

JEE (MAIN) 2025

.....
MEMORY BASED QUESTIONS & TEXT SOLUTION

SHIFT-2

DATE & DAY: 02nd April 2025 & Wednesday

PAPER-1

Duration: 3 Hrs.

Time: 03:00 PM – 06:00 PM

SUBJECT: PHYSICS

Selections in JEE (Advanced)/
IIT-JEE Since 2002

52395

Selections in JEE (Main)/
AIEEE Since 2009

257576

Selections in NEET (UG)/
AI/PMT/AIIMS Since 2012

22494

Admission Open for 2025-26

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PART : PHYSICS

1. The moment of inertia of a ring of mass m and diameter R about an axis passing through tangential point in the plane of ring

(1) $\frac{3MR^2}{8}$

(2) $\frac{MR^2}{8}$

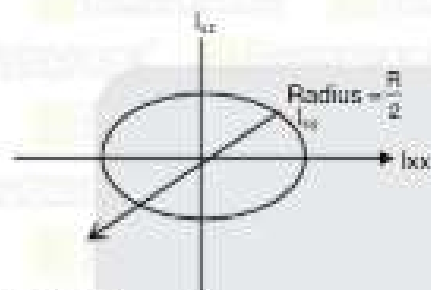
(3) $\frac{MR^2}{4}$

(4) $\frac{3MR^2}{4}$

Ans.

(1)

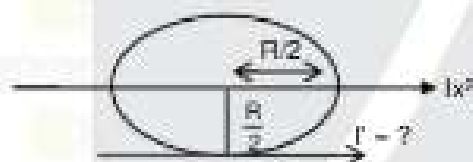
Sol.



$$I_{xx} = I_{xx} + I_{yy}$$

$$M\left(\frac{R}{2}\right)^2 = 2I_{xx}$$

$$I_{xx} = \frac{MR^2}{8}$$



$$I' = \frac{MR^2}{8} + M\left(\frac{R}{2}\right)^2$$

$$= \frac{MR^2}{8} + \frac{MR^2}{4}$$

$$I' = \frac{3MR^2}{8} \text{ Ans.}$$

2. A disc of mass M and radius 0.2 m is hinged keeping axis horizontal. If angular acceleration of disc is 2 rad/s^2 . Find moment of inertia ?

(1) 1

(2) 2

(3) 3

(4) 4

Ans.

(1)

Sol.

$$\tau = r \times F$$

$$\tau = r F \sin 90^\circ$$

$$\tau = 0.2 \times 10 = 2$$

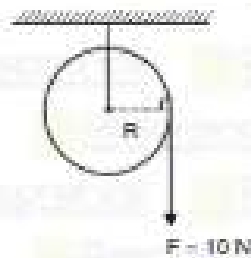
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$$\therefore \tau = I\alpha$$

$$I = \frac{\tau}{\alpha} = \frac{2}{2}$$

$$I = 1 \text{ kg/m}^2$$

3. What is the dimensional formula of $\frac{1}{\mu_0 \epsilon_0}$ (where μ_0 is permeability and ϵ_0 is permittivity of free space)

(1) LT^{-1}

(2) $L^2 T^{-2}$

(3) MLT^{-1}

(4) $ML^2 T^{-2}$

Ans.

(2)

Sol.

$$c = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$$

c is speed of light

$$c^2 = \frac{1}{\mu_0 \epsilon_0}$$

$$[LT^{-1}]^2 = \frac{1}{\mu_0 \epsilon_0}$$

$$L^2 T^{-2} = \frac{1}{\mu_0 \epsilon_0}$$

Ans.

4. An equilateral prism is made of a material of refractive index $\sqrt{2}$. Find angle of incidence for minimum deviation

(1) 60°

(2) 30°

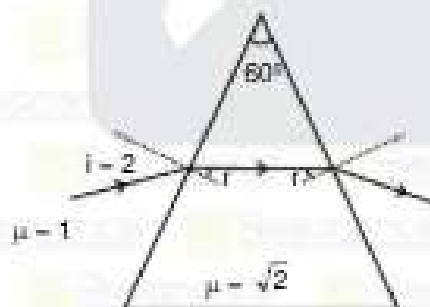
(3) 37°

(4) 45°

Ans.

