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JEE (MAIN) 2025

MEMORY BASED QUESTIONS & TEXT SOLUTION

SHIFT-1

DATE & DAY: 28th January 2025 & Tuesday

PAPER-1

Duration: 3 Hrs.
Time: 09:00 – 12:00 IST

SUBJECT: PHYSICS

Selections in JEE (Advanced)/ IIT-JEE Since 2002	Selections in JEE (Main)/ AIEEE Since 2009	Selections in NEET (UG)/ AIPMT/AIIMS Since 2013
52395	257576	22494

PART : PHYSICS

1. Which of the following reaction is correct :

(1) ${}_0n^1 \rightarrow {}_1p^1 + {}_{-1}\beta^0 + \bar{\nu}$ (2) ${}_0n^1 \rightarrow {}_1p^1 + {}_{-1}\beta^0 + \nu$

(3) ${}_1p^1 \rightarrow {}_0n^1 + {}_{-1}\beta^0 + \bar{\nu}$ (4) ${}_0n^1 \rightarrow {}_1p^1 + {}_{-1}\beta^0 + \nu$

Ans. **(1)**

Sol. ${}_0n^1 \rightarrow {}_1p^1 + {}_{-1}\beta^0 + \bar{\nu}$

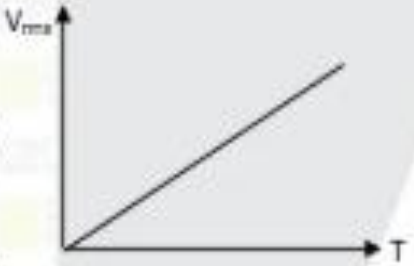
neutron decays into proton and electron and antineutrino also emits along with electron

2. The graph between root mean square speed with the absolute temperature will be :

(1)

(2)

(3)



(4)

Ans. **(2)**

Sol. $V_{rms} = \sqrt{\frac{3RT}{M_w}} \Rightarrow V_{rms} \propto T^{1/2}$

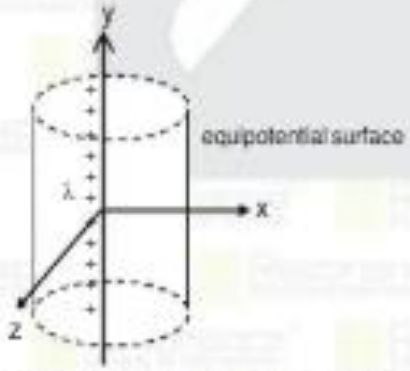
3. A uniform wire of linear