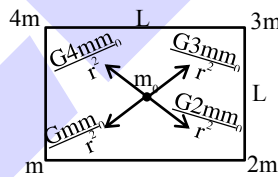
21. If initially force on $m_0 = F_0$. When position of 4m & 3m are interchanged, force become F' . If $F_0/F' = \alpha/\sqrt{5}$. Find α :



- (1) 1 (2) 2
 (3) 3 (4) 4

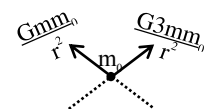
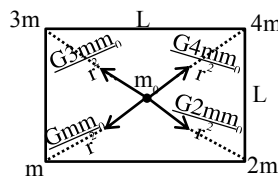
Ans. (2)

Sol. Initial configuration

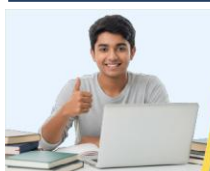


$$F = 2\sqrt{2} \frac{Gmm_0}{r^2}$$

New configuration



$$F' = \sqrt{10} \frac{Gmm_0}{r^2}$$



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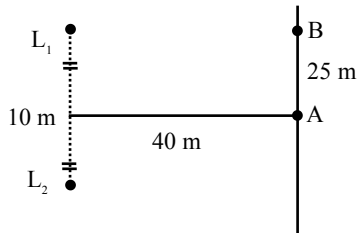
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$$\Rightarrow \frac{F}{F'} = 2\sqrt{2} \cdot \frac{1}{\sqrt{10}} = \frac{2}{\sqrt{5}}$$

$$\therefore \alpha = 2$$

22. Two coherent loudspeaker L_1 and L_2 are placed at separation of 10 m parallel to the wall at distance 40 m as shown in the figure. On width AB on the wall, 10 maximas and minimas are found. If velocity of sound is 324 m/s. find frequency of sound ($\sqrt{5} = 2.23$) :



- (1) 600 Hz (2) 500 Hz
 (3) 400 Hz (4) 700 Hz

Ans. (1)

Sol. $L_1B = \sqrt{20^2 + 40^2} = 20\sqrt{5}m = 44.6m$

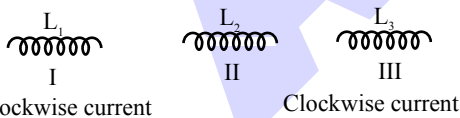
$$L_2B = \sqrt{30^2 + 40^2} = 50m$$

$$\Delta x = 50 - 44.6 = 5.4 m = 10\lambda \text{ for 10 cycles}$$

$$\lambda = 0.54 m$$

$$f = \frac{v}{\lambda} = \frac{324}{0.54} = 600Hz$$

23. As shown three coils are given having equal current in first and last coil, choose the correct option for the 2nd inductor to have clockwise current :

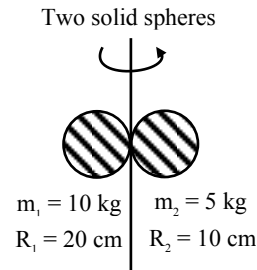


- (1) Move L_1 to words L_2 & L_3 away from L_2 .
 (2) Move L_1 away from L_2 & L_3 away from L_2 .
 (3) Move L_1 to words L_2 & L_3 towards L_2 .
 (4) Move L_1 away from L_2 & L_3 towards L_2 .

Ans. (1)

Sol. Theory

24. Find the moment of inertia about given axis.



- (1) 0.63 kg m^2 (2) 0.61 kg m^2
 (3) 0.62 kg m^2 (4) 0.60 kg m^2

Ans. (1)

Sol. $I = \frac{2}{5}m_1R_1^2 + m_1R_1^2 + \frac{2}{5}m_2R_2^2 + m_2R_2^2$

$$= \frac{7}{5}[m_1R_1^2 + m_1R_2^2]$$

$$= \frac{7}{5}[10 \times (20)^2 + 5(10)^2] \times 10^{-4}$$

$$= \frac{7}{5}[10 \times 4 + 5] \times 10^2 \times 10^{-4}$$

$$= \frac{7}{5} \times 45 \times 10^{-2}$$

$$I = 63 \times 10^{-2} \text{ kg m}^2$$

$$I = 0.63 \text{ kg m}^2$$

25. If potential is $v = 500$ volts at (10, 20) and electric field given $\vec{E} = 10x\hat{i} + 5y\hat{j} \text{ N/C}$. Find potential at origin.

- (1) 1000 volt (2) 2000 volt
 (3) 1500 volt (4) 3000 volt

Ans. (2)

Sol. $\Delta V = -\int \vec{E} \cdot d\vec{r}$

$$V_{(10,20)} - V_{(0,0)} = -\int_{(0,0)}^{(10,20)} (10xdx + 5ydy)$$

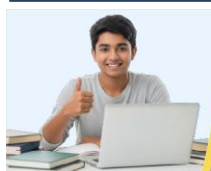
$$500 - V = -\left[5x^2 + \frac{5}{2}y^2\right]_{0,0}^{10,20}$$

$$= -\left[5(10)^2 + \frac{5}{2}(20)^2 - 0\right]$$

$$500 - V = -1500$$

$$V = 500 + 1500$$

$$V_{(0,0)} = 2000 \text{ volt}$$



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MEMORY BASED QUESTIONS JEE-MAIN EXAMINATION – JANUARY 2026

(HELD ON THURSDAY 22nd JANUARY 2026)

TIME : 3:00 PM TO 6:00 PM

PHYSICS

TEST PAPER WITH SOLUTION

1. **Statement-1** : Work done by \vec{F} from \vec{r}_1 to \vec{r}_2 is

given as $W = -\int_{r_1}^{r_2} \vec{F} \cdot d\vec{r}$, if \vec{F} is conservative.

Statement-2 : There are infinite ways through which we can go from \vec{r}_1 to \vec{r}_2 and work done for each case will be different for conservative force.

(1) **Statement-1** is True, **Statement-2** is True ; **Statement-2** is correct explanation of **Statement-1**.

(2) **Statement-1** is True, **Statement-2** is True ; **Statement-2** is **NOT** correct explanation of **Statement-1**.

(3) **Statement-1** is True, **Statement-2** is False.

(4) **Statement-1** and **Statement-2** both are False.

Ans. (4)

Sol. Theoretical

2. In case of capillary action if surface tension of liquid, radius of capillary and density of liquid decreases by 1% then percentage change in height of liquid level inside capillary :

- (1) 1 % increase (2) 1 % decrease
- (3) 2 % increase (4) 2 % decrease

Ans. (1)

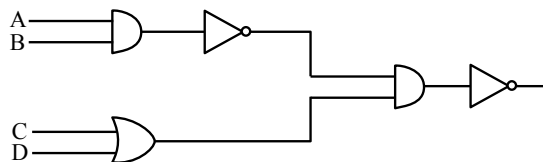
Sol. $h = \frac{2T \cos \theta}{\rho g r}$

$\frac{dh}{h} = \frac{dT}{T} - \frac{d\rho}{\rho} - \frac{dr}{r}$

$\frac{dh}{h} \% = -1\% + 1\% + 1\% = 1\%$

1% increase

3. For given logic gate circuit select correct output corresponding to each input :



A	B	C	D
1	1	1	1
1	0	1	0
0	1	0	1
0	0	1	1

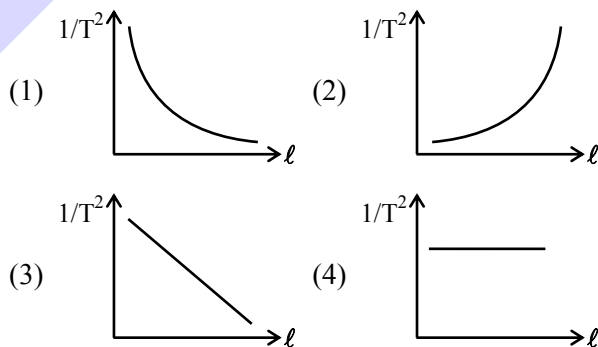
- (1) 1, 0, 0, 0 (2) 1, 0, 1, 0
- (3) 0, 1, 0, 1 (4) 1, 0, 0, 1

Ans. (1)

Sol. On simplifying :

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

4. In simple pendulum experiment gravity (g) is determined by its time period (T). Which of the following graph is correct?

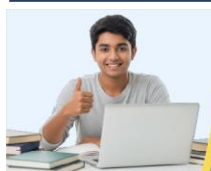


Ans. (1)

Sol. $T = 2\pi \sqrt{\frac{l}{g}}$

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

$\frac{1}{T^2} = \left(\frac{g}{4\pi^2 l} \right)$



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5. A metal has work function $\phi = 110 \times 10^{-20}$ J when exposed with monochromatic light maximum kinetic energy of photoelectrons is found to be zero. Find angular frequency of incident light. ($h = 6.63 \times 10^{-34}$ Js)

- (1) 1.04×10^{16} (2) 1.04×10^{18}
 (3) 1.66×10^{17} (4) 1.66×10^{18}

Ans. (1)

Sol. $\omega = 2\pi f$

$$hf - \phi = k_{\max}$$

$$f = \frac{\phi}{h} = \frac{110 \times 10^{-20}}{6.63 \times 10^{-34}} = 1.66 \times 10^{15}$$

$$\omega = 2\pi f = 1.04 \times 10^{16} \text{ rad/sec}$$

6. Transmission line having resistance 2Ω and power delivered is 1000 W. When potential difference of 250 volts is applied, find efficiency of transmission line.

- (1) 94 % (2) 96.9 %
 (3) 100 % (4) 91 %

Ans. (2)

Sol. Current in wire : $I = \frac{1000}{250} = 4$ Amp

$$\text{Heat loss} = I^2 R = 32 \text{ W}$$

$$\text{Power input} = 1032 \text{ W}$$

$$\% \eta = \frac{\text{Power output}}{\text{Power input}}$$

$$\% \eta = \frac{1000}{1032} = 96.89\%$$

7. Find the dimension of the expression $\frac{\epsilon_0 E}{T}$, where

ϵ_0 , E & T are permittivity, electric field and time :

- (1) $[AL^{-2}]$ (2) $[AL^{-3}]$
 (3) $[AL^{-3}T]$ (4) $\frac{[AL^{-3}]}{T}$

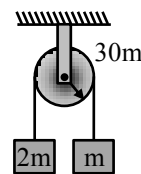
Ans. (1)

Sol. $\frac{\epsilon_0 E}{T} = \frac{\epsilon_0}{T} \times \frac{1}{4\pi\epsilon_0} \times \frac{q}{r^2}$

$$= \frac{[AT]}{[T][L^2]}$$

$$= [AL^{-2}]$$

8. A pulley has mass 30 m. There are two blocks of masses m and 2m. Find speed of 2m when it descends by distance 3.6 meter. ($g = 10 \text{ m/s}^2$)



- (1) -2 m/s (2) 4 m/s (3) 8 m/s (4) 2 m/s

Ans. (4)

Sol. Using energy conservation

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

$$mgh = 9mv^2$$

$$v = \sqrt{\frac{gh}{9}} = \sqrt{\frac{3.6 \times 10}{9}} = \sqrt{4} = 2 \text{ m/s}$$

9. 3 identical bubbles each have same charge q. They combine to form one bubble. Find $\frac{V_i}{V_f}$?

- (1) $\frac{1}{3^{2/3}}$ (2) $\frac{3^{2/3}}{1}$
 (3) $\frac{1}{2^{2/3}}$ (4) $3^{1/3}$

Ans. (1)

Sol. Using volume conservation

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

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

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

10. **Statement-1** :- Time period of revolution of satellite around earth depends on density of earth.

Statement-2 :- Time period of revolution of satellite just above the surface of earth is given by

$$2\pi \sqrt{\frac{Re}{g}} \text{ (Re = Radius of earth)}$$

- (1) Statement 1 & 2 both are correct & statement 1 is correct explanation
 (2) Statement 1 & 2 both are correct & statement 1 is not correct explanation
 (3) Statement is true Statement 2 is false
 (4) Statement is false Statement 2 is true

Ans. (1)



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Sol. Both are correct & explanation

$$T = 2\pi\sqrt{\frac{Re}{g}} = 2\pi\sqrt{\frac{Re}{\frac{4}{3}\pi G\rho Re}} = 2\pi\sqrt{\frac{3}{4\pi G\rho}}$$

$$T \propto \frac{1}{\sqrt{\rho}}$$

11. Wavelength of light in water is 540 nm. Refractive index of water is 4/3. Find wavelength of light in glass ($\mu = 3/2$) :

- (1) 480 nm
- (2) 240 nm
- (3) 360 nm
- (4) 630 nm

Ans. (1)

Sol. $\Rightarrow \lambda \propto \frac{1}{\mu}$

$$\Rightarrow \frac{\lambda_1}{\lambda_2} = \frac{\mu_2}{\mu_1} = \frac{3/2}{4/3} = \frac{9}{8}$$

$$\lambda_2 = \frac{8}{9} \times 540 = 480 \text{ nm}$$

12. Five positive charges each having charge q are placed at the vertices of a pentagon as shown in the figure. The electric potential (V) & the electric field (\vec{E}) at the centre of the pentagon due to the 5 positive charges are :

(1) $V = \frac{5q}{4\pi\epsilon_0 r}, E = \frac{5q}{4\pi\epsilon_0 r^2}$

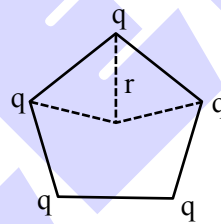
(2) $V = \frac{5q}{4\pi\epsilon_0 r}, E = 0$

(3) $V = 0, E = \frac{5q}{4\pi\epsilon_0 r^2}$

(4) $V = \frac{5q}{4\pi\epsilon_0 r}, E = \frac{q}{4\pi\epsilon_0 r^2}$

Ans. (2)

Sol.



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13. There are 2 different gases in 2 different containers A and B. Gas A has temperature 'T' and pressure 'P' and number of molecules per unit volume in Gas A is N. Gas B has temperature 'T' and pressure 'P' and number of molecules per unit volume is N. Mass of gas A is 4 times of mass of gas 'B' and size of molecules of gas A is half the size of molecules of gas 'B'. If collision frequency of B is 32×10^8 /sec. Find collision frequency of A :

- (1) 16×10^8 /sec (2) 4×10^8 /sec
 (3) 2×10^8 /sec (4) 8×10^8 /sec

Ans. (3)

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

$$\frac{Z_A}{Z_B} = \frac{\left(\frac{d}{2}\right)^2 \frac{N}{\sqrt{4M}}}{\left(\frac{d^2 N}{\sqrt{M}}\right)} \Rightarrow Z_A = Z_B \times \frac{1}{8}$$

$$= 32 \times 10^8 \times \frac{1}{8}$$

$$= 4 \times 10^8 / \text{sec}$$

14. $I = 4 \times 10^{14}$ W/m² then find amplitude of magnetic field of laser Beam :

- (1) 2.87 T (2) 1.83 T
 (3) 3.86 T (4) 4.78 T

Ans. (2)

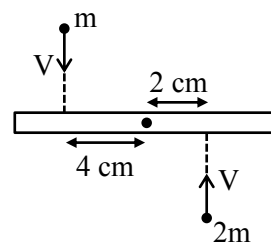
Sol. $I = \left(\frac{B^2}{2\mu_0} \cdot C\right) = 4 \times 10^{14}$

$$B^2 = \frac{2\mu_0}{C} \times 4 \times 10^{14}$$

$$B^2 = \frac{2 \times 4\pi \times 10^{-7} \times 4 \times 10^{14}}{3 \times 10^8}$$

$$B = 1.83 \text{ T}$$

15. Mass of rod is 20m. If both particles stick with rod after collision than find V/ω ? Here ω is angular velocity of rod after collision. Length of rod is 12 cm :



- (1) 64 (2) 66 (3) 33 (4) $\sqrt{88}$

Ans. (3)

Sol. Using angular momentum conservation about COM of rod :

$$L_i = L_f$$

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

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

$$8V = 264 \omega$$

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

16. An ideal gas at pressure 2×10^5 Pa, temperature 27°C has volume 60 cm³. If volume of same gas is 20 cm³ & temperature is 77°C, find out pressure at this state. :

- (1) 7×10^5 Pa (2) 6×10^5 Pa
 (3) 3×10^5 Pa (4) 5×10^5 Pa

Ans. (1)

Sol. $PV = nRT$

$$\frac{P_1 V_1}{RT_1} = \frac{P_2 V_2}{RT_2}$$

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

$$P_2 = 7 \times 10^5 \text{ Pa}$$

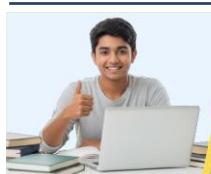
17. **Statement -1** : Total KE of system can be written as sum of KE of individual particles from ground frame.

Statement -2 : Total KE of system can be written as KE of center of mass + KE of individual particles in C.M. frame

- (1) statement-1 is true statement-2 is false
 (2) statement-1 is false statement-2 is true
 (3) Both statement are false.
 (4) Both statement are true.

Ans. (4)

Sol. $KE_{\text{system}} = KE_{\text{cm}} + KE_{\text{inC-frame}}$



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18. For H atom if shortest wavelength of Lyman series is 91nm, then find difference of minimum wavelength of Balmer and Paschen series :

- (1) 525 nm (2) 455 nm
(3) 305 nm (4) 545 nm

Ans. (2)

Sol. For Lyman:

$$\frac{1}{\lambda} = R \left(\frac{1}{1^2} - \frac{1}{\infty^2} \right) \Rightarrow \lambda = \frac{1}{R} = 91\text{nm}$$

For Balmer shortest wavelength:

$$\frac{1}{\lambda_1} = R \left(\frac{1}{2^2} - \frac{1}{\infty^2} \right) \Rightarrow \lambda_1 = \frac{4}{R}$$

For shortest wavelength of Paschen series

$$\frac{1}{\lambda_2} = R \left(\frac{1}{3^2} - \frac{1}{\infty^2} \right) \Rightarrow \lambda_2 = \frac{9}{R}$$

$$\text{So } \lambda_2 - \lambda_1 = \frac{5}{R} = 455\text{nm}$$

19. For single slit diffraction :

- (A) If we increase λ , keeping slit width constant, width of central maxima increases.
(B) If we increase λ , keeping slit width constant, width of central maxima decreases.
(C) If we keep λ same and decreases slit width, the width of central maxima increases
(D) If we keep λ same and decreases slit width the width of central maxima decreases
(E) If we increases λ by keeping slit width same, intensity of central maxima increases

Choose the correct option:

- (1) A, C only (2) B,D & E only
(3) A, C & E only (4) A, D only

Ans. (1)

Sol. Width of central maxima = $\frac{2\lambda D}{a}$

20. For non parallax in concave mirror, what should be the position of object from the pole :

- (1) Beyond centre of curvature only
(2) Between centre of curvature and focus only
(3) Between focus and pole only
(4) Beyond focus

Ans. (4)

Sol. For non-parallax, image should be real.

∴ Object must be kept beyond focus.