(4)

Sol.



Prism property $r_1 + r_2 = A$

$$r + r = 60^\circ$$

$$2r = 60^\circ$$

$$r = 30^\circ$$

Snell's rule

$$\mu_1 \sin i = \mu_2 \sin r$$

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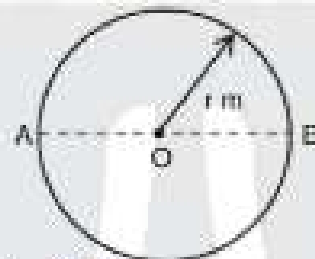
$$\perp \sin i = \sqrt{2} \sin 30^\circ$$

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

$$\sin i = \frac{1}{\sqrt{2}}$$

$$i = 45^\circ$$

5. A particle moves on a circular path of radius r . Find its displacement when it moves from $A \rightarrow B \rightarrow A \rightarrow B$. Also its distance are it moves from $A \rightarrow B \rightarrow A \rightarrow B \rightarrow A$



(1) Distance = $2r$ m Displacement = $4\pi r$ m

(2) Distance = $2r$ m Displacement = $5\pi r$ m

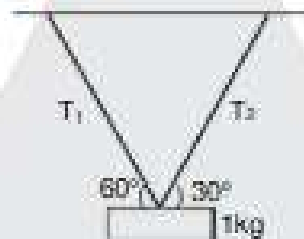
(3) Distance = $4\pi r$ m Displacement = $2r$ m

(4) Distance = $5\pi r$ m Displacement = $2r$ m

Ans.

(3)

6. If object A is in equilibrium find ratio T_1 / T_2 .



(1) $\sqrt{2}$

(2) 2

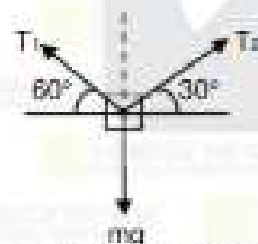
(3) 3

(4) $\sqrt{3}$

Ans.

(4)

Sol.



$$T_1 \cos 60^\circ = T_2 \cos 30^\circ$$

$$T_1 \times \frac{1}{2} = T_2 \frac{\sqrt{3}}{2}$$

$$T_1 = T_2 \sqrt{3} \quad \dots\dots\dots (i)$$

$$\frac{T_1}{T_2} = \sqrt{3}$$

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7. A solenoid having area A and length l is filled with a material having relative permeability 2. The magnetic energy stored in the solenoid is

(1) $\frac{B^2 A l}{\mu_0}$ (2) $\frac{B^2 A l}{4\mu_0}$ (3) $B^2 A l$ (4) $\frac{B^2 A l}{2\mu_0}$

Ans. (2)

Sol. Energy density $\frac{U}{V} = \frac{B^2}{2\mu_0 \mu_r}$

Energy stored in the solenoid $U_0 = \frac{B^2 V}{2\mu_0 \mu_r} = \frac{B^2 A l}{2\mu_0 \cdot 2} = \frac{B^2 A l}{4\mu_0}$

8. Two identical drops of radius R and surface tension ' T ' collapse to form a bigger drop. The change in surface energy in this process is :

(1) $4\pi R^2 T [1 - 2^{-1/3}]$ (2) $8\pi R^2 T [1 + 2^{1/3}]$ (3) $4\pi R^2 T [1 + 2^{1/3}]$ (4) $4\pi R^2 T [2^{2/3} - 2]$

Ans. (4)

Sol. $U_i = 4\pi R^2 T \times 2$

$\therefore 2R + 3 = R^2$

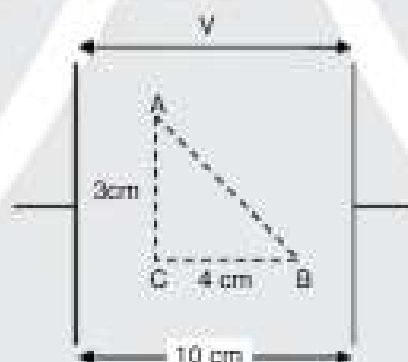
$2^{2/3} R = R^2$

$U_f = 4\pi 2^{2/3} R^2 T$

$U_f - U_i = 4\pi R^2 T (2^{2/3} - 2)$

$\Delta U = 4\pi R^2 T (2^{2/3} - 2)$

9. The figure shows the plates of a parallel plate capacitor with a separation 10 cm and charged to a potential difference V . Find the potential difference between B and A ?