21. In an open organ pipe 3rd and 6th harmonic frequency differ by 3200 Hz. Find the length of organ pipe. (Speed of sound = 320 m/s)

Ans. (15)

Sol. $f = n \frac{v_0}{2L}$

$$\frac{6v_0}{2L} - \frac{3v_0}{2L} = 3200$$

$$\frac{3 \times 320}{2L} = 3200$$

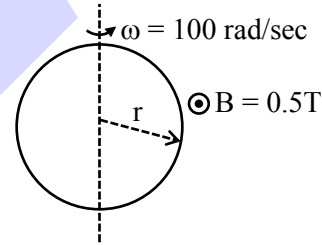
$$L = \frac{3}{20} \text{m}$$

$$L = \frac{3}{20} \times 100 \text{ cm} = 15 \text{ cm}$$

22. A ring of radius 'r' mm rotating with 100 rad/sec about its diameter. It is present in a uniform magnetic field 0.5 T perpendicular to the plane of paper. If EMF produced in the ring when it has rotated by 30° is 15.4 mV, find 'r':

Ans. (14)

Sol.



$$\phi = \pi r^2 B \cos \omega t$$

$$\therefore -\frac{d\phi}{dt} = \pi r^2 B \omega \sin \omega t$$

given $\left| \frac{d\phi}{dt} \right| = 15.4 \times 10^{-3} \text{ V}$

$$\therefore 15.4 \times 10^{-3} = \pi r^2 B \omega \sin (\omega t)$$

$$\Rightarrow r = \sqrt{\frac{15.4 \times 10^{-3}}{3.14 \times 0.5 \times 100 \times \frac{1}{2}}} = 14\text{mm}$$

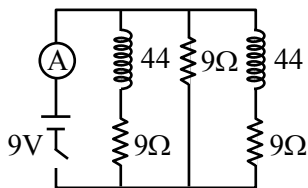


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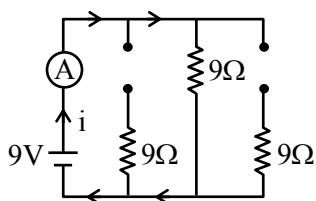
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23. In the figure shown below switch S is closed at $t = 0$, find reading of ideal ammeter (in Amp.) just after S is closed.



Ans. (1)

Sol.



at $t = 0$ all inductors act as open circuit

$$i = \frac{9}{9} = 1\text{A}$$

24. A tube carries 1.6 A current has length 2m & cross section area = 0.2mm^2 . If potential difference of 2V is applied and no. of electrons/volume is 5×10^{28} , mobility of electron is $\alpha \times 10^{-3}$ find α :

Ans. (1)

Sol. $i = ne AV_d = neA\mu E$

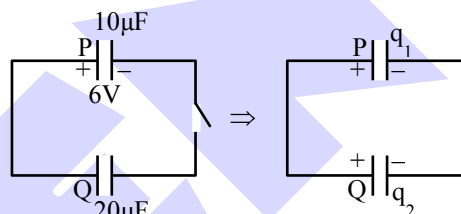
$$\mu = \frac{i}{neAE} = \frac{1.6}{5 \times 10^{28} \times 1.6 \times 10^{-19} \times 0.2 \times 10^{-6} \times (2/2)}$$

$$= 1 \times 10^{-3}$$

25. A capacitor "P" of capacitance 10×10^{-6} F is charged to 6 Volts and is now connected to another capacitor Q of capacitance 20×10^{-6} F (Q has no initial charge). The final charge on Q is $\alpha \times 10^{-5}$ C. Find α .

Ans. (4)

Sol. Charge will be distributed in ratio of capacitors

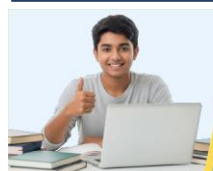


$$\frac{q_1}{q_2} = \frac{1}{2} \text{ and } q_1 + q_2 = 60$$

$$3q_1 = 60$$

$$q_1 = 20 \mu\text{C}$$

$$q_2 = 40 \mu\text{C} = 4 \times 10^{-5} \text{ C}$$



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MEMORY BASED QUESTIONS JEE-MAIN EXAMINATION – JANUARY 2026

(HELD ON FRIDAY 23rd JANUARY 2026)

TIME : 9:00 AM TO 12:00 NOON

PHYSICS

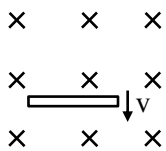
TEST PAPER WITH SOLUTION

1. A rod of mass 'm' and length 'l' falls from rest in a region of uniform horizontal magnetic field B. Find emf induced in the rod after falling through a distance 'x' :

- (1) $B\ell\sqrt{gx}$ (2) $B\ell\sqrt{5gx}$
- (3) $B\ell\sqrt{2gx}$ (4) $B\ell\sqrt{3gx}$

Ans. (3)

Sol. Free fall distance 'x'



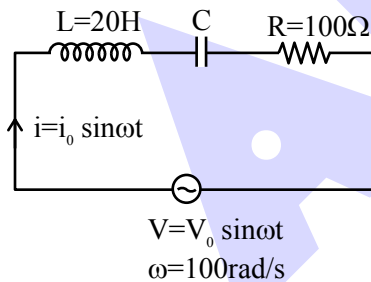
$$v = \sqrt{2gx}$$

induced emf

$$e = Bv\ell$$

$$= B\ell\sqrt{2gx}$$

2. Find capacitance 'C' for the given circuit.



- (1) 5×10^{-6} farad
- (2) 8×10^{-6} farad
- (3) 7×10^{-6} farad
- (4) 4×10^{-6} farad

Ans. (1)

Sol. Condition of resonance

$$\omega = \omega_0 = \frac{1}{\sqrt{LC}}$$

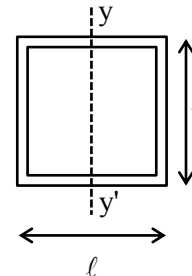
$$LC = \frac{1}{\omega_0^2}$$

$$C = \frac{1}{L\omega_0^2} = \frac{1}{20 \times (100)^2}$$

$$C = \frac{1}{2} \times 10^{-5}$$

$$C = 5 \times 10^{-6} \text{ farad}$$

3. All are cylindrical rods having radius of cross-section 'R' and mass of each rod is $\frac{M}{4}$. Find moment of inertia about yy' axis :



- (1) $I = \frac{1}{16}MR^2 + \frac{1}{6}M\ell^2$
- (2) $I = \frac{5}{16}MR^2 + M\ell^2$
- (3) $I = \frac{16}{5}MR^2 + \frac{1}{6}M\ell^2$
- (4) $I = \frac{3}{8}MR^2 + \frac{M\ell^2}{6}$

Ans. (4)



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Sol. $I = I_1 + I_2 + I_3 + I_4$

$$= 2 \left(\frac{M'R^2}{4} + \frac{M'\ell^2}{12} \right) + 2 \left(\frac{M'R^2}{2} + M' \left(\frac{\ell}{2} \right)^2 \right)$$

$$= \frac{M'R^2}{2} + \frac{M'R^2}{6} + M'R^2 + \frac{M'\ell^2}{2}$$

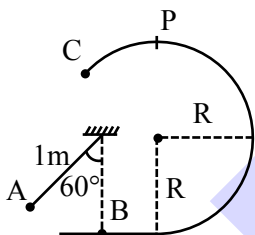
$$= \frac{3M'R^2}{2} + \frac{2M'\ell^2}{3}$$

Given masses $M' = \frac{M}{4}$

So, $I = \frac{3(M/4)R^2}{2} + 2 \frac{(M/4)\ell^2}{3}$

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

4. A and B are identical point masses. A is released as shown in diagram at angle 60° from vertical. Find 'R' if B is able to reach point 'C' after elastic impact.



- (1) $\frac{1}{5}$
- (2) $\frac{1}{2}$
- (3) $\frac{1}{3}$
- (4) $\frac{1}{6}$

Ans. (1)

Sol. If ball reach at point 'p' then it will pass through C surely.

- $\sqrt{2g(1-\cos\theta)}$ → (A) (B)
- \sqrt{gR} → (A) (B)
- (rest) → $\sqrt{5gR}$ (A) (B)

Before :

$$\sqrt{g\ell} = \sqrt{5gR}$$

$$\ell = 5R$$

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

5. Among the given options choose the correct energy of transition :

- (1) $H_{2 \rightarrow 1}$ (6.8ev)
- (2) $Li_{2 \rightarrow 1}^{2+}$ (13.6ev)
- (3) $He_{2 \rightarrow 1}^+$ (40.8ev)
- (4) $Be_{2 \rightarrow 1}^{3+}$ (13.6ev)

Ans. (C)

Sol. $E_x = -13.6 \frac{Z^2}{n^2}$

H-atom :

$$E_1 = -13.6 \text{ eV} \quad E_2 = -3.4 \text{ eV} \quad \Delta E = 10.2 \text{ eV}$$

He^+ -ion :

$$E_1 = -54.4 \text{ eV} \quad E_2 = -13.6 \text{ eV} \quad \Delta E = 40.8 \text{ eV}$$

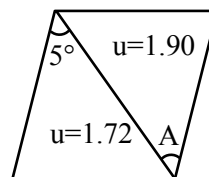
Li^{2+} -ion :

$$E_1 = -122.4 \text{ eV} \quad E_2 = -30.6 \text{ eV} \quad \Delta E = 91.8 \text{ eV}$$

Be^{3+} ion :

$$E_1 = -217.6 \text{ eV} \quad E_2 = -54.4 \text{ eV} \quad \Delta E = 163.2 \text{ eV}$$

6. Find the angle A of second prism so that light ray suffers dispersion without deviation :



- (1) 6°
- (2) 4°
- (3) 7°
- (4) 2°

Ans. (2)

Sol. For no deviation,

$$(\mu_{y_1-1})A_1 - (\mu_{y_2-1})A_2 = 0$$

$$\Rightarrow (1.72-1)5 - (1.90-1)A = 0$$

$$\therefore A = 4^\circ$$

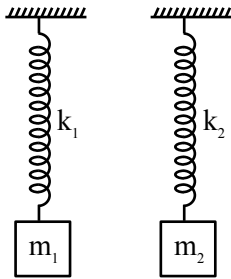


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7. There are two spring-block system as shown. They are in equilibrium. If $\frac{m_1}{m_2} = \alpha$ and $\frac{k_1}{k_2} = \beta$. Then the ratio of the energies of springs $\left(\frac{E_1}{E_2}\right)$ is :-



- (1) $\frac{E_1}{E_2} = \frac{\alpha^2}{\beta}$ (2) $\frac{E_1}{E_2} = \frac{\alpha}{\beta}$
 (3) $\frac{E_1}{E_2} = \frac{\alpha}{\beta^2}$ (4) $\frac{E_1}{E_2} = \frac{\alpha^2}{\beta^2}$

Ans. (1)

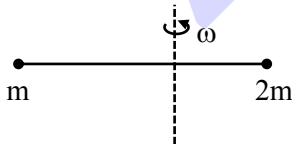
Sol. $x_1 = \frac{m_1 g}{k_1}$ and $x_2 = \frac{m_2 g}{k_2}$

$$\frac{E_1}{E_2} = \frac{\frac{1}{2} k_1 x_1^2}{\frac{1}{2} k_2 x_2^2} = \frac{\frac{1}{2} k_1 \left(\frac{m_1 g}{k_1}\right)^2}{\frac{1}{2} k_2 \left(\frac{m_2 g}{k_2}\right)^2} = \frac{\frac{m_1^2}{k_1}}{\frac{m_2^2}{k_2}}$$

$$\frac{E_1}{E_2} = \left(\frac{m_1}{m_2}\right)^2 \times \frac{k_2}{k_1} = \frac{\alpha^2}{\beta}$$

$$\frac{E_1}{E_2} = \frac{\alpha^2}{\beta}$$

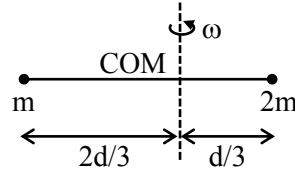
8. Masses 'm' and '2m' are connected by a massless rod of length 'd'. If angular momentum about axis passing through centre of mass and perpendicular to length is 'L'. Then angular speed (ω) of the system is :



- (1) $\frac{3L}{2md^2}$ (2) $\frac{L}{2md^2}$ (3) $\frac{5L}{3md^2}$ (4) $\frac{3L}{md^2}$

Ans. (1)

Sol.



$$L = I\omega \text{ and } \omega = \frac{L}{I}$$

$$\omega = \frac{L}{m\left(\frac{2d}{3}\right)^2 + 2m\left(\frac{d}{3}\right)^2} = \frac{L}{\frac{4}{9}md^2 + \frac{2}{9}md^2} = \frac{L}{\frac{6md^2}{9}}$$

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

9. In young's double slit experiment with two different set-up fringe widths are equal. If ratio of slits-separation is 2 and wavelengths ratio is $\frac{1}{2}$. Find ratio of screen distances in both setup :

- (1) $\frac{D_1}{D_2} = 3$
 (2) $\frac{D_1}{D_2} = 2$
 (3) $\frac{D_1}{D_2} = 8$
 (4) $\frac{D_1}{D_2} = 4$

Ans. (4)

Sol. $\beta_1 = \beta_2$

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

$$\frac{D_1}{D_2} = \frac{\lambda_2}{\lambda_1} \left(\frac{d_1}{d_2}\right)$$

$$= 2 \times 2$$

$$\frac{D_1}{D_2} = 4$$

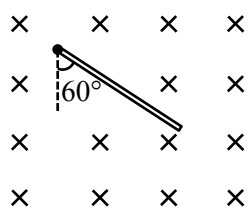


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10. A rod of mass m and length ℓ is released from the position shown with upper end hinged in uniform horizontal magnetic field 'B'. Find maximum induced emf in the rod:



- (1) $B\ell\sqrt{\frac{3}{8}gl}$ (2) $B\ell\sqrt{\frac{1}{8}gl}$
 (3) $B\ell\sqrt{\frac{7}{8}gl}$ (4) $B\ell\sqrt{\frac{5}{8}gl}$

Ans. (1)

Sol. Maximum emf of maximum ' ω '

$$e_{\max} = \frac{B\omega\ell^2}{2}$$

W.E.T.

$$mg\frac{\ell}{2}(1 - \cos 60) = \frac{1}{2} \frac{m\ell^2}{3} \omega^2$$

$$\frac{mg\ell}{4} = \frac{m\ell^2}{6} \omega^2$$

$$\omega^2 = \frac{3g}{2\ell}$$

$$e_{\max} = \frac{B\ell^2}{2} \sqrt{\frac{3g}{2\ell}} = B\ell\sqrt{\frac{3}{8}gl}$$

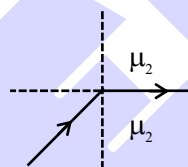
11. Two media of refractive indices n_1 and n_2 have a plane interface. In the first medium, speed of light is 2.4×10^8 m/s and in the second medium, it is 2.8×10^8 m/s. Find the critical angle when light travels from 1st medium to 2nd medium :

- (1) $\sin^{-1}\left(\frac{5}{7}\right)$ (2) $\sin^{-1}\left(\frac{1}{3}\right)$
 (3) $\sin^{-1}\left(\frac{6}{7}\right)$ (4) $\sin^{-1}\left(\frac{1}{4}\right)$

Ans. (3)

Sol. $\mu_1 = \frac{c}{v_1} = \frac{3}{2.4} = \frac{5}{4}$

$$\mu_2 = \frac{c}{v_2} = \frac{3}{2.8} = \frac{15}{14}$$



For critical angle :

$$\mu_1 \times \sin\theta_c = \mu_2 \times \sin 90^\circ$$

$$\Rightarrow \sin\theta_c = \frac{\mu_1}{\mu_2} = \frac{15}{14} \times \frac{4}{5} = \frac{6}{7}$$

$$\theta_c = \sin^{-1}\left(\frac{6}{7}\right)$$

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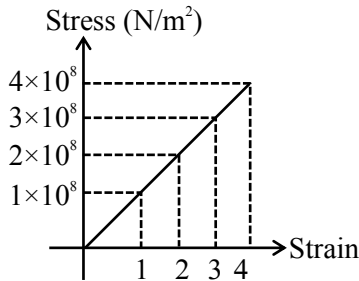
12. A screw gauge has a least count of 0.01 mm. Using this screw gauge a measurement was done. When nothing was present in the jaw, zero of circular scale was above reference line by 3 units. When a sphere was kept between the jaws, main scale reads 1 mm and 51st division of circular scale coincides with reference line. The actual diameter of the ball is :

- (1) 1.54 mm (2) 1.48 mm
- (3) 1.51 mm (4) 1.53 mm

Ans. (1)

Sol. Screw gauge has negative zero error.

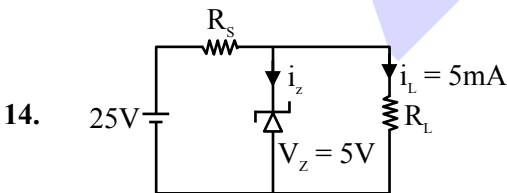
13. The stress v/s strain graph of a material is as shown. Find the Young's modulus of the material.



- (1) 10^8 N/m^2 (2) $2 \times 10^8 \text{ N/m}^2$
- (3) $4 \times 10^8 \text{ N/m}^2$ (4) $3 \times 10^8 \text{ N/m}^2$

Ans. (1)

Sol. $Y = \frac{\text{Stress}}{\text{Strain}}$
 $= \frac{4 \times 10^8}{4}$
 $= 10^8 \text{ N/m}^2$



14. In the given diagram if $i_z = 4i_L$. Find R_s (in Ω)

Ans. (800)

Sol. Zener diode is conducting

means $V_Z = V_{R_L} = 5V$

$i_L = 5mA$

$\therefore V_{RS} = 20V$

$i_{RS} = i_z + i_L = 5i_L = 25mA$

$R_S = \frac{V_{RS}}{i_{RS}} = \frac{20}{25 \times 10^{-3}} = \frac{20 \times 1000}{25} = 800\Omega$

15. A set of measurements of a certain parameter is : 20.00, 19.75, 18.25, 17.01. Find relative error for the set of measurements.

- (1) 0.12 (2) 0.06
- (3) 0.09 (4) 0.17

Ans. (2)

Sol. Average value = $\frac{75.01}{4} = 18.75$

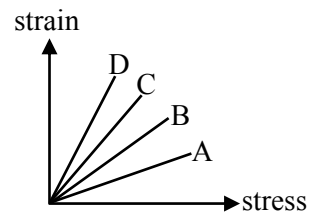
Absolute error of each measurement :

1.25, 1.00, 0.5, 1.74

Mean absolute error = 1.12

Relative error = $\frac{1.12}{18.75} = 0.06$

16. Figure beside represent strain versus stress graph for four materials A,B,C and D. Which material has maximum Young's modulus.



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

Ans. (1)

Sol. Young's modulus

$= \frac{\text{stress}}{\text{strain}}$

= inverse of slope given in graph.

Hence, A should have maximum Young's modulus.



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17. A simple pendulum of length 30cm makes 20 oscillations in 10 sec on a certain planet. Another pendulum makes 40 oscillations in 10 sec on same planet. Find length of second pendulum:

- (1) 10 cm (2) 14 cm
 (3) 7.5 cm (4) 25 cm

Ans. (3)

Sol. $T = 2\pi\sqrt{\frac{\ell}{g}} = \frac{\Delta t}{N}$

1st pendulum

$$2\pi\sqrt{\frac{0.3}{g}} = \frac{10}{20} \quad \dots(i)$$

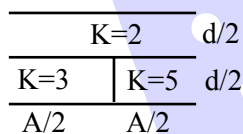
2nd pendulum

$$2\pi\sqrt{\frac{\ell}{g}} = \frac{10}{40} \quad \dots(ii)$$

$$(ii)/(i) \sqrt{\frac{\ell}{0.3}} = \frac{1}{2}$$

$$\ell = \frac{0.3}{4} \text{ m} = 7.5 \text{ cm}$$

18. When there is no dielectric then value of capacitance of a capacitor is C. Now some dielectrics inserted in this capacitor as shown in the diagram if capacitance become $\frac{nC}{3}$ then find value of 'n' to the nearest integer.



Ans. (8)

Sol. $C_1 = \frac{5\epsilon_0 A/2}{d/2} = \frac{5\epsilon_0 A}{d} = 5C$

$$C_2 = \frac{2\epsilon_0 A/2}{d/2} = \frac{2\epsilon_0 A}{d} = 2C$$

C_1 & C_2 in series.

$$C' = \frac{C_1 C_2}{C_1 + C_2} = \frac{(5C)(2C)}{7C} = \frac{10}{7}C$$

$$C_3 = \frac{3\epsilon_0 A/2}{d/2} = 3C$$

$$C_4 = \frac{2\epsilon_0 A/2}{d/2} = 2C$$

C_4 & C_3 in series; $C'' = \frac{(2C)(3C)}{5C} = \frac{6}{5}C$

C' & C'' in parallel;

So, $C_{eq} = C\left(\frac{6}{5} + \frac{10}{7}\right) = C\left(\frac{42+50}{35}\right) = \left(\frac{92}{35}\right)C$

$$\frac{92}{35}C = \frac{nC}{3}$$

$$n = \frac{92 \times 3}{35} = 7.9$$

$$n \approx 8$$

19. Find de-Broglie wavelength of oxygen molecule at 27°C. Molar mass of oxygen molecule is 32 gm/mole.

- (1) 0.257 Å (2) 2.57 Å
 (3) 25.7 Å (4) 257 Å

Ans. (1)

Sol. KE of O_2 molecule at 27°C

$$K = \frac{3}{2}kT$$

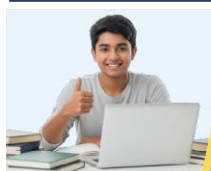
$$= \frac{3}{2} \times 1.38 \times 10^{-23} \times 300$$

$$= 6.21 \times 10^{-21} \text{ J}$$

de-Broglie wavelength $\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mk}}$

$$= \frac{6.63 \times 10^{-34}}{\sqrt{2 \times \frac{32 \times 10^{-3}}{6 \times 10^{23}} \times 6.21 \times 10^{-21}}} = 2.57 \times 10^{-11}$$

$$= 0.257 \text{ Å}$$

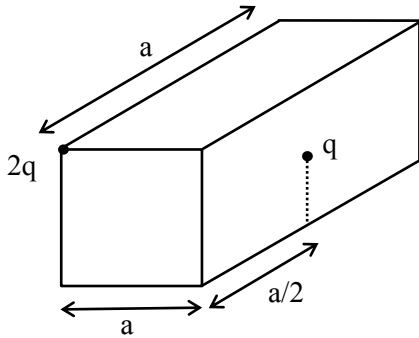


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20. There are two point charges, one at vertex and other at face centre as shown on the cube. Find electric flux through the cube :



- (1) $3q/\epsilon_0$
- (2) q/ϵ_0
- (3) $3q/4\epsilon_0$
- (4) $5q/\epsilon_0$

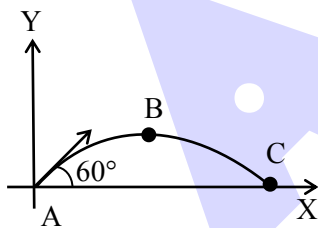
Ans. (3)

Sol.
$$\phi = \frac{(2q)}{8\epsilon_0} + \frac{q}{2\epsilon_0}$$

$$= \frac{q}{4\epsilon_0} + \frac{2}{2\epsilon_0}$$

$$= \frac{3q}{4\epsilon_0}$$

21. A projectile is projected with speed v at an angle 60° with ground (horizontal). Find the ratio of difference of kinetic energies at point C (at ground) and point B (at highest point) with kinetic energy at point C as shown in the diagram:



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

Ans. (1)

Sol. $K_A = K_C = K = \frac{1}{2}mu^2$

$$K_B = \frac{1}{2}m(u\cos 60^\circ)^2$$

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

$$\frac{K_C - K_B}{K_C} = 1 - \frac{K_B}{K_C} = 1 - \frac{1}{4} = \frac{3}{4}$$

22. If electric field component is $E = 377 \sin(\omega t + kx)$ V/m of a electromagnetic wave and $\sqrt{\frac{\mu_0}{\epsilon_0}} = 377$

. Then find average intensity of the wave. (in W/m^2)

- (1) 188.5
- (2) 200
- (3) 100
- (4) 300

Ans. (1)

Sol.
$$I_{avg} = \left(\frac{1}{2}\epsilon_0 E^2\right).C$$

$$= \frac{1}{2}\epsilon_0 E^2 \frac{1}{\sqrt{\mu_0\epsilon_0}}$$

$$= \frac{1}{2}\sqrt{\frac{\epsilon_0}{\mu_0}}.E_0^2$$

$$= \frac{1}{2} \times \frac{1}{377} \times (377)^2$$

$$= \frac{377}{2} = 188.5 W / m^2$$

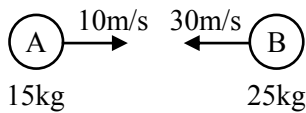


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23.



Two ball made of same material collides perfectly inelastically. Energy lost in the collision is completely utilized for raising temperature of each ball. Find rise in temperature of balls. [specific heat: 31 cal/kg-°C] :

- (1) 1.24°C
- (2) 2.44°C
- (3) 2.24°C
- (4) 1.44°C

Ans. (4)

Sol. $(K.E)_{lost} = \frac{1}{2} \mu V_{rel}^2 (1-e^2)$

$$= \frac{1}{2} \left(\frac{m_1 m_2}{m_1 + m_2} \right) (10 + 30)^2 (1 - 0)$$

$$= \frac{1}{2} \left[\frac{(15)(25)}{40} \right] [40]^2$$

$$= 7500 \text{ J}$$

$(K.E)_{loss} = (m_1 + m_2) (S) (\Delta T)$

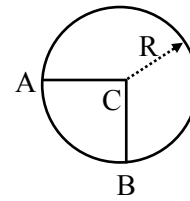
$[S = 31 \times 4.2 \text{ J/kg-}^\circ\text{C}]$

$$7500 = (40) (31) (\Delta T)$$

$$\Delta T = \frac{7500}{40 \times 31 \times 4.2} = 1.44^\circ\text{C}$$

24.

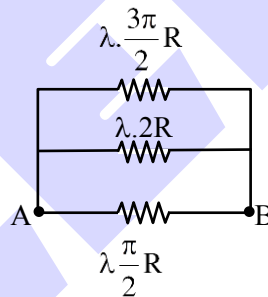
A circular ring and two wires AC and BC are joined as shown in the figure. If all wires have resistance $\lambda\Omega/m$. Find equivalent resistance across A and B :



- (1) $\lambda R \left(\frac{6\pi}{16 + 3\pi} \right)$
- (2) $\lambda R \left(\frac{6\pi}{16 - 3\pi} \right)$
- (3) $\lambda R \left(\frac{\pi}{16 - 3\pi} \right)$
- (4) $\lambda R \left(\frac{\pi}{6 - 3\pi} \right)$

Ans. (1)

Sol.

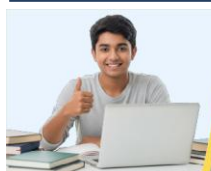


$$\frac{1}{R_{AB}} = \frac{2}{\lambda\pi R} + \frac{1}{\lambda \cdot 2R} + \frac{2}{\lambda \cdot 3\pi R}$$

$$= \frac{1}{\lambda R} \left[\frac{2}{\pi} + \frac{1}{2} + \frac{2}{3\pi} \right]$$

$$= \frac{1}{\lambda R} \left(\frac{12 + 3\pi + 4}{6\pi} \right) = \frac{1}{\lambda R} \left(\frac{16 + 3\pi}{6\pi} \right)$$

$$R_{AB} = \lambda R \left(\frac{6\pi}{16 + 3\pi} \right)$$



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MEMORY BASED QUESTIONS JEE-MAIN EXAMINATION – JANUARY 2026

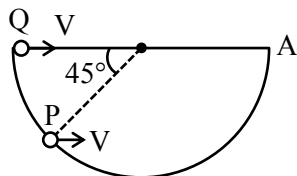
(HELD ON FRIDAY 23rd JANUARY 2026)

TIME : 3:00 PM TO 6:00 PM

PHYSICS

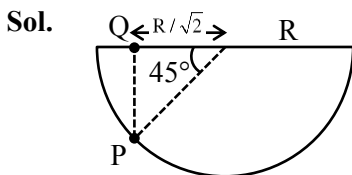
TEST PAPER WITH SOLUTION

1. Two beads P & Q move along two wires straight and semi circle. At some instant both are shown in figure having same horizontal component of velocity V. Find relation of time taken to reach A by beads :



- (1) $t_p > t_Q$ (2) $t_p < t_Q$
 (3) $t_p = t_Q$ (4) None of these

Ans. (2)



X-displacements :

$X_p < X_Q$

and average velocity in X-direction of P is > average velocity in X-direction of Q

hence

$t_p < t_Q$

2. When an object is kept at distance 8 cm and 24 cm from a convex lens, magnitude of magnification is same in both cases. Find focal length (in cm) of the lens :

- (1) 18 cm (2) 16 cm
 (3) 20 cm (4) 8 cm

Ans. (2)

Sol. $m = \frac{f}{f + u}$

$m_1 = -m_2$

$\frac{f}{f - 8} = -\frac{f}{f - 24}$

$f - 8 = 24 - f$

$2f = 32$

$f = 16 \text{ cm}$

3. Time taken to achieve terminal velocity by a body depends on density of material (ρ), density of liquid (σ), radius of material (r) and viscosity of liquid (η) as $t = k\rho^a r^b \eta^c \sigma^d$. Find $\frac{b+c}{a+d}$?

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

Ans. (1)

Sol. $T = (ML^{-3})^a L^b (ML^{-1}T^{-1})^c (ML^{-3})^d$

$T = M^{a+c+d} L^{-3a-c-3d+b} T^{-c}$

on comparing

$c = -1; a + c + d = 0; -3a - c - 3d + b = 0$

$b = 2; a + d = 1$

4. Speed of sound at $T_1 = 0^\circ\text{C}$ is V_0 and at $T_2 = \alpha^\circ\text{C}$ speed becomes $2V_0$. Find α :

- (1) 819°C (2) 918°C
 (3) 546°C (4) 1092°C

Ans. (1)

Sol. $V = \sqrt{\frac{\gamma RT}{M}}$

$\frac{V_1}{V_2} = \frac{\sqrt{T_1}}{\sqrt{T_2}}$

$\frac{V_0}{2V_0} = \sqrt{\frac{273}{T_2}}$

$\frac{1}{4} = \frac{273}{T_2}$

$T_2 = 4 \times 273$

$\alpha + 273$

$\alpha = 3 \times 273$

$\alpha = 819^\circ\text{C}$



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5. An air bubble inside water at depth $h = 5$ m rises to surface. At bottom temperature is T_1 and volume is V_1 and at surface the temperature is T_2 . Find final volume (Given that number of moles remains same and $P_0 = 10^5$ Pa) :

- (1) 6 cm^3 (2) 8 cm^3
 (3) 2 cm^3 (4) 1 cm^3

Ans. (3)

Sol. $T_1 = 17^\circ\text{C}$, $V_1 = 2.9 \text{ cm}^3$
 $T_2 = 27^\circ\text{C}$

$$\frac{10^5 \times 2.9}{290} = \frac{1.5 \times 10^5 \times V_2}{300}$$

$$V_2 = 2 \text{ cm}^3$$

6. A metallic sphere of diameter 2mm and density 10.5 g/cc is dropped in glycerine having viscosity 10 poise and density 1.5 g/cc . The terminal velocity attained by sphere is _____

$$\text{cm/s.} \left[\pi = \frac{22}{7}, g = 10 \text{ m/s}^2 \right]$$

- (1) 2.0 (2) 1.0
 (3) 1.5 (4) 3.0

Ans. (1)

$$\text{Sol. } V = \frac{2}{9} \frac{r^2 g}{\eta} (\rho_m - \rho_l)$$

$$= \frac{2}{9} \times \frac{(0.1)^2 \times 1000}{10} (10.5 - 1.5)$$

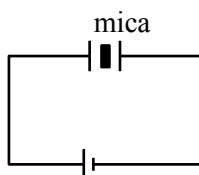
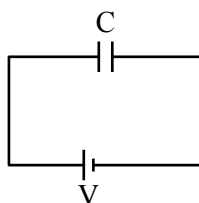
$$= 2 \text{ cm/s}$$

7. A parallel plate capacitor with plate separation 5 mm is charged by a battery. On introducing a mica sheet of 2 mm while battery is connected, it is found that it draws 25% more charge. The dielectric constant of mica is :

- (1) 2 (2) 1.5
 (3) 1 (4) 4

Ans. (1)

Sol.



$$C = \frac{\epsilon_0 A}{5}$$

$$Q_i = CV$$

$$Q_f = C_{eq} V = 1.25 CV$$

$$C_{eq} = \frac{\frac{\epsilon_0 A}{3} \times \frac{K \epsilon_0 A}{2}}{\frac{\epsilon_0 A}{3} + \frac{K \epsilon_0 A}{2}}$$

$$= \frac{\epsilon_0 A 5K}{5(3K + 2)}$$

$$= \frac{5CK}{3K + 2}$$

$$C_{eq} = 1.25 C$$

$$\frac{5K}{3K + 2} = 1.25 = \frac{5}{4}$$

$$4K = 3K + 2$$

$$K = 2$$

8. Two point charges $7\mu\text{C}(-9,0,0)$ and $-2\mu\text{C}(9,0,0)$

are placed in external electric field $\vec{E} = \frac{A}{r^2} \hat{r}$ where

$A = 10^3$ SI unit. Find potential energy of system ?

(1) $-\frac{58}{9} \times 10^{-3} \text{ J}$ (2) $\frac{50}{3} \times 10^{-6} \text{ J}$

(3) $40 \times 10^{-4} \text{ J}$ (4) $2 \times 10^{-5} \text{ J}$

Ans. (1)

Sol. $U = U_{self} + U_{interaction}$

$$= q_1 V_1 + q_2 V_2 + \frac{kq_1 q_2}{r}$$

$$\text{Here } V = \int_{\infty}^r E dr = -A \left(-\frac{1}{r} \right)_{\infty}^r = \frac{A}{r}$$

$$\text{So } U = -7 \times 10^{-3} + \frac{7 \times 10^{-6} A}{9} - \frac{2 \times 10^{-6} A}{9}$$

$$= \left(\frac{5}{9} - 7 \right) \times 10^{-3} = -\frac{58}{9} \times 10^{-3} \text{ J}$$

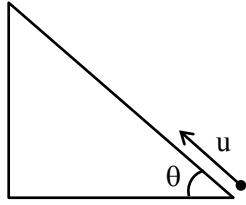


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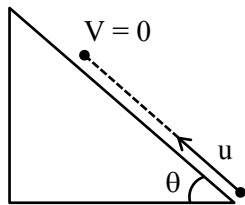
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9. A particle is projected from bottom of inclined plane with speed u find distance covered along plane before coming to rest :



- (1) $\frac{u^2}{2g\sin\theta}$ (2) $\frac{u^2}{g\sin\theta}$
 (3) $\frac{u^2}{g\cos\theta}$ (4) $\frac{u^2}{2g\cos\theta}$

Ans. (1)
Sol.



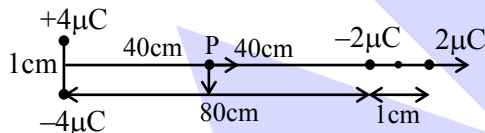
$$a = -g\sin\theta$$

$$V^2 = U^2 + 2as$$

$$0 = u^2 - 2g\sin\theta \cdot s$$

$$s = \frac{u^2}{2g\sin\theta}$$

10. Four charges are kept as shown in the figure. Find magnitude of electric field at point P. P is mid point of line AB.



- (1) $625\sqrt{2}$ (2) $5625\sqrt{2}$
 (3) $3625\sqrt{2}$ (4) $4525\sqrt{2}$

Ans. (2)

Sol. $E_p = -\frac{KP_1}{r^3} \hat{j} + \frac{2KP_2}{r^3} (\hat{i})$

$$|\vec{E}_{net}| = \frac{\sqrt{2} \times 2 \times 9 \times 10^9 \times 2 \times 10^{-6} \times 10^{-2}}{(0.4)^3}$$

$$= 5625\sqrt{2}$$

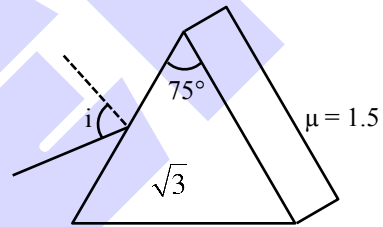
11. Dielectric constant of a medium is 3 and its magnetic permeability $\mu = 2\mu_0$. Find ratio of velocity of light in vacuum to velocity of light in medium :

- (1) $\sqrt{5}$ (2) $\sqrt{6}$
 (3) 2 (4) 3

Ans. (1)

Sol. $\frac{c}{v} = \mu = \sqrt{\epsilon_r \mu_r} = \sqrt{3 \times 2} = \sqrt{6}$

12. A prism with angle of prism 75° and having refractive index $\sqrt{3}$ has a slab of refractive index 1.5 kept on one side of the prism as shown. Find angle of incidence such that TIR occurs at slab-prism interface. (Given $\sin 15^\circ = 0.25$ and $\sin 25^\circ = 0.43$) :



- (1) $10^\circ < \theta < 20^\circ$ (2) $\theta < 25^\circ$
 (3) $\theta < 15^\circ$ (4) $15^\circ < \theta < 25^\circ$

Ans. (2)

Sol. For TIR at prism-slab interface,

$$r_2 = \sin^{-1}\left(\frac{1.5}{\sqrt{3}}\right) = 60^\circ$$

$$\therefore r_1 = 15^\circ$$

$$\therefore 1 \sin i = \sqrt{3} \sin 15^\circ = 0.433 \Rightarrow i = 25^\circ$$

$$\therefore \theta < 25^\circ$$

13. When an unpolarized light falls at a particular angle on a glass plate (placed in air). It is observed that reflected beam is completely polarized the angle of refracted beam with respect to the normal is :

- (Given : $\tan^{-1}(1.52) = 57.3^\circ$, $\mu_{air} = 1$, $\mu_{glass} = 1.52$)
 (1) 57.3 (2) 36.7
 (3) 28.65 (4) 61.35



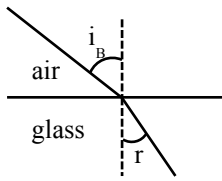
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Ans. (2)

Sol.