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

Ans. (1)

Sol. $dv = -E \cdot dr$

$\Delta v = E \Delta r$ ($\Delta r = 4$ cm)

$[V_{CB}] = E \times 4$ cm (1)

$v = E \times 10$ cm

$E = \frac{V}{10 \text{ cm}}$ (2)

from equation (1) & equation (2)

$[V_{CB}] = \frac{V}{10 \text{ cm}} \times 4$

$[V_{CB}] = \frac{2V}{5}$

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10. Find dimension of momentum in term of current, charge and magnetic permeability volume

(1) $p = q^2 \mu_0$

(2) $p = q \mu_0$

(3) $p = q \mu_0^2$

(4) $p = q \mu_0^3$

Ans. (1)

Sol. $p = mv$ magnetic permeability of value

$$p = (q)^n (I)^a (\mu_0)^c$$

$$B = \frac{\mu_0 I}{2R} = \frac{F}{q v}$$

$$\mu_0 = \frac{R}{I} \times \frac{m v}{q \times R} = \frac{m R}{q^2}$$

$$MLT^{-1} = q^n I^a \left(\frac{m R}{q^2} \right)^c$$

$$a = 2$$

$$b = 0$$

$$c = 1$$

$$p = q^2 \mu_0$$

11. Two galvanometer G_1 and G_2 are having resistors $R_1 = 50\Omega$ and $R_2 = 70\Omega$ number of turns $N_1 = 21$, $N_2 = 15$ magnetic fields $B_1 = 0.25\text{ T}$, $B_2 = 0.5\text{ T}$ and area of coil $A_1 = 36 \times 10^{-3}\text{ cm}^2$ and $A_2 = 1.8 \times 10^{-3}\text{ cm}^2$. Find the ratio of their voltage sensitivity (same spring in both)

(1) $\frac{49}{25}$

(2) $\frac{7}{5}$

(3) $\frac{5}{7}$

(4) $\frac{49}{20}$

Ans. (1)

Sol. $V_s = \frac{\theta}{i g R_g}$

$$\tau = c d = B i N A$$

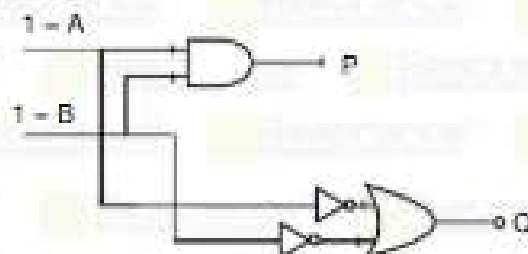
$$\frac{\theta}{i} \propto B N A$$

$$V_s \propto \frac{B N A}{R_g}$$

$$\frac{V_{s1}}{V_{s2}} = \frac{B_1}{B_2} \times \frac{N_1}{N_2} \times \frac{A_1}{A_2} \times \frac{R_2}{R_1}$$

$$= \frac{0.25}{0.5} \times \frac{21}{15} \times \frac{3.6}{1.8} \times \frac{7}{5} = \frac{1}{2} \times \frac{7}{5} \times 2 \times \frac{7}{5} = \frac{49}{25}$$

12. Find the output P and Q for a given logic gate.
 Find P & Q ?



(1) $P = 1, Q = 0$

(2) $P = 1, Q = 1$

(3) $P = 0, Q = 0$

(4) $P = 0, Q = 1$

Ans. (1)

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Sol. $P = 1$ $Q = 0$
 $P = 1$
 $Q = 0$

13. If a ring of radius $\sqrt{2}R$. At what distance from centre electric field is maximum.

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

Ans. (1)