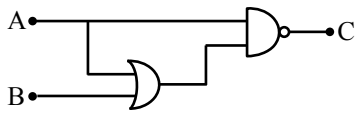
$$\tan i_B = \frac{n_2}{n_1} = \frac{n_g}{n_a}$$

$$\tan i_B = 1.52$$

$$i_B = 57.6^\circ$$

$$r = 90 - i_B = 36.7^\circ$$

14. For given logic gate circuit choose correct truth table.



(1)

A	B	C
0	0	1
1	0	1
0	1	1
1	1	0

(2)

A	B	C
0	0	1
1	0	0
0	1	1
1	1	0

(3)

A	B	C
0	0	0
1	0	0
0	1	0
1	1	1

(4)

A	B	C
0	0	0
1	0	1
0	1	0
1	1	1

Ans. (2)

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

$$C = \overline{A} \cdot A + A \cdot \overline{B} = \overline{A} \cdot (1+B) = \overline{A}$$

A	B	C
0	0	1
1	0	1
0	1	1
1	1	0

15. Energy released per fission of U-235 is 190 MeV, then total energy released by 47 g of U-235 is $x \times 10^{23}$ MeV. Find the value of x .

Ans. (228)

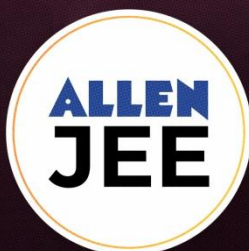
Sol. Total numbers of U-235 atom is

$$47 \text{ g} = \frac{47}{235} \text{ moles} = \frac{1}{5} \text{ moles}$$

$$\therefore \text{Total energy released} = \frac{1}{5} \times 6 \times 10^{23} \times 190 \text{ MeV}$$

$$= 228 \times 10^{23} \text{ MeV}$$

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16. A parachutist jumps from a helicopter. It falls freely for 2 sec. Then he opens parachute which produces retardation of 3 m/s^2 . When his height from ground is 10 m his velocity is 5 m/s . Find his initial height from ground.

- (1) 90 m (2) 82 m
(3) 92.5 m (4) 100 m

Ans. (3)

Sol. $S_1 = \frac{1}{2} \times 10 \times 2^2 = 20 \text{ m}$

$v_1 = 0 + g \times 2 = 20 \text{ m/s}$

For 2nd part of journey :

$5^2 = 20^2 + 2(-3)S_2$

$S_2 = 62.5 \text{ m}$

So, total distance $S = S_1 + S_2 + S_3$
 $= 20 + 62.5 + 10 = 92.5 \text{ m}$

17. One mole of diatomic gas is expanding isothermally from V to $2V$ at 27°C . If the magnitude of work done by gas in this case is same as the work done in adiabatic process where initial temperature is 27°C and final temperature is $T^\circ\text{C}$. Find T .

- (1) -37°C (2) -57°C
(3) -35°C (4) -55°C

Ans. (2)

Sol. $W_{\text{isothermal}} = 1 \times R \times (300) \ln(2)$

$W_{\text{adiabatic}} = \frac{nR(300 - T)}{\left(\frac{7}{5} - 1\right)} = \frac{5}{2} \times 1 \times R \times (300 - T)$

$W_{\text{isothermal}} = W_{\text{adiabatic}}$

$300 \ln 2 = \frac{5}{2} (300 - T)$

$\frac{5}{2} T = 750 - 300 \ln 2$

$T = 216.82 \text{ K}$

$T = -56.17^\circ\text{C}$

18. A bomb at rest explodes into three pieces in the ratio of masses $2 : 2 : 3$. The identical masses fly off perpendicular to each other with 18 m/s . Find speed of the third piece.

- (1) $12\sqrt{2} \text{ m/s}$ (2) $12 / \sqrt{2} \text{ m/s}$
(3) 12 m/s (4) 18 m/s

Ans. (2)

Sol. $7m \times 0 = 2m \times 18 \hat{i} + 2m \times 18 \hat{j} + 3m \times \vec{v}$

$\vec{v} = -12\hat{i} - 12\hat{j}$

$|\vec{v}| = 12\sqrt{2} \text{ m/s}$

19. Choose correct option :

(A) Number of photons required for a light beam of 2000 pm wavelength and 1 Joule energy is 1.01×10^{16} .

(B) Light with wavelength 300 nm has energy E_1 and for wavelength 900 nm has energy E_2 , then

$\frac{E_1}{E_2} = \frac{1}{3}$

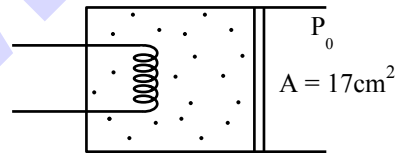
(C) Frequency of light is 4.5×10^{16} then its wavelength is $6.7 \times 10^{-9} \text{ m}$.

(D) If electrons and protons are accelerated by same potential difference, then their de-Broglie wavelength are equal.

- (1) A only (2) A & B only
(3) A & C only (4) A, B, C & D

Ans. (3)

20. Internal energy of gas is given as $U = 3nRT$. 1mole He gas takes 126 J heat and its temperature rise by 4°C . Atmospheric pressure is $P_0 = 10^5 \text{ Pa}$ and area of piston is 17 cm^2 . Find distance moved by piston.



- (1) 18.5 cm (2) 21.3 cm
(3) 12.3 cm (4) 10.2 cm

Ans. (1)

Sol. Piston is free to move hence

For isobaric process

$\Delta Q = \Delta U + W = 3nR\Delta T + nR\Delta T$

$\Delta Q = 4P\Delta V$

$126 = 4 \times 10^5 \times A(\Delta x)$

$\Delta x = \frac{126}{4 \times 10^5 \times 17 \times 10^{-4}}$

$= 0.185 \text{ m} = 18.5 \text{ cm}$

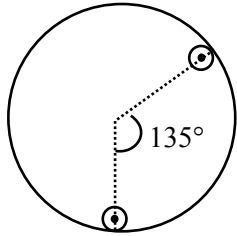


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21. A disc of mass (M, R) is given. Two discs of radius $\frac{R}{4}$ are cut from this, whose center are at 135° angle. Their peripheries touch larger disc as shown. If moment of inertia of remaining disc about center is $\frac{\alpha}{256}MR^2$ find α :



Ans. ($\alpha = 109$)

Sol. $M = \sigma\pi R^2$

$$\sigma\pi R^2 = 16m$$

$$m = \frac{\sigma\pi R^2}{16}$$

$$I_{\text{system}} = \frac{MR^2}{2} - 2\left(\frac{mR^2}{2 \times 16} + \frac{9mR^2}{16}\right)$$

$$= \frac{MR^2}{2} - 2 \times \frac{19mR^2}{32}$$

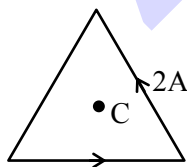
$$= \frac{MR^2}{2} - \frac{19}{16}mR^2$$

$$= \frac{MR^2}{2} - \frac{19}{256}MR^2 \quad \text{becoz } m = \frac{M}{16}$$

$$= \frac{(128 - 19)(MR^2)}{256}$$

$$= \frac{109MR^2}{256}$$

22. The equilateral triangular frame has current 2A. The side of frame is $4\sqrt{3}$ cm. Magnetic field at center C is:



(1) $30\sqrt{3} \mu\text{T}$

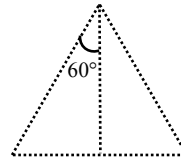
(2) $10\sqrt{3} \mu\text{T}$

(3) $3\sqrt{10} \mu\text{T}$

(4) $10\sqrt{10} \mu\text{T}$

Ans. (1)

Sol.



$$B = 3 \left[\frac{\mu_0 i}{4\pi \left(\frac{a}{2\sqrt{3}}\right)} (\sin 60 + \sin 60) \right]$$

$$= \frac{9\mu_0 i}{2\pi a}$$

$$= \frac{9 \times 4\pi \times 10^{-7} \times 2}{2\pi \times (4\sqrt{3} / 100)}$$

$$= 3\sqrt{3} \times 10^{-5} = 30\sqrt{3} \mu\text{T}$$

23. An experiment is performed for comparing EMF of two cells using a potentiometer. For 1st cell, balancing length was achieved at 200 cm and for 2nd cell it was 150 cm. If least count of measurement of length of potentiometer wire is 1cm, the percentage error in the ratio of emf of two cells is :

(1) $\frac{8}{7}$

(2) $\frac{7}{6}$

(3) $\frac{5}{6}$

(4) $\frac{3}{2}$

Ans. (2)

Sol. At balancing length $\epsilon = \lambda l$ [λ is potential gradient]

$$\therefore \epsilon_1 = \lambda \times 200$$

$$\epsilon_2 = \lambda \times 150$$

$$\text{Let } y = \frac{\epsilon_1}{\epsilon_2}$$

$$\therefore \frac{\Delta y}{y} = \frac{\Delta \epsilon_1}{\epsilon_1} + \frac{\Delta \epsilon_2}{\epsilon_2} = \frac{\Delta l_1}{l_1} + \frac{\Delta l_2}{l_2} = \frac{1}{200} + \frac{1}{150} = \frac{7}{600}$$

$$\therefore \% \text{ error} = \frac{7}{6}$$



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24. A small ring is given some velocity along the axis of a solenoid and it remains coaxial with solenoid. Current in solenoid $i = 10 \sin \omega t$; $\omega = 1000 \text{ rad/s}$. Number of turns per unit length is $500/\text{m}$. Radius of ring is 1 cm and its resistance is 10Ω . Find RMS value of induced current in the ring :

- (1) $\sqrt{2} \times 10^{-5} \text{ A}$ (2) $3 \times 10^{-4} \text{ A}$
 (3) $\sqrt{2} \times 10^{-4} \text{ A}$ (4) $5 \times 10^{-6} \text{ A}$

Ans. (3)

Sol. EMF induced $\varepsilon = A \frac{dB}{dt} = A\mu_0 n \frac{di}{dt}$

$\varepsilon = A\mu_0 n i_0 \omega \cos \omega t$

current induced $i = \frac{\varepsilon}{R} = \frac{\pi r^2 \mu_0 n i_0 \omega}{R} \cos \omega t$

So $i = \frac{\pi r^2 \mu_0 n i_0 \omega}{\sqrt{2} R}$

$= \frac{\pi \times 10^{-4} \times 4\pi \times 10^{-7} \times 500 \times 10 \times 10^3}{\sqrt{2} \times 10}$

$= \frac{20\pi^2}{\sqrt{2}} \times 10^{-6}$

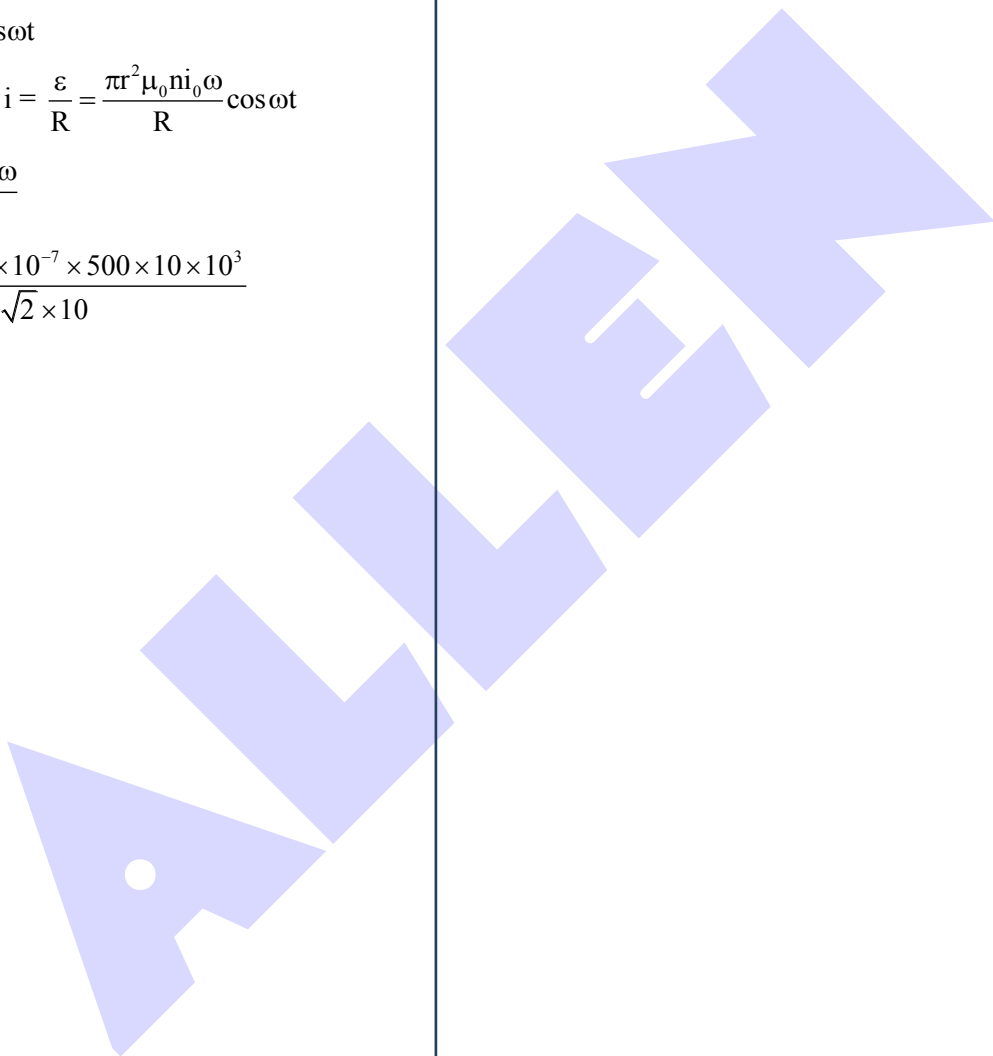
$= \sqrt{2} \times 10^{-4} \text{ A}$

25. Which of the following is isobaric pairs :

- (1) ${}^3_1\text{C}$ & ${}^{13}_6\text{C}$
 (2) ${}^3_1\text{H}$ & ${}^3_2\text{He}$
 (3) ${}^{14}_7\text{N}$ & ${}^{13}_6\text{He}$
 (4) ${}^{16}_8\text{O}$ & ${}^{15}_7\text{N}$

Ans. (2)

Sol. Isobars are atoms having same number of nucleons



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Sol. Work done by external agent :

$$W_{\text{ext}} = \Delta U$$

$$U_i = \frac{Gm_1m_2}{r_i} + \frac{Gm_2m_3}{r_i} + \frac{Gm_1m_3}{r_i} : r_i = 20 \text{ m}$$

$$U_f = \frac{Gm_1m_2}{r_f} + \frac{Gm_2m_3}{r_f} + \frac{Gm_1m_3}{r_f} : r_f = 25 \text{ m}$$

$$U_i = \frac{-6.67 \times 10^{-11}}{20} [200 \times 300 + 300 \times 400 + 200 \times 400]$$

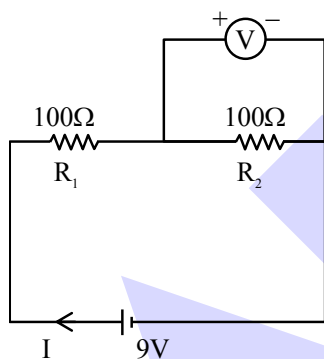
$$= \frac{-6.67 \times 10^{-11}}{20} \times 26 \times 10^4 = -86.71 \times 10^{-8} \text{ J}$$

$$U_f = \frac{-6.67 \times 10^{-11}}{0.25} [200 \times 300 + 300 \times 400 + 200 \times 400]$$

$$= \frac{-6.67 \times 10^{-11}}{0.25} \times 26 \times 10^4 = -693.68 \times 10^{-9}$$

$$= -69.36 \times 10^{-8} \text{ J} \quad W = +\Delta U = 17.35 \times 10^{-8} \\ = 1.735 \times 10^{-7} \text{ J}$$

5. Two resistors of resistances $R_1 = 100\Omega$ and $R_2 = 100\Omega$ are connected in series. A voltmeter of resistance 400Ω is connected in parallel to one of the resistance. Find the reading of voltmeter. The emf of battery is $9V$. :



(1) 3 V

(3) 2 V

(2) 4 V

(4) 5 V

Ans. (2)

Sol. Current in circuit.

$$I = \frac{E}{R_{\text{eq}}}$$

$$R_{\text{eq}} = 100 + \frac{400 \times 100}{500} = 180\Omega$$

$$\therefore I = \frac{9}{180} = \frac{1}{20} \text{ A}$$

$$\text{Reading of voltmeter} = V = I \times 80 = \frac{1}{20} \times 80 = 4V$$

6. A brass rod is fixed rigidly at two ends at 27°C . If it is cooled to temperature -43°C , tension in rod becomes T_0 . Find temperature (in $^\circ\text{C}$) at which tension will be $1.4 T_0$:

Ans. -71°C

Sol. Thermal stress causes tension

$$T = \alpha y A \Delta T$$

$$-43^\circ\text{C} \quad T_0 = \alpha y A (43 + 27) \quad \dots\dots(i)$$

$$-t^\circ\text{C} \quad T_0 = \alpha y A (t + 27) \quad \dots\dots(ii)$$

(ii)/(i)

$$1.4 = \frac{t + 27}{70}$$

$$t + 27 = 98$$

$$t = 71^\circ$$

\therefore temp (-71°C)

7. Electric potential at a point is $V = Ar^3 + B$. Find charge enclosed in a sphere of radius 1m , centered at $r = 0$

(1) $-4\epsilon_0 A$

(2) $-8\epsilon_0 A$

(3) $-12\epsilon_0 A$

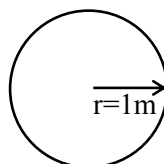
(4) $-16\epsilon_0 A$

Ans. (3)

Sol. $E = -\frac{dv}{dr}$

$$E = -3Ar^2$$

Charge enclosed in 1m radius is



Applying Gauss law

$$\oint \epsilon \cdot ds = \frac{q_{\text{in}}}{\epsilon_0}$$

$$E \cdot S = \frac{q_{\text{in}}}{\epsilon_0}$$

$$q_{\text{in}} = \epsilon_0 E S = -\epsilon_0 \cdot (3Ar^2) (4\pi r^2)$$

$$q_{\text{in}})_{r=1\text{m}} = -12\epsilon_0 A$$

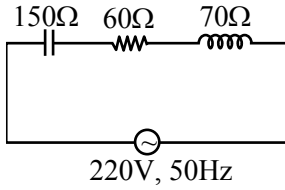


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8. Figure shows a circuit consisting capacitor, inductor and a resistor connected in series with an AC source. Find the power factor of the circuit.



- (1) 0.2
- (2) 0.4
- (3) 0.6
- (4) 0.8

Ans. (3)

Sol. Power factor = $\frac{R}{Z}$

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$= \sqrt{60^2 + (150 - 70)^2} = 100\Omega$$

$$\therefore \text{Power factor} = \frac{60}{100} = 0.6$$

9. Following are two lists, list-I contains the types of electromagnetic waves and list-II contains their sources. Match the entries from list-I to appropriate entries from list-II.

	List-I		List-II
(a)	x-rays	(p)	Hot bodies and molecules
(b)	Infrared rays	(q)	Oscillatory current in antennas
(c)	Microwaves	(r)	Magnetron
(d)	Radio waves	(s)	Fast moving electrons striking a metal plate

- (1) (a)→(r), (b)→(q), (c)→(s), (d)→(q)
- (2) (a)→(p), (b)→(s), (c)→(r), (d)→(q)
- (3) (a)→(s), (b)→(p), (c)→(q), (d)→(s)
- (4) (a)→(s), (b)→(p), (c)→(r), (d)→(q)

Ans. (4)

Sol.

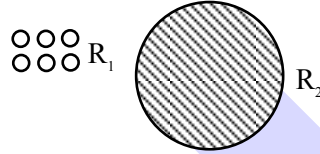
10. Terminal velocity of drop of radius 1 cm is 10 cm/sec. 64 such balls are combined to make a large drop. Find terminal velocity of this larger drop. :

- (1) 160 cm/sec
- (2) 140 cm/sec
- (3) 180 cm/sec
- (4) 150 cm/sec

Ans. (1)

Sol. $V_T = \frac{2r^2g}{9\eta}[\sigma - \rho]$

$$V_T \propto r^2$$



64 drop

$$64 \left(\frac{4}{3} \pi R_1^3 \right) = \frac{4}{3} \pi R_2^3$$

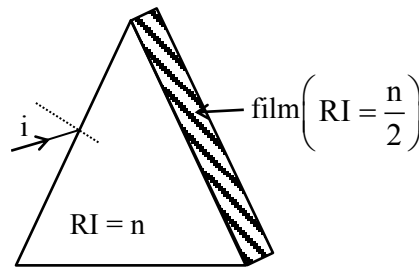
$$R_2 = 4R_1$$

$$\frac{(V_T)_1}{(V_T)_2} = \left(\frac{R_1}{R_2} \right)^2 = \left(\frac{1}{4} \right)^2$$

$$\frac{10}{(V_T)_2} = \frac{1}{16}$$

$$(V_T)_2 = 160 \text{ cm/sec}$$

11. Light is incident at such an angle so that minimum deviation takes place. Now a film of refractive index $\left(R I = \frac{n}{2} \right)$ is stick on other face such that total internal reflection takes place on second surface. Find angle of prism :



- (1) 60°
- (2) 50°
- (3) 90°
- (4) 30°

Ans. (1)

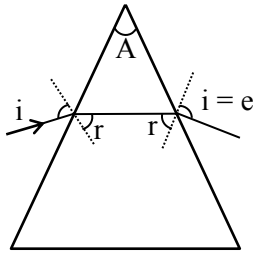


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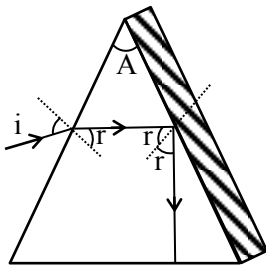
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Sol. $i = e$ & $r = A/2$ for minimum deviation



For TIR ; $r > \theta_c$



$$\sin r > \sin \theta_c$$

$$\sin r > \frac{n/2}{n}$$

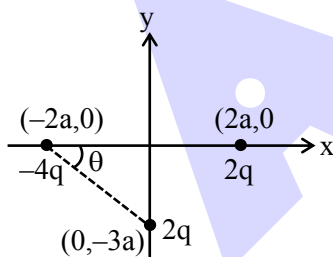
$$\sin r > \frac{1}{2}$$

$$\sin \frac{A}{2} > \sin 30^\circ$$

$$\frac{A}{2} > 30^\circ$$

$$A > 60^\circ$$

12. In the following configuration of charges. Find the net dipole moment of the system :



(1) $\sqrt{180} qa$

(2) $\sqrt{150} qa$

(3) $\sqrt{200} qa$

(4) $\sqrt{140} qa$

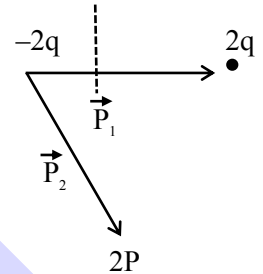
Ans. (1)

Sol. $\vec{P}_1 = (2q)(4a)\hat{i} = 8qa\hat{i}$

$$\vec{P}_2 = (2q)(\sqrt{13}a)(\cos\theta\hat{i} - \sin\theta\hat{j})$$

$$= (3q)(\sqrt{3}a)(\cos\theta\hat{i} - \sin\theta\hat{j})$$

$$= (3q)(\sqrt{3}a)\left(\frac{2}{\sqrt{13}}\hat{i} - \frac{3}{\sqrt{3}}\hat{j}\right)$$



$$= 2qa(2\hat{i} - 3\hat{j})$$

$$\cos\theta = \frac{2}{\sqrt{13}}$$

$$= 4qa\hat{i} - 6qa\hat{j}$$

$$\sin\theta = \frac{3}{\sqrt{13}}$$

$$\vec{P}_{net} = \vec{p}_1 + \vec{p}_2$$

$$= 12qa\hat{i} - 6qa\hat{j}$$

$$|\vec{p}_{net}| = \sqrt{180} qa$$

13. Density of water at 4°C is 1000 kg/m^3 and at 20°C it is 998 kg/m^3 . If 4kg of water is heated from 4°C to 20°C , the change in internal energy of water is : (Given : specific heat capacity of water = 4200 J/kg).

(1) 268799.2 J

(2) 268800.8 J

(3) 268800.0 J

(4) 267765.2 J

Ans. (1)

Sol. $Q = mS\Delta T = 4 \times 4200 \times 16 \text{ J} = 268800 \text{ J}$

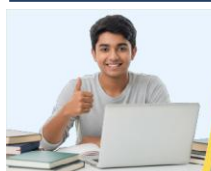
$$W = P\Delta V$$

$$\Delta V = \left(\frac{m}{\rho_f} - \frac{m}{\rho_i}\right) = 4\left[\frac{1}{998} - \frac{1}{1000}\right]$$

$$P = 10^5 \text{ Pa.}$$

$$\therefore W = 10^5 \times 4 \times \left[\frac{1}{998} - \frac{1}{1000}\right] = \frac{8 \times 10^5}{10^3 \times 998} \approx 0.8 \text{ J}$$

$$\Delta U = Q - W = 268799.2 \text{ J}$$

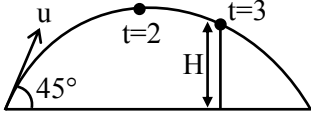


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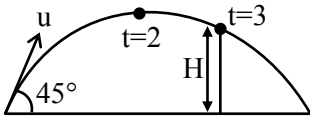
14. A projectile is projected with certain speed at an angle of 45° with horizontal as shown. At $t = 2$ s, projectile is at maximum height and at $t = 3$ s, it just touches a wall at a height H above horizontal. Find H in meters :



- (1) 20 m
- (2) 10 m
- (3) 15 m
- (4) 25 m

Ans. (3)

Sol. $T = \frac{2u_y}{g} = 4$



$\Rightarrow u_y = \frac{40}{2} = 20 \text{ m/s}$

$u_x = 20 \text{ m/s}$

$\Delta y = u_y \Delta t - \frac{1}{2} g (\Delta t)^2$

$\Rightarrow H = 20 \times 3 - 5 \times 9$

$= 60 - 45$

$= 15 \text{ m}$

15. Column-I gives physical quantities and Column-II represent their dimensions. Choose the option representing correct matching.

Column-I		Column-II	
(I)	Magnetic field intensity	(P)	$MLT^{-2}A^{-2}$
(II)	Magnetic flux	(Q)	$ML^2T^{-2}A^{-2}$
(III)	Magnetic permeability	(R)	$ML^2T^{-2}A^{-1}$
(IV)	Magnetic inductance	(S)	$MT^{-2}A^{-1}$

- (1) I-S, II-R, III-P, IV-Q (2) I-Q, II-R, III-P, IV-S
 (3) I-R, II-S, III-P, IV-Q (4) I-S, II-P, III-R, IV-Q

Ans. (1)

Sol. Magnetic field intensity, $B = [MT^{-2}A^{-1}]$ – S
 Magnetic Flux, $\phi = [ML^2T^{-2}A^{-1}]$ – R
 Magnetic Permeability, $\mu = [MLT^{-2}A^{-2}]$ – P
 Magnetic inductance, $L = [ML^2T^{-2}A^{-1}]$ – Q

16. A cylindrical body of mass m and cross section A is floating in a liquid of density ρ_L such that its axis is vertical. If body is displaced by a small displacement 'x' vertically, find the time period of oscillation of the body :

- (1) $2\pi \sqrt{\frac{m}{\rho_L Ag}}$ (2) $3\pi \sqrt{\frac{m}{\rho_L Ag}}$
 (3) $4\pi \sqrt{\frac{m}{\rho_L Ag}}$ (4) $5\pi \sqrt{\frac{m}{\rho_L Ag}}$

Ans. (1)

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Sol. $\rho_L A \times hg = mg$

After displacing by x ,

$$F = \rho_L A (h + x) g - mg$$

$$F = \rho_L Ahg + \rho_L A x g - mg$$

$$F = \rho_L A x g$$

$$a = \left(\frac{\rho_L A g}{m} \right) x$$

comparing,

$$a = \omega^2 x$$

$$\omega = \sqrt{\frac{\rho_L A g}{m}}$$

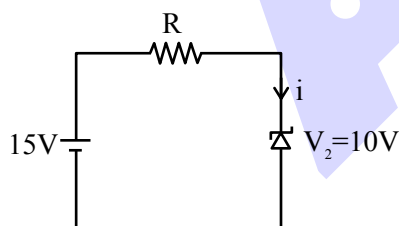
$$T = \frac{2\pi}{\omega} = 2\pi \sqrt{\frac{m}{\rho_L A g}}$$

17. A zener diode of breakdown voltage 10 V is connected to an external voltage of 15 V and a resistance R in series. If power of zener diode is 0.4 W. Find value of unknown resistance R :

- (1) 125 Ω
- (2) 105 Ω
- (3) 130 Ω
- (4) 115 Ω

Ans. (1)

Sol.

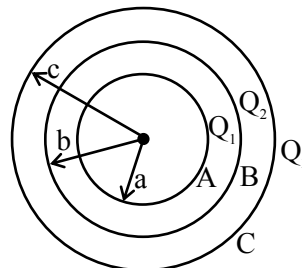


$$P_D = 0.4W = 10i$$

$$i = 0.04A$$

$$R = \frac{15-10}{0.04} = \frac{5}{0.04} = 125 \Omega$$

18. Three uniformly charged concentric shells are kept as shown in the diagram. Charges on individual shells are as shown. Find the final potential on each shell :



$$(1) V_A = \frac{KQ_1}{a} + \frac{KQ_2}{b} + \frac{KQ_3}{c}$$

$$V_B = \frac{K(Q_1 + Q_2 + Q_3)}{c}$$

$$V_C = \frac{KQ_1}{b} + \frac{KQ_2}{b} + \frac{KQ_3}{c}$$

$$(2) V_A = \frac{KQ_1}{b} + \frac{KQ_2}{b} + \frac{KQ_3}{c}$$

$$V_B = \frac{KQ_1}{a} + \frac{KQ_2}{b} + \frac{KQ_3}{c}$$

$$V_C = \frac{K(Q_1 + Q_2 + Q_3)}{c}$$

$$(3) V_A = \frac{K(Q_1 + Q_2 + Q_3)}{c}$$

$$V_B = \frac{KQ_1}{b} + \frac{KQ_2}{b} + \frac{KQ_3}{c}$$

$$V_C = \frac{KQ_1}{a} + \frac{KQ_2}{b} + \frac{KQ_3}{c}$$

$$(4) V_A = \frac{KQ_1}{a} + \frac{KQ_2}{b} + \frac{KQ_3}{c}$$

$$V_B = \frac{KQ_1}{b} + \frac{KQ_2}{b} + \frac{KQ_3}{c}$$

$$V_C = \frac{K(Q_1 + Q_2 + Q_3)}{c}$$

Ans. (4)

Sol. $V_A = \frac{KQ_1}{a} + \frac{KQ_2}{b} + \frac{KQ_3}{c}$

$$V_B = \frac{KQ_1}{b} + \frac{KQ_2}{b} + \frac{KQ_3}{c}$$

$$V_C = \frac{KQ_1}{c} + \frac{KQ_2}{c} + \frac{KQ_3}{c}$$

$$= \frac{K(Q_1 + Q_2 + Q_3)}{c}$$



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19. An ideal gas in a closed rigid container is at 50°C and pressure 3.23 kPa. If temperature is doubled, find new pressure in Pa :

- (1) 3730 Pa (2) 3230 Pa
 (3) 6460 Pa (4) 6430 Pa

Ans. (1)

Sol. Closed rigid container

V = constant

$P \propto T$

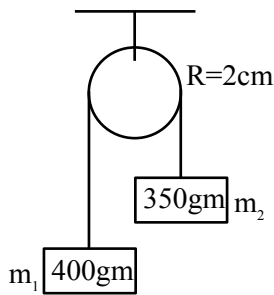
$T_1 = 50^\circ \text{C} = 323 \text{K}$

$T_2 = 2 \times 50^\circ \text{C} = 100^\circ \text{C} = 373 \text{K}$

$$\frac{P_1}{P_2} = \frac{T_1}{T_2} \Rightarrow \frac{3.23}{P_2} = \frac{323}{373}$$

$\therefore P_2 = 3730 \text{ Pa}$

20. After release, the blocks moves 81 cm in 9 seconds. Find moment of inertia of the pulley :



- (1) $97 \times 10^{-4} \text{ Kg-m}^2$ (2) $100 \times 10^{-4} \text{ Kg-m}^2$
 (3) $21 \times 10^{-4} \text{ Kg-m}^2$ (4) $87 \times 10^{-4} \text{ Kg-m}^2$

Ans. (1)

Sol. $a = \frac{(m_1 - m_2)}{m_1 + m_2 + \frac{I}{R^2}} \cdot g$

$$S = ut + \frac{1}{2}at^2$$

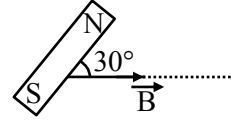
$$\frac{81}{100} = \frac{1}{2} \left(\frac{m_1 - m_2}{m_1 + m_2 + \frac{I}{R^2}} \right) g \times (81)$$

$$500(m_1 - m_2) = (m_1 + m_2) + \frac{I}{R^2}$$

$$500 \left(\frac{50}{1000} \right) = \left(\frac{750}{1000} \right) + \frac{I}{R^2}$$

$$I = 97 \times 10^{-4} \text{ Kg-m}^2$$

21. A bar magnet is kept such that it is making an angle of 30° with the magnetic field. The torque acting on the magnet is 0.016 N-m. Find the amount of work done by external agent in rotating the magnet from most stable position to most unstable position.



- (1) 0.064 J
 (2) 0.020 J
 (3) 0.034 J
 (4) 0.055 J

Ans. (1)

Sol. $\tau = \mu B \sin \theta \Rightarrow 0.016 = \mu \times B \times \frac{1}{2}$

$$\Rightarrow \mu = \frac{0.032}{B}$$

$$W_{\text{ext}} = U_f - U_i = \mu B - (\mu B) = 2\mu B$$

$$= 2 \times \frac{0.032}{B} \times B$$

$$= 0.064 \text{ J}$$

22. Statement – I : Greater is the mass of nucleus, more will be its binding energy.

Statement – II : Nucleus with less $\frac{BE}{A}$ (Binding energy/nucleon) breaks into nucleus with higher $\frac{BE}{A}$.

Choose the correct option :

- (1) Statement I is true & statement II is false
 (2) Statement I is false & statement II is true
 (3) Both are true
 (4) Both are false

Ans. (3)

Sol. On increasing number of nucleon, BE increase but stability of nucleus depends on BE/A.



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MEMORY BASED QUESTIONS JEE-MAIN EXAMINATION – JANUARY 2026

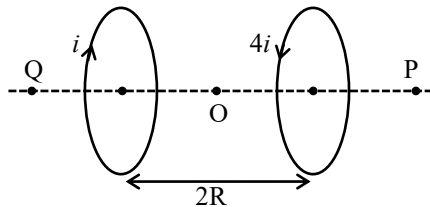
(HELD ON SATURDAY 24th JANUARY 2026)

TIME : 3:00 PM TO 6:00 PM

PHYSICS

TEST PAPER WITH SOLUTION

1. Find magnetic field at midpoint O. Rings have radius R and direction of current in opposite sense.



- (1) $\frac{3\mu_0 i}{4\sqrt{2}R}$ Towards P
- (2) $\frac{3\mu_0 i}{4\sqrt{2}R}$ Towards Q
- (3) $\frac{3\mu_0 i}{2\sqrt{2}R}$ Towards P
- (4) $\frac{3\mu_0 i}{2\sqrt{2}R}$ Towards Q

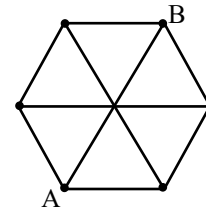
Ans. (1)

Sol. $B_{net} = B_1 - B_2$

$$= \frac{4\mu_0 i R^2}{2(R^2 + R^2)^{3/2}} - \frac{\mu_0 i R^2}{2(R^2 + R^2)^{3/2}}$$

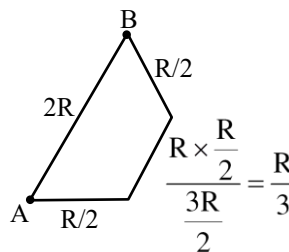
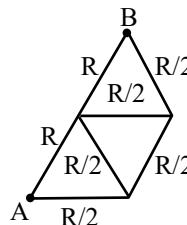
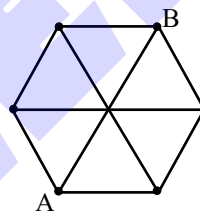
$$= \frac{3\mu_0 i}{4\sqrt{2}R}$$

2. Resistance of each side is R. Find equivalent resistance between two opposite points as shown in figure.

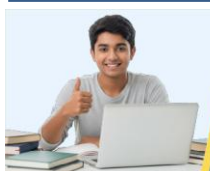


- (1) $\frac{4}{5}R$
- (2) $\frac{8}{5}R$
- (3) $\frac{8}{10}R$
- (4) $\frac{2}{5}R$

Ans. (1)
Sol.



$$R_{eq} = \frac{2R \times \frac{4R}{3}}{2R + \frac{4R}{3}} = \frac{8R^2}{10R} = \frac{4}{5}R$$



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3. In case of meter bridge experiment balance length for 2Ω and 3Ω is ℓ and for $x\Omega$ and 3Ω is $(\ell + 10)$ cm. Find x .

Ans. (3)

Sol. $\frac{2}{3} = \frac{\ell}{100 - \ell}$

$\ell = 40$ cm

$\frac{x}{3} = \frac{\ell + 10}{90 - \ell} = \frac{50}{50}$

$x = 3\Omega$

4. 5th Harmonic of closed organ pipe frequency matches with 1st Harmonic of open organ pipe. Find ratio of their lengths.