Sol. $E = \frac{KQx}{(R^2 + x^2)^{3/2}}$

$$\frac{dE}{dx} = 0$$

$$\Rightarrow x = \frac{R}{\sqrt{2}} = \frac{R\sqrt{2}}{\sqrt{2}} = R$$

14. If a cubed of $4 \times 4 \times 3$ cm, pressure is 1 atm. Find internal energy of air consider air to be diatomic

- (1) 6 J (2) 12 J (3) 24 J (4) 3 J

Ans. (2)

Sol. $U = \frac{f}{2} nRT$

$$= \frac{f}{2} pV$$

$$= \frac{5}{2} 10^5 \times 4 \times 4 \times 3 \times 10^{-6}$$

$$= 120 \times 10^{-1} = 12J \quad \text{Ans.}$$

$$f = 5$$

$$V = 4 \times 4 \times 3 \text{ cm}^3$$

$$p = 1 \text{ atm}$$

15. Kinetic Energy (KE) of satellite at height 270 km

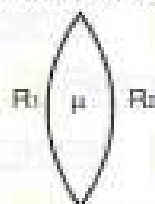
Sol. $KE = \frac{GMM_e}{2r} = \frac{gR^2m_s}{2r}$

$$r = R + h$$

$$h = 270 \text{ km}$$

$$R = 6400 \text{ km}$$

16. Find which option results in same 'I' as shown in the figure. If μ is same (R_1 & R_2 are in SI unit)



(1) $R_1 = 6$, $R_2 = \frac{1}{6}$ and $R_1 = 8$, $R_2 = \frac{1}{8}$

(2) $R_1 = 6$, $R_2 = \frac{1}{6}$ and $R_1 = \frac{1}{6}$, $R_2 = 6$

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

(4) None of these

Ans. (1)

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Sol. $\frac{1}{r} = (\mu - 1) \left(\frac{1}{R_1} + \frac{1}{R_2} \right)$

$\frac{1}{R_1} + \frac{1}{R_2}$ = same only in option (2)

17. Match the list-I with the list -II

- | | |
|-----------------------------|--------------------------------------|
| (i) Heat capacity | (a) $\text{J kg}^{-1} \text{K}^{-1}$ |
| (ii) specific heat capacity | (b) JK^{-1} |
| (iii) latent heat | (c) $\text{wm}^{-1} \text{K}^{-1}$ |
| (iv) thermal conductivity | (d) Jkg^{-1} |

(1) (i) $\rightarrow$ b, (ii) $\rightarrow$ d, (iii) $\rightarrow$ c, (iv) $\rightarrow$ a

(2) (i) $\rightarrow$ b, (ii) $\rightarrow$ a, (iii) $\rightarrow$ c, (iv) $\rightarrow$ a

(3) (i) $\rightarrow$ b, (ii) $\rightarrow$ c, (iii) $\rightarrow$ d, (iv) $\rightarrow$ a

(4) (i) $\rightarrow$ b, (ii) $\rightarrow$ a, (iii) $\rightarrow$ d, (iv) $\rightarrow$ c

Ans. (4)

Sol. (i) $m_s = \frac{\Delta Q}{\Delta \theta} = \text{J /}^\circ\text{C or J/K} \rightarrow$ (b)

(ii) $S = \frac{\Delta Q}{m \Delta \theta} = \frac{\text{J}}{\text{kg} \times \text{K}} \rightarrow$ (a)

(iii) $L = \frac{\Delta Q}{m} = \frac{\text{J}}{\text{kg}} \rightarrow$ (d)

(iv) $H = KA \frac{\Delta \theta}{l}$

$k = \frac{H \times l}{A \times \Delta \theta} = \frac{\text{J/S} \times \text{m}}{\text{m}^2 \times ^\circ\text{C}}$

$= \frac{\text{J}}{\text{s} \times \text{m}^2 \times ^\circ\text{C}} = \frac{\text{W}}{\text{m} \times \text{K}}$

18. Find radius of Li^{+2} is terms of a_0 in ground state

(1) $a_0 \times \frac{1}{2}$

(2) $a_0 \times \frac{1}{4}$

(3) $a_0 \times \frac{1}{3}$

(4) $a_0 \times \frac{1}{3}$

Ans. (4)

Sol. $r = a_0 \times \frac{n^2}{z}$

$n = 1$

$z = 3$

$r = a_0 \times \frac{1}{3}$

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