- (1) 5 (2) 2 (3) 5/2 (4) 2/5

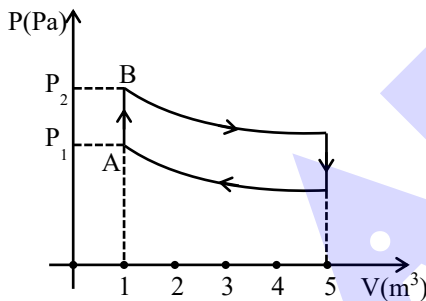
Ans. (3)

Sol. $f_{5 \text{ closed}} = f_{1 \text{ open}}$

$\frac{5v}{4L_{\text{closed}}} = \frac{v}{2L_{\text{open}}}$

$\frac{L_{\text{closed}}}{L_{\text{open}}} = \frac{5}{2}$

5. Find heat given to gas to take it from A to B. (Given : $C_v = 21$ S.I.units, $P_2 = 30$ Pa, $P_1 = 21.7$ Pa, $R = 8.3$ S.I.units, $n = 10$ moles)



- (1) 30 J (2) 21 J (3) 42 J (4) 50 J

Ans. (2)

Sol. $Q = \Delta U + W = \Delta U = nC_v\Delta T$
 $= \frac{f}{2}(P_2 - P_1)V \dots(1)$

Here $C_v = 21 = \frac{f}{2}R$

$f = \frac{42}{R}$

So, from eq(1)

$Q = \frac{42}{R \times 2}(8.3) \times 1 = 21$ J

6. A cylindrical object of density 600 kg/m^3 and height 8 cm is floating in a liquid of density 900 kg/m^3 . Find height of cylinder inside liquid.

(1) $\frac{16}{3}$ cm

(2) $\frac{20}{3}$ cm

(3) $\frac{5}{3}$ cm

(4) $\frac{25}{3}$ cm

Ans. (1)

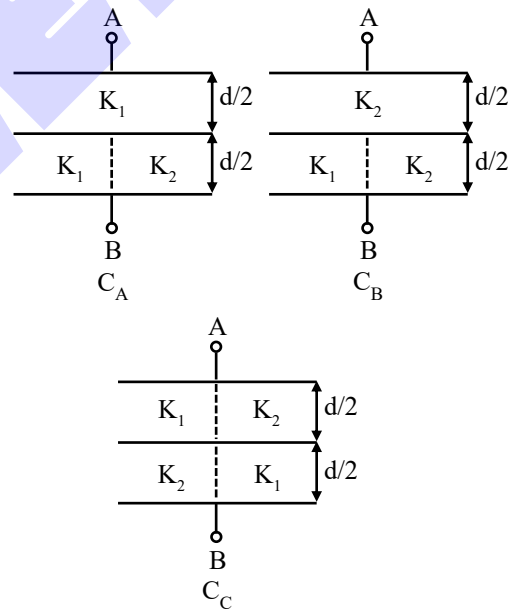
Sol. $Mg = F_b$

$dAHg = \rho Ahg$

$600 \times 8 \text{ cm} = 900 \times h$

$h = \frac{16}{3}$ cm

7. Diagram shows three arrangement of di-electric in the capacitor.



Arrange the capacitors in increasing order of capacitance between A & B if $K_1 > K_2$:

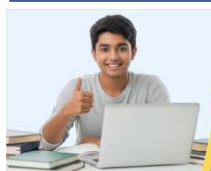
(1) $C_A < C_B < C_C$

(2) $C_A < C_C < C_B$

(3) $C_B < C_C < C_A$

(4) $C_B < C_A < C_C$

Ans. (3)

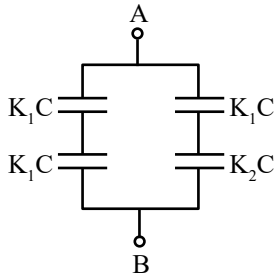


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Sol. For C_A :

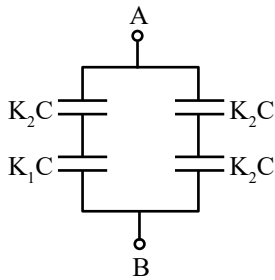


Let $\frac{\epsilon_0 A}{d} = C$

$$\therefore C_A = \frac{K_1 C}{2} + \frac{K_1 K_2 C}{K_1 + K_2}$$

$$= K_1 C \left[\frac{K_1 + 2K_2}{2(K_1 + K_2)} \right]$$

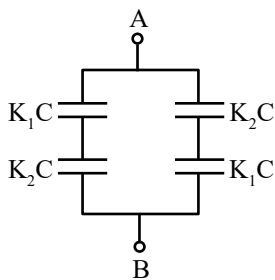
For C_B :



$$C_B = \frac{K_2 C}{2} + \frac{K_1 K_2 C}{K_1 + K_2}$$

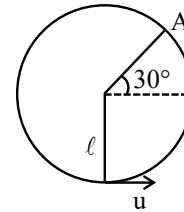
$$= K_2 C \left[\frac{K_1 + 2K_2}{2(K_1 + K_2)} \right]$$

For C_C :



$$C_C = \frac{2K_1 K_2 C}{(K_1 + K_2)}$$

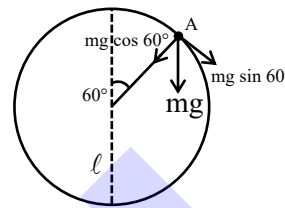
8. Find speed given to particle at lowest point so that tension in string at A point becomes zero :



- (1) $\sqrt{\frac{7gl}{2}}$ (2) $\sqrt{3gl}$ (3) $\sqrt{\frac{9}{4}gl}$ (4) $\sqrt{\frac{gl}{2}}$

Ans. (1)

Sol.



$$T + mg \cos 60^\circ = \frac{mV^2}{l}$$

$$T = 0$$

$$V^2 = \frac{gl}{2} \text{ here } V \text{ is the speed at point A}$$

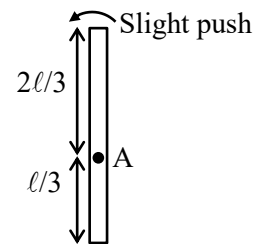
M.E.C.

$$\frac{1}{2} mu^2 = mg(l + l \cos 60^\circ) + \frac{1}{2} mV^2$$

$$u^2 = 3gl + \frac{gl}{2}$$

$$u = \sqrt{\frac{7gl}{2}}$$

9. When rod becomes horizontal find it's angular velocity. It is pivoted at point A as shown :



- (1) $\sqrt{\frac{3g}{l}}$ (2) $\sqrt{\frac{2g}{l}}$
 (3) $\sqrt{\frac{g}{l}}$ (4) $\sqrt{\frac{5g}{l}}$

Ans. (1)



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Sol. $mg \frac{\ell}{6} = \frac{1}{2} I \omega^2$

Here $I = \frac{m\ell^2}{12} + \frac{m\ell^2}{36} = \frac{m\ell^2}{9}$

$mg \frac{\ell}{6} = \frac{m\ell^2}{18} \omega^2 \Rightarrow \omega^2 = \frac{3g}{\ell}$

$\omega = \sqrt{\frac{3g}{\ell}}$

10. A soap bubble of diameter 7 cm its diameter is increased to 14 cm. If change in its surface energy (15000 - x) μJ. Find x

(Given surface tension is 0.04 N/m)

- (1) 208 (2) 216 (3) 432 (4) 512

Ans. (2)

Sol. $\Delta E = (\text{change in surface area}) \cdot (\text{surface tension})$

$\Delta E = 2[(4\pi)(r_2^2 - r_1^2)](T)$

$\Delta E = 8\pi(r_2^2 - r_1^2) T$

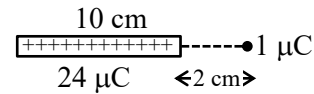
$= 8 \times \frac{22}{7} \left(\frac{14^2 - 7^2}{10^4} \right) \times 0.04$

$= 14784 \mu\text{J}$

$15000 - x = 14784 \mu\text{J}$

$x = 216 \mu\text{J}$

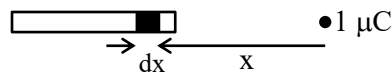
11. Rod has uniformly distributed charge 24 μC and length 10 cm. Find force on 1 μC particle ?



- (1) 70 N
 (2) 10.5 N
 (3) 90 N
 (4) 25 N

Ans. (3)

Sol.

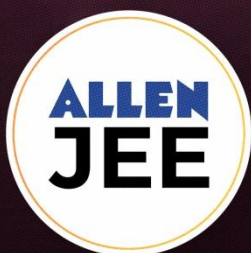


$F = \int dF = \int_{2\text{cm}}^{12\text{cm}} \frac{kq\lambda dx}{x^2} = kq\lambda \left(\frac{1}{2 \times 10^{-2}} - \frac{1}{12 \times 10^{-2}} \right)$

$F = (9 \times 10^9)(10^{-6}) \left(\frac{24 \times 10^{-6}}{10^{-1}} \right) \left(\frac{5}{12} \right) \times 10^2$

$= 9 \times 24 \times \frac{5}{12} = 90\text{N}$

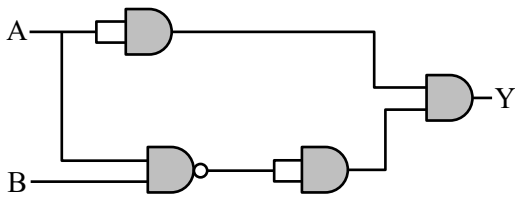
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12. Select correct truth table ?



(1)

A	B	Y
0	0	0
0	1	0
1	0	1
1	1	1

(2)

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

(3)

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1

(4)

A	B	Y
0	0	0
0	1	0
1	0	1
1	1	0

Ans. (4)

Sol. $Y = (\overline{A \cdot B}) \cdot A = (\overline{A} + \overline{B}) \cdot A = 0 + A \cdot \overline{B}$

A	B	Y
0	0	0
0	1	0
1	0	1
1	1	0

13. On a surface, if photon of λ wavelength is incident. The stopping potential is 3.2 V. If the wavelength incident is 2λ , stopping potential is 0.7V. Find λ .

- (1) 4.96×10^{-7} m (2) 3.62×10^{-7} m
 (3) 7.24×10^{-7} m (4) 2.48×10^{-7} m

Ans. (4)

Sol. $q(3.2) = \frac{hc}{\lambda} - \phi \dots(1)$

$q(0.7) = \frac{hc}{2\lambda} - \phi \dots(2)$

Eq. (1) – Eq. (2)

$q(2.5) = \frac{hc}{2\lambda}$

$2.5 = \left(\frac{hc}{e}\right) \left(\frac{1}{2\lambda}\right)$

$2.5 = \frac{12400}{2(\lambda)}$

$\lambda = \frac{12400}{5} \text{ \AA}$

$\lambda = 2480 \text{ \AA}$

$\lambda = 2.48 \times 10^{-7} \text{ m}$

14. 300 Joule of energy is given to a gas at constant volume which increases its temperature from 20°C to 50°C. If

$R = 8.3$ SI units & $C_p = \frac{7R}{2}$ then find mass of gas :

Ans. ()

Sol. \Rightarrow For Isochoric process

$Q = n C_v \Delta T$

$300 = n \cdot \frac{5R}{2} \cdot (50 - 20)$

$n = \left(\frac{4}{R}\right) \text{ mole}$

mass of gas = $\left(\frac{4}{R}\right)$ (molecular weight)

NOTE : molecular weight of gas is unknown in question.



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15. An electron makes transition from higher energy orbit n_2 to lower energy orbit n_1 in Li^{+2} ion such that $n_1 + n_2 = 4$ & $n_2 - n_1 = 2$. Determine the wavelength of emitted photon in transition (in cm) :

- (1) 1.14×10^{-6} cm (2) 3.28×10^{-6} cm
 (3) 5.76×10^{-6} cm (4) 8.23×10^{-6} cm

Ans. (1)

Sol. $n_1 + n_2 = 4$

$$n_2 - n_1 = 2$$

$$n_2 = 3; \quad n_1 = 1$$

$$E_3 - E_1 = +13.6 \times 9 \left(\frac{1}{1} - \frac{1}{9} \right) \text{eV}$$

$$= 108.8 \text{ eV}$$

$$\lambda = \frac{12400}{108.8} \text{ \AA} \approx 114 \text{ \AA} = 1.14 \times 10^{-6} \text{ cm}$$

16. In a vernier callipers 50 VSD are equal to 48 MSD. 1 MSD is equal to 0.05 mm. Find least count of this vernier callipers :

- (1) 0.005 mm (2) 0.004 mm
 (3) 0.001 mm (4) 0.002 mm

Ans. (4)

Sol. $LC = 1 \text{ MSD} - 1 \text{ MSD} = 1 \text{ MSD} - \frac{48}{50} \text{ MSD}$

$$= \frac{2}{50} \text{ MSD} = \frac{2}{50} \times 0.05 \text{ mm} = 0.002 \text{ mm}$$

17. Power of convex lens is 5D. Four students measure object and image distances as shown :

	u(in cm)	v(in cm)
A	35	37
B	30	60
C	60	30
D	25	100

- (1) Students A & B are correct
 (2) All are correct
 (3) Student A is wrong
 (4) Students C & D are wrong

Ans. (3)

Sol. $f = \frac{100}{5} = 20 \text{ cm}$

For student A

$$\frac{1}{f} = \frac{1}{37} + \frac{1}{35} \Rightarrow f \approx 18 \text{ cm}$$

For student B

$$\frac{1}{f} = \frac{1}{60} + \frac{1}{30} \Rightarrow f = 20 \text{ cm}$$

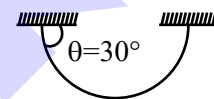
For student C

$$\frac{1}{f} = \frac{1}{30} + \frac{1}{60} \Rightarrow f = 20 \text{ cm}$$

For student D

$$\frac{1}{f} = \frac{1}{25} + \frac{1}{100} \Rightarrow f = 20 \text{ cm}$$

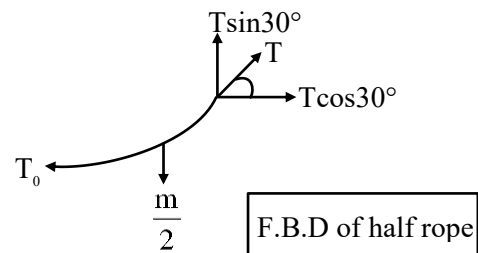
18. A flexible chain of mass m is hanging as shown. Find tension at the lowest point :



- (1) $\frac{\sqrt{3}}{2} mg$ (2) $\frac{1}{2} mg$
 (3) $\frac{\sqrt{2}}{3} mg$ (4) $\sqrt{2} mg$

Ans. (1)

Sol.



$$T \sin 30^\circ = \frac{m}{2} g$$

$$T \cos 30^\circ = T_0$$

$$\tan 30^\circ = \frac{mg}{2T_0}$$

$$T_0 = \frac{\sqrt{3}}{2} mg$$



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19. In YDSE, slits separation d is 2mm, distance between slits and screen D is 10 m. Wave length of light is $\lambda = 6000\text{\AA}$. If intensity of light through each slit is I_0 then find intensity at point directly in front of one of the slits

- (1) $4I_0$ (2) Zero
(3) I_0 (4) $2I_0$

Ans. (3)

Sol. Path difference $\Delta x = d \sin\theta = d \times \frac{y}{D} = d \times \frac{d}{D}$

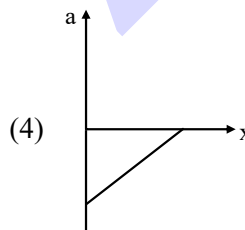
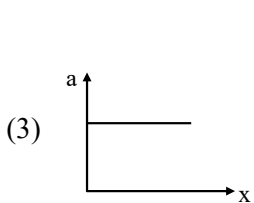
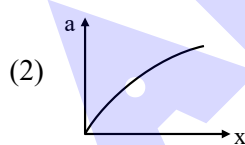
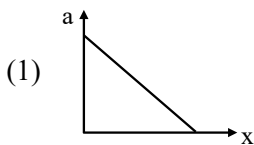
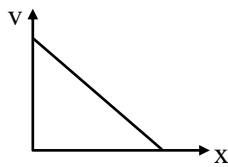
$$\Delta x = \frac{d^2}{D}$$

$$\Delta\phi = \frac{2\pi}{\lambda} \times \Delta x = \frac{2\pi d^2}{\lambda D}$$

$$\Delta\phi = \frac{2\pi \times 4 \times 10^{-6}}{6 \times 10^{-7} \times 10} = \frac{4\pi}{3}$$

$$I = I_0 + I_0 + 2I_0 \cos\left(\frac{4\pi}{3}\right) = I_0$$

20. Velocity of particle varies with position as shown in figure. Find the correct variation of acceleration with position :



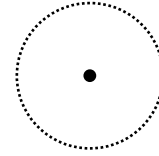
Ans. (4)

Sol. $v = -mx + c$

$$a = v \frac{dv}{dx} = (-mx + c)(-m)$$

$$a = m^2x - mc$$

21. The intensity at spherical surface due to a isotropic point source placed at its center is I_0 . If it's volume is increased by 8 times, what will be intensity at the spherical surface :



- (1) Increase by 128 times
(2) Increase by 8 times
(3) Decrease by 4 times
(4) Decrease by 8 times

Ans. (3)

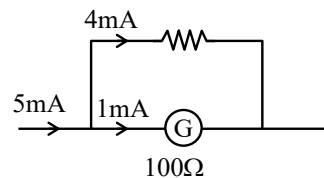
Sol. $V \rightarrow 8V \Rightarrow R \rightarrow 2R \Rightarrow A \rightarrow 4A \Rightarrow I \rightarrow \frac{I_0}{4}$

22. There is a galvanometer of resistance 100Ω and full scale current $I_g = 1\text{mA}$. Find shunt resistance required to increase its range to 5mA :

- (1) 25Ω (2) 0.25Ω
(3) 0.5Ω (4) 1Ω

Ans. (1)

Sol.



$$4 \times r_s = 1 \times G$$

$$r_s = \frac{G}{4} = \frac{100}{4} = 25\Omega$$

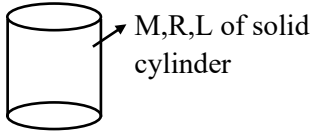


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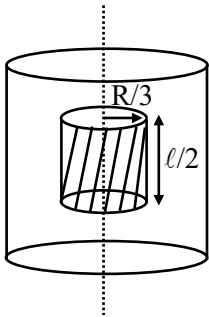
23. A solid cylinder of radius $\frac{R}{3}$ and length $\frac{L}{2}$ is removed along the central axis. Find ratio of Initial moment of inertia and moment of inertia of removed cylinder :



- (1) 162 (2) 158
 (3) 138 (4) 178

Ans. (1)

Sol.



Original mass (M)

The removed mass (m)

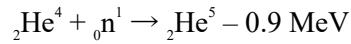
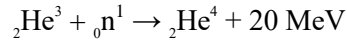
$$m = \rho \times \pi \left(\frac{R}{3}\right)^2 \times \frac{L}{2}$$

$$= \frac{\rho \cdot \pi R^2 L}{18} = \frac{M}{18}$$

$$I' = \frac{1}{2} \cdot \frac{M}{18} \cdot \frac{R^2}{9} = \frac{1}{324} MR^2$$

$$\frac{I}{I'} = \frac{\frac{1}{2} MR^2}{\frac{1}{324} MR^2} = 162$$

24. For given nuclear reactions



X_3 represents stability of ${}_2\text{He}^3$, X_4 represents stability of ${}_2\text{He}^4$ and X_5 represents stability of ${}_2\text{He}^5$. compare the stabilities.

- (1) $X_4 > X_5 > X_3$ (2) $X_4 < X_3 > X_5$
 (3) $X_3 > X_4 > X_5$ (4) $X_4 > X_3 > X_5$

Ans. (1)

Sol. $BE_{\text{He}^4} - BE_{\text{He}^3} = 20 \text{ MeV} \dots(1)$

$$BE_{\text{He}^5} - BE_{\text{He}^4} = -0.9 \text{ MeV} \dots(2)$$

From eq (1) & (2)

$$BE_{\text{He}^4} > BE_{\text{He}^5} > BE_{\text{He}^3}$$



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MEMORY BASED QUESTIONS JEE-MAIN EXAMINATION – JANUARY 2026

(HELD ON WEDNESDAY 28th JANUARY 2026)

TIME : 9:00 AM TO 12:00 NOON

PHYSICS

TEST PAPER WITH SOLUTION

1. Find the ratio of de-Broglie wavelengths of deuteron having energy E and α -particle having energy 2E :

Ans. (2)

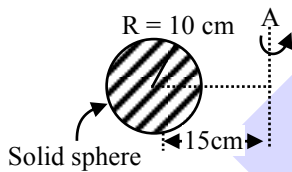
Sol. $\lambda = \frac{h}{\sqrt{2mKE}}$

$$\frac{\lambda_D}{\lambda_\alpha} = \sqrt{\frac{m_\alpha (KE_\alpha)}{m_D (KE_D)}}$$

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

$$\frac{\lambda_D}{\lambda_\alpha} = 2$$

2. As shown in the figure, radius of gyration about the axis shown in \sqrt{n} cm for a solid sphere. Find 'n'.



Ans. (265)

Sol. $I_A = I_{cm} + md^2$
 $= \frac{2}{5}mR^2 + md^2$

$$mk^2 = I_A = m\left[\frac{2}{5}(10)^2 + (15)^2\right]$$

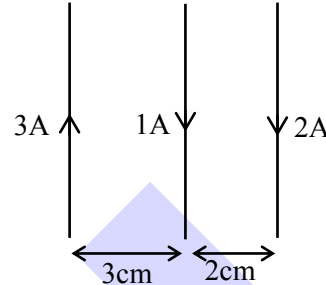
$$k^2 = \left[\frac{2}{5} \times 100 + 225\right]$$

$$k^2 = [40 + 225]$$

$$k = \sqrt{265} \text{ cm}$$

$$n = 265$$

3. Three very long parallel wires carrying current as shown. Find the force acting at 15 cm length of middle wire :



- (1) 1 μ N (2) 6 μ N
 (3) 7 μ N (4) 5 μ N

Ans. (2)

Sol. Force per unit length on middle wire :

$$F_{\text{net}} = \frac{\mu_0(1)(2)}{2\pi \times 2 \times 10^{-2}} + \frac{\mu_0(1)(3)}{2\pi \times 3 \times 10^{-2}}$$

$$= \frac{\mu_0}{2\pi \times 10^{-2}}(1+1)$$

$$= \frac{4\pi \times 10^{-7}}{2\pi \times 10^{-2}} \times 2$$

$$= 4 \times 10^{-5} \text{ N/m}$$

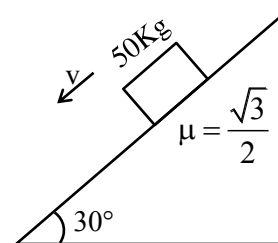
$$\text{For 15 cm length } F = 4 \times 10^{-5} \times 15 \times 10^{-2} \text{ N}$$

$$= 60 \times 10^{-7} \text{ N}$$

$$= 6 \times 10^{-6} \text{ N}$$

$$= 6 \mu\text{N}$$

4. Find external force F so that block can move on inclined plane with constant velocity.



- (1) 125 N (2) 120 N
 (3) 145 N (4) 115 N

Ans. (1)

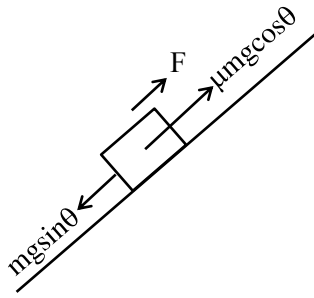


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Sol.



$$mgsin\theta = F + \mu mgcos\theta$$

$$F = mgsin\theta - \mu mgcos\theta$$

$$= 500[\sin 30^\circ - \mu \cos 30^\circ]$$

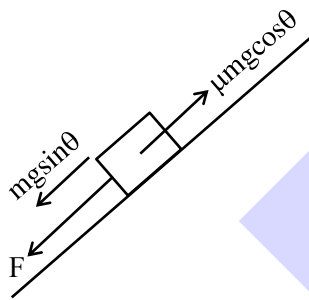
$$= 500 \left[\frac{1}{2} - \frac{\sqrt{3}}{2} \cdot \frac{\sqrt{3}}{2} \right]$$

$$= 500 \left[\frac{1}{2} - \frac{3}{4} \right]$$

$$F = 500 \left[-\frac{1}{4} \right]$$

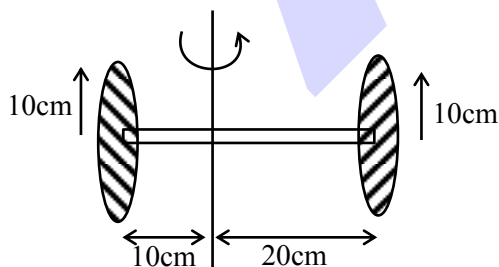
$$F = -125\text{N}$$

$$F = 125\text{N}$$



∴

5. In the system of two discs and a rod of mass 600 g each, a torque of magnitude 43×10^5 dyne-cm is applied along the axis of rotation as shown in figure. Find the approx angular acceleration about given axis :



(1) 11 rad/s^2

(2) 100 rad/s^2

(3) 27 rad/s^2

(4) 22 rad/s^2

Ans. (1)

Sol. $\tau = I_{\text{sys}} \alpha$

$$\tau = (I_{\text{disc1}} + I_{\text{disc2}} + I_{\text{rod}}) \alpha$$

$$\tau = \left(\left(\frac{MR^2}{4} + Md_1^2 \right) + \left(\frac{MR^2}{4} + Md_2^2 \right) + \left(\frac{M\ell^2}{12} + Md_3^2 \right) \right) \alpha$$

$$43 \times 10^5 \times 10^{-7} = \left(\left(\frac{(0.6)(0.1)^2}{4} + (0.6)(0.1)^2 \right) + \left(\frac{(0.6)(0.1)^2}{4} + 0.6(0.2)^2 \right) + \right.$$

$$\left. \left(\frac{(0.6)(0.3)^2}{12} + (0.6)(0.05)^2 \right) \right) \alpha$$

$$43 \times 10^{-2} = ((0.0015 + 0.006) + 0.0015 + 0.024) + (0.0045 + 0.0015) \alpha$$

$$43 \times 10^{-2} = (0.039) \alpha$$

$$\alpha = 11.025 \text{ rad/s}^2$$

6. Focal length of a convex lens in air is $f = 18$ cm. It is immersed in a liquid of refractive index $4/3$. If change in focal length of lens is $\Delta f = nf$, Find n . [Given refractive index of lens is 1.5] :

Ans. 3

Sol. For lens in air,

$$\frac{1}{f} = \left(\frac{\mu_L}{1} - 1 \right) \left[\frac{1}{R_1} - \frac{1}{R_2} \right] = \frac{1}{18}$$

$$\therefore \frac{1}{R_1} - \frac{1}{R_2} = \frac{1}{18} \times 2 = \frac{1}{9}$$

In liquid,

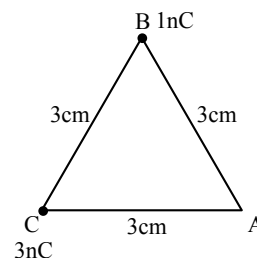
$$\frac{1}{f'} = \left(\frac{\mu_L}{\mu_s} - 1 \right) \left(\frac{1}{R_1} - \frac{1}{R_2} \right) = \left(\frac{1.5 \times 3}{4} - 1 \right) \left(\frac{1}{9} \right) = \frac{1}{8} \times \frac{1}{9}$$

$$\therefore f' = 72 \text{ cm}$$

$$\therefore \Delta f = (72 - 18) \text{ cm} = 54 \text{ cm} = 3 \times 18 \text{ cm}$$

$$\therefore n = 3$$

7. Find work done in bringing charge $q = 3\text{nC}$ from infinity to point A as shown in the figure :



(1) $11 \times 10^{-7} \text{ J}$

(2) $36 \times 10^{-7} \text{ J}$

(3) $12 \times 10^{-7} \text{ J}$

(4) $13 \times 10^{-7} \text{ J}$



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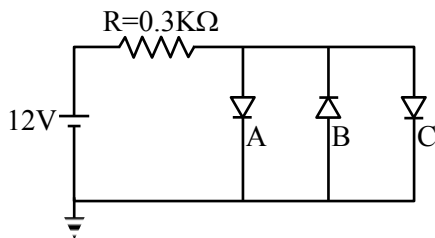
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- $t = 0.2 \rightarrow 2^{\text{nd}}$ ball
- $t = 0.4 \rightarrow 3^{\text{rd}}$ ball
- $t = 0.6 \rightarrow 4^{\text{th}}$ ball
- $t = 0.8 \rightarrow 5^{\text{th}}$ ball
- $t = 1 \rightarrow 6^{\text{th}}$ ball

So, height dropped by 4th ball : $h = \frac{1}{2}g(0.4)^2$
 $= \frac{1}{2} \times 10 \times 0.16 = 0.8 \text{ m}$

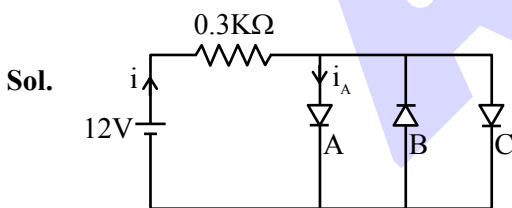
So, height above ground = $5 - 0.8 = 4.2 \text{ m}$

12. Three silicon diodes connected parallel to each other as shown. Forward voltage of diode is 0.7 V. Find current through diode A :



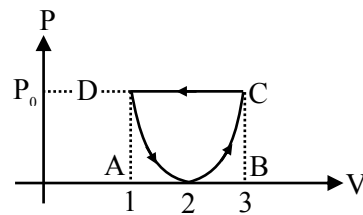
- (1) $\frac{113}{3}$ mA
- (2) $\frac{113}{6}$ mA
- (3) $\frac{113}{9}$ mA
- (4) $\frac{226}{3}$ mA

Ans. (2)



Sol.
 $i = \frac{12 - 0.7}{0.3 \times 10^3} \Rightarrow i = \frac{113}{3} \text{ mA}$
 $i_A = \frac{i}{2} = \frac{113}{6} \text{ mA}$ (Option B is correct)

13. For a gas P-V curve is given as shown in the diagram. Curve path follows equations $(V - 2)^2 = 4aP$. Find work done by gas in given cyclic process.



- (1) $-\frac{1}{3a}$
- (2) $\frac{1}{3a}$
- (3) $\frac{1}{5a}$
- (4) $\frac{1}{2a}$

Ans. (1)

Sol. Work done = Area of parabola

$$= \frac{2}{3} \text{ Area of rectangle ABCD}$$

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

$$= \frac{4P_0}{3}$$

$$V = 1 \Rightarrow (1 - 2)^2 = 4aP_0$$

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

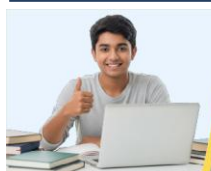
$$= \frac{4}{3} \times \frac{1}{4a}$$

$$\text{Work done by gas} = \frac{-1}{3a}$$

14. An atom ${}^8_3\text{X}$ is bombarded with electrons, neutrons and protons and in 10 sec, 10 electrons, 10 protons and 9 neutrons are absorbed. If final surface area is x% of initial area, find x :- :

- (1) 250%
- (2) 350%
- (3) 225%
- (4) 900%

Ans. (3)



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Sol. $R = R_0 A^{1/3}$

$$\therefore R_{\text{initial}} = R_0 8^{1/3} = 2R_0$$

$$R_{\text{final}} = R_0 27^{1/3} = 3R_0$$

$$\text{Initial surface area} = 4\pi(2R_0)^2$$

$$\text{Final surface area} = 4\pi(3R_0)^2$$

Final area = 225% of initial area.

15. 10kg ice at -10°C & 100kg water at 25°C are mixed together. Find final temperature. (Given $S_{\text{ice}} = \frac{1}{2} \text{ cal/g}^\circ\text{C}$, $L_{\text{fusion}} = 80 \text{ cal/g}$ and $S_{\text{water}} = 1 \text{ cal/g}^\circ\text{C}$)

$$= \frac{1}{2} \text{ cal/g}^\circ\text{C}, L_{\text{fusion}} = 80 \text{ cal/g and } S_{\text{water}} = 1 \text{ cal/g}^\circ\text{C}$$

(1) 15°C

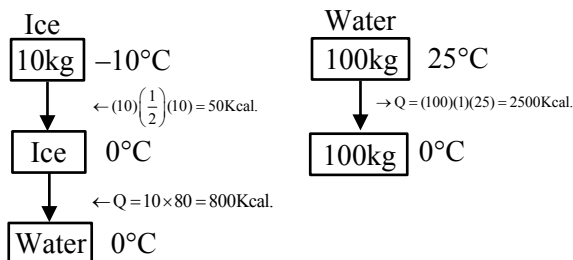
(2) 10°C

(3) 25°C

(4) 20°C

Ans. (1)

Sol.



Whole ice will melt. Let final temperature is T. Net heat conserved.

$$\therefore m_i(0 - (-10)) + m_i L_f + m_i S_w(T - 0) + m_w S_w(T - 25) = 0$$

$$10 \left(\frac{1}{2} \right) (10) + 10 \times 80 + 10(1)(T - 0) + 100(1)(T - 25) = 0$$

$$50 + 800 + 10T + 100T - 2500 = 0$$

$$110T = 2500 - 850$$

$$110T = 1650$$

$$T = \frac{165}{11} = 15^\circ\text{C}$$

Final temperature $T = 15^\circ\text{C}$

16. A particle moves according to the equation $x = A \sin(\omega t)$. The potential energy is maximum at time $t = \frac{T}{2\beta}$, where T is the time period of particle. Find the minimum value of β :

Ans. (2)

Sol. For SHM starting from mean, PE is maximum after T/4 time.

$$\therefore 2\beta = 4 \Rightarrow \beta = 2$$

17. Two wires of cross sectional area 1 cm^2 and 2 cm^2 and lengths 20 cm and 30 cm are connected to the same load. If their extensions are same, find the ratio of their Young's modulus :

(1) $\frac{4}{2}$

(2) $\frac{4}{3}$

(3) $\frac{1}{2}$

(4) $\frac{3}{2}$

Ans. (2)

Sol. $\Delta l_1 = \Delta l_2$

$$\Rightarrow \frac{F l_1}{A_1 Y_1} = \frac{F l_2}{A_2 Y_2}$$

$$\frac{Y_1}{Y_2} = \frac{A_2}{A_1} \times \frac{l_1}{l_2} = \frac{4}{3}$$

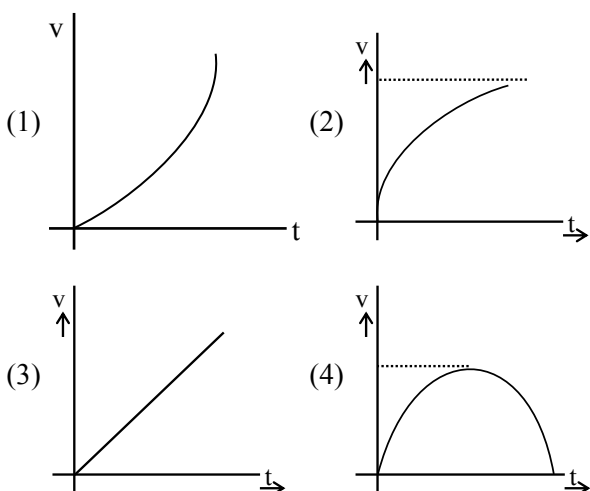
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18. A particle is falling under gravity. Air resistance on particle is $F = -kv$. Find correct option :



Ans. (2)

Sol. $a = g - \frac{kv}{m}$

$$\frac{dv}{dt} = g - \frac{kv}{m} = \frac{gm - kv}{m}$$

$$\int_0^v \frac{dv}{gm - kv} = \int_0^t \frac{1}{m} dt$$

$$\left[-\frac{\ln(gm - kv)}{k} \right]_0^v = \frac{1}{m} t$$

$$\left[-\ln(gm - kv) \right]_0^v = \frac{k}{m} t$$

$$\ln \left[\frac{gm}{gm - kv} \right] = \frac{k}{m} t$$

$$\ln \left[\frac{gm - kv}{gm} \right] = -\frac{k}{m} t$$

$$\ln \left[1 - \frac{kv}{gm} \right] = -\frac{k}{m} t$$

$$\frac{kv}{gm} = \left(1 - e^{-\frac{k}{m} t} \right)$$

$$v = \frac{gm}{k} \left(1 - e^{-\frac{k}{m} t} \right)$$

19. **Statement-1** : Planer wavefronts are incident on a prism, remain planer after passing through prism, but if planer wavefronts are passed through a pin hole then wavefronts may become spherical.

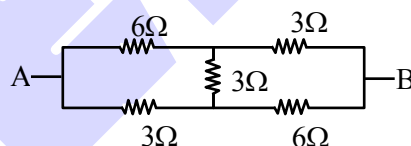
Statement-2 : If slit width is increased then curvature of wave front increases.

- (1) Statement-1 is correct, statement-2 is incorrect.
- (2) Statement-1 is incorrect, statement-2 is correct.
- (3) Both statement are correct.
- (4) Both statement are incorrect.

Ans. (3)

Sol. On increasing width size radius of curvature of wavefront increases and for very large slits it is almost plane.

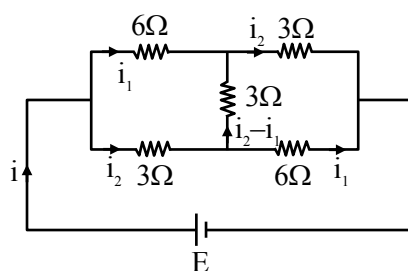
20. If equivalent resistance between points A and B is $\frac{X}{5}$ (in Ω), then find value of X:



- (1) 20
- (2) 25
- (3) 21
- (4) 30

Ans. (3)

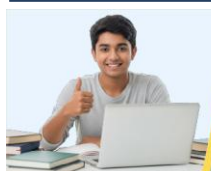
Sol.



$$-3i_2 - 6i_1 + E = 0 \quad \dots(1)$$

$$3(i_2 - i_1) - 6i_1 + 3i_2 = 0 \quad \dots(2)$$

$$6i_2 - 9i_1 = 0 \Rightarrow i_2 = \frac{3}{2} i_1$$



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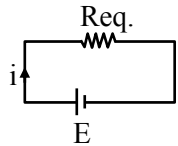
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From (1) $+3\left(\frac{3}{2}i_1\right) + 6i_1 = E$

$i_1 = \frac{2E}{21}, i_2 = E/7$

$\frac{5E}{21} = i = i_1 + i_2$



$i = \frac{E}{Req.} \Rightarrow Req. = \frac{21}{5} = \frac{X}{5}$

Value of X is 21.

21. If nothing is kept between jaws, zero of Vernier scale lies right of 0 cm of main scale and 4th line of Vernier scale matches perfectly with any line of main scale. An object is kept between jaws and zero of Vernier scale crosses 15th division of main scale and 5th division of Vernier scale exactly matches with any line of main scale. (Least count = 0.1 mm and 1 MSD = 1mm). Find dimension of object :

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

Ans. (1)

Sol. Reading = MSR + VSR × LC – Zero error

= 15 mm + 5 × 0.1 mm – 4 × 0.1 mm

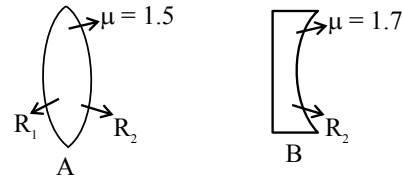
= 15 mm + 0.5 mm – 0.4 mm

Reading = 15.1 mm

Dimension = 15.1 mm

Note : Vernier scale has positive zero error.

22. Two lenses one biconvex and other plano concave have same magnitude of power. The refractive indices of their materials are 1.5 and 1.7 respectively. If the radii of curvature of the lenses are as shown. find the ratio : $\frac{R_1}{R_2}$:



- (1) $\frac{5}{2}$
- (2) $\frac{5}{3}$
- (3) $\frac{5}{4}$
- (4) $\frac{5}{5}$

Ans. (1)

Sol. $\frac{1}{f_A} = (\mu_A - 1) \left[\frac{1}{R_1} - \frac{1}{(-R_2)} \right]$

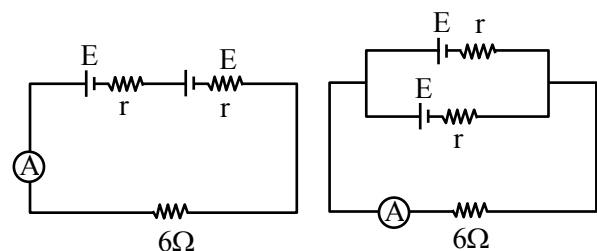
$\frac{1}{f_B} = (\mu_B - 1) \left[\frac{1}{\infty} - \frac{1}{R_2} \right]$

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

$\Rightarrow \frac{0.5}{R_1} = \frac{0.2}{R_2}$

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

23. Figure shows two combinations of real cells with 6Ω internal resistance. If reading of ammeters are same in both cases, find the value of 'r'.



- (1) 6Ω
- (2) 5Ω
- (3) 8Ω
- (4) 12Ω

Ans. (1)



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Sol. In 1st case, $i = \frac{2E}{6+2r}$

In 2nd case, $i = \frac{E}{6+\frac{r}{2}}$

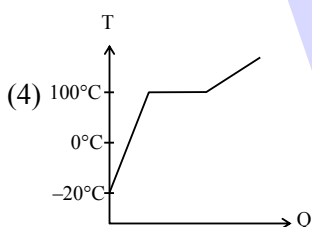
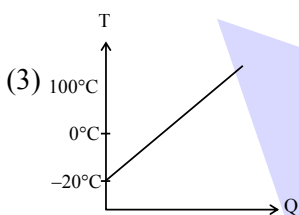
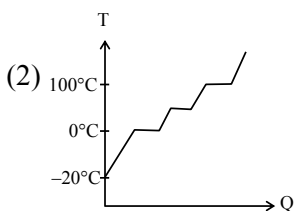
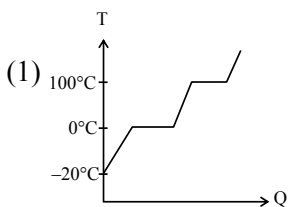
$$\therefore \frac{2E}{6+2r} = \frac{E}{6+r/2}$$

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

$$\Rightarrow 12+r = 6+2r$$

$$\Rightarrow r = 6\Omega$$

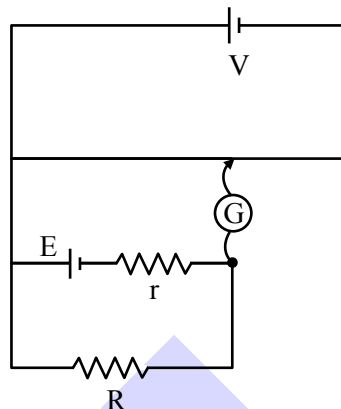
24. Ice is heated from -20°C to 200°C . Which of the following temperature (T) vs heat (Q) graph is correct ?



Ans. (1)

Sol. Theoretical

25. For the given circuit, if $R = 12\Omega$, balancing length is 180 cm. When value of R is 4Ω , then balancing length is 120 cm. Find internal resistance of cell E.



(1) 2Ω

(2) 5Ω

(3) 4Ω

(4) 1Ω

Ans. (3)

Sol. Let potential gradient of potentiometer wire be λ .

\therefore In 1st case

$$12 i_1 = 180 \lambda = E - i_1 r \Rightarrow E - 15\lambda r = 180\lambda \dots(1)$$

In 2nd case

$$4 i_2 = 120 \lambda = E - i_2 r \Rightarrow E - 30\lambda r = 120\lambda \dots(2)$$

From (1) and (2)

$$r = 4\Omega$$



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MEMORY BASED QUESTIONS JEE-MAIN EXAMINATION – JANUARY 2026

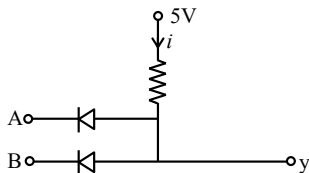
(HELD ON WEDNESDAY 28th JANUARY 2026)

TIME : 3:00 PM TO 6:00 PM

PHYSICS

TEST PAPER WITH SOLUTION

1. For the circuit below, identify the logic gate :



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

Ans. (1)

Sol. $V_y = 5 - ir$

For high voltage at A and B diodes will not conduct & output will be high.

For either high input output will be small so it must be AND.

2. Measurement taken with Vernier calliper are as follows 1.21, 1.23, 1.24, 1.20 mm. What can be the least count of Vernier Calliper?

- (1) 0.1 mm (2) 0.01 mm
(3) 0.001 mm (4) 0.0001 mm

Ans. (2)

Sol. Least count will be 0.01 mm.

3. The minimum deviation produced by a prism is equal to refracting angle of prism, then choose the range of refractive index (μ) of material of prism :

- (1) $1 < \mu < \sqrt{2}$ (2) $1 < \mu < 2$
(3) $1 < \mu < 2\sqrt{2}$ (4) $1 < \mu < \sqrt{3}$

Ans. (1)

Sol. $\delta_{\min} = 2i - A \Rightarrow i = \frac{\delta_{\min} + A}{2}$

$$i_{\max} = \frac{\pi}{2} \Rightarrow A_{\max} = \frac{\pi}{2}$$

$$\text{Also, } \mu = \frac{\sin\left(\frac{\delta_{\min} + A}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

$$\Rightarrow \mu = \frac{\sin A}{\sin \frac{A}{2}} = 2 \cos\left(\frac{A}{2}\right)$$

$$\therefore \mu_{\max} = 2 \cos\left(\frac{\pi}{4}\right) \cdot \sqrt{2}$$

$$\mu_{\min} = 1$$

4. (I) Gauss Law is defined for inverse square of distance forces.

(II) Work done by uniform electric field on a charge moving in a circle is zero.

(III) Electric field of a point-charge forms concentric circle around it.

(IV) Electric field line forms closed loop.

Choose correct option(s).

- (1) 1,2 (2) 1,3 (3) 3,4 (4) 1,4

Ans. (1)

Sol. (I) Gauss law is valid for $\frac{1}{r^2}$ force.

(II) Electric force is conservative force.

(III) Electric field due to point charge is radial nature.

(IV) Electric field line does not forms closed loop.

5. If position vector is given as $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ and if its signs are reversed then which of the following physical quantity remains unaffected?

- (1) Velocity
(2) Displacement
(3) Acceleration
(4) Torque

Ans. (4)

Sol. $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$

$$\vec{a} = \frac{d^2\vec{r}}{dt^2} = a_x\hat{i} + a_y\hat{j} + a_z\hat{k}$$

$$\vec{F} = m\vec{a}$$

$$\vec{\tau} = \vec{r} \times \vec{F}$$

$$= (x\hat{i} + y\hat{j} + z\hat{k}) \times m(a_x\hat{i} + a_y\hat{j} + a_z\hat{k})$$

$$\vec{\tau} = m(ya_z - za_y)\hat{i} + (xa_z - za_x)\hat{j} + (xa_y - ya_x)\hat{k}$$

When sign of \vec{r} change so x, y, z, a_x, a_y, a_z changes but $\vec{\tau}$ constant.



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6. Find number of photons emitted per second by a light source of wavelength 663 nm at power 6 mW. If $h = 6.63 \times 10^{-34}$ J-sec is $N \times 10^{15}$ then find N.

Ans. (2)

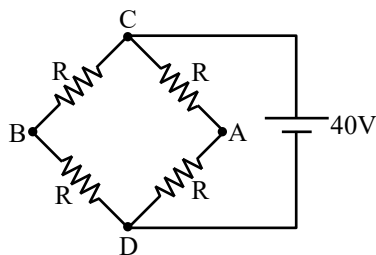
Sol. $P = \frac{nhc}{\lambda}$

$$6 \times 10^{-3} = \frac{n \times 1240}{663} \times 1.6 \times 10^{-19}$$

$$n = 2 \times 10^{15} \text{ photons}$$

$$N = 2$$

7.

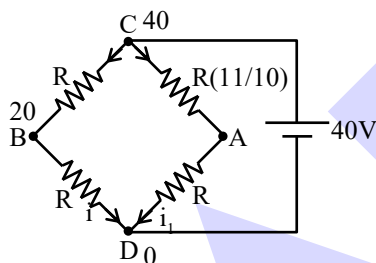


If resistance between A & C is increased by 10% through heating, then calculate $|V_A - V_B|$.

- (1) $\frac{10}{21}$ (2) $\frac{5}{21}$ (3) $\frac{20}{21}$ (4) $\frac{5}{7}$

Ans. (3)

Sol.



$$i_1 = \frac{40}{21R} = \frac{400}{21R}$$

$$V_A - V_D = \frac{400}{21R} \times R = \frac{400}{21}$$

$$|V_A - V_B| = \left(\frac{400}{21} - 20 \right)$$

$$= \left| \frac{400 - 420}{21} \right| = \left| \frac{20}{21} \right|$$

8. Match the following as per dimensional formula.

(1)	Pressure	(P)	$M^1L^{-1}T^{-1}$
(2)	Coefficient of viscosity	(Q)	$M^1L^0T^{-2}$
(3)	Surface Tension	(R)	$M^1L^{-1}T^{-2}$
(4)	Surface energy	(S)	$M^1L^2T^{-2}$

(1) 1-R, 2-P, 3-Q, 4-S

(2) 1-S, 2-Q, 3-R, 4-S

(3) 1-R, 2-P, 3-S, 4-Q

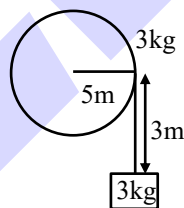
(4) 1-S, 2-Q, 3-Q, 4-S

Ans. (1)

9. Block of mass 3 kg is connected to a flywheel of mass 3 kg and radius 5m through a massless string wrapped around the flywheel. Find kinetic energy (in J) of flywheel when block descends by 3m.

Ans. (30)

Sol.



$$mg \times 3 = \frac{1}{2} \cdot \frac{mR^2}{2} \omega^2 + \frac{1}{2} mv^2$$

$$\& v = \omega R$$

$$= g \times 3 = \frac{3}{4} \cdot v^2$$

$$\text{KE of flywheel} = \frac{1}{2} \cdot \frac{MR^2}{2} \cdot \omega^2 = \frac{1}{4} Mv^2$$

$$= \frac{1}{4} \times 3 \times 40 = 30 \text{ Joule}$$

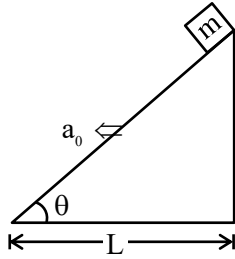


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10. Find time taken by the block to reach to the bottom



(1) $\left[\frac{4L}{\cos\theta(g\sin\theta - a_0 \cos\theta)} \right]^{1/2}$

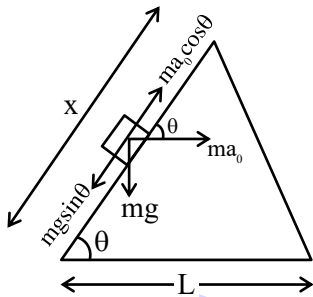
(2) $\left[\frac{2L}{\cos\theta(g\sin\theta - a_0 \cos\theta)} \right]^{1/2}$

(3) $\left[\frac{8L}{\cos\theta(g\sin\theta - a_0 \cos\theta)} \right]^{1/2}$

(4) $\left[\frac{L}{\cos\theta(g\sin\theta - a_0 \cos\theta)} \right]^{1/2}$

Ans. (2)

Sol.



$$a_{\text{down}} = \frac{mg\sin\theta - ma_0 \cos\theta}{m}$$

$$a_{\text{down}} = g\sin\theta - a_0 \cos\theta$$

$$x = ut + \frac{1}{2} a_{\text{down}} t^2$$

$$x = ut + \frac{1}{2} a_{\text{down}} t^2$$

$$\left[\frac{2L}{\cos\theta(g\sin\theta - a_0 \cos\theta)} \right]^{1/2} = t$$

= time to reach bottom standing from rest.

11. Mass number of a nucleus is α and its radius is R_α . Radius of other nucleus of mass number β is R_β . If $\beta = 8\alpha$ then $\frac{R_\alpha}{R_\beta}$?

- (1) $\frac{1}{4}$ (2) $\frac{1}{2}$ (3) $\frac{1}{8}$ (4) 2

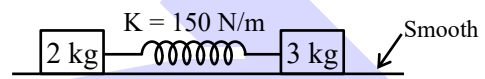
Ans. (2)

Sol. $R_\alpha = R_0 \alpha^{1/3}$

$R_\beta = R_0 \beta^{1/3}$

$$\frac{R_\alpha}{R_\beta} = \left(\frac{\alpha}{\beta} \right)^{1/3} = \frac{1}{2}$$

12. System is released after slightly stretching it. Find angular frequency of its oscillations :

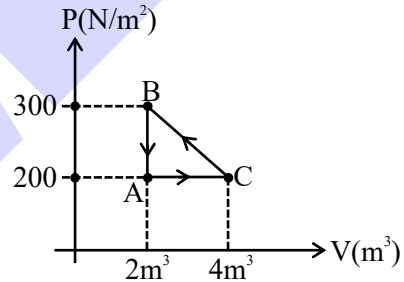


- (1) 5 (2) $10\sqrt{5}$
 (3) $2\sqrt{5}$ (4) $5\sqrt{5}$

Ans. (4)

Sol. $\omega = \sqrt{\frac{k}{\mu}} = \sqrt{\frac{150}{6/5}} = 5\sqrt{5}$

13. Find work done by gas in cyclic process :



- (1) 100 J (2) -100 J
 (3) 200 J (4) -200 J

Ans. (2)

Sol. $w_{AC} = P_A(\Delta V) = P_A(V_C - V_A)$

$$w_{AC} = (200)(4 - 2) = 400 \text{ Joule}$$

$$w_{CB} = \frac{1}{2}(P_C + P_B)(V_B - V_C)$$

$$w_{CB} = -\frac{1}{2}(300 + 200)(2) = -\frac{500}{2} \times 2 = -500 \text{ Joule}$$

$$w_{BA} = P\Delta V = 0$$

$$w_{\text{Net}} = w_{AC} + w_{CB} + w_{BA}$$

$$w_{\text{Net}} = 400 - 500 + 0 = -100 \text{ Joule}$$



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14. Consider the following electromagnetic waves :
 wave A :- wavelength = 400 nm
 wave B :- frequency = 10^{16} Hz
 wave C :- wave number = 10^4 cm^{-1}
 order of energies is :

- (1) $A > B > C$ (2) $C > B > A$
 (3) $B > A > C$ (4) $C > A > B$

Ans. (3)

Sol. $\lambda_A = 400 \text{ nm} = 4 \times 10^{-7} \text{ m}$

$$\lambda_B = \frac{3 \times 10^8}{10^{16}} = 3 \times 10^{-8} \text{ m}$$

$$\lambda_C = 10^{-6} \text{ m}$$

$$\therefore E = \frac{hc}{\lambda} \Rightarrow \lambda \uparrow E \downarrow$$

15. Electric field of an EM wave is given as $\vec{E} = 54 \sin(kz - \omega t) \hat{i}$. Then what will be its corresponding magnetic field ?

- (1) $18 \times 10^{-8} (kz - \omega t) \hat{j}$
 (2) $162 \times 10^8 \sin(kz - \omega t) \hat{j}$
 (3) $18 \times 10^{-8} \sin(\omega t - kz) \hat{j}$
 (4) $54 \times 10^{-8} \sin(kz - \omega t) \hat{i}$

Ans. (1)

Sol. $\hat{B} = \hat{C} \times \hat{E} = \hat{k} \times \hat{i} = \hat{j}$

$$\therefore \vec{B} = \frac{54}{3 \times 10^8} \sin(kz - \omega t) \hat{j}$$

$$= 18 \times 10^{-8} \sin(kz - \omega t) \hat{j}$$

16. Time period of a spring-block system is given by $T = 2\pi \sqrt{\frac{m}{k}}$. If mass of the block is given by

$m = 10\text{g} \pm 10\text{mg}$ and time period is measured using stopwatch having least count of 2 sec and was found to be 60 sec for 50 oscillations, then the % error in measurement of 'k'.

- (1) 5.6% (2) 6.8% (3) 7.7% (4) 5.9%

Ans. (2)

Sol. $\frac{\Delta K}{K} = \frac{2\Delta T}{T} + \frac{\Delta m}{m}$

$$T = \frac{60}{50} = 1.2 \text{ sec}$$

$$\Delta T = \frac{1}{30} \text{ sec} \times 1.2$$

$$\therefore \frac{\Delta K}{K} = \frac{2 \times 1 \times 1.2}{30 \times 1.2} + \frac{10 \times 10^{-3}}{10} = 0.068$$

$$\therefore \% \text{ Error} = 6.8\%$$

17. For particle moving in x direction according to

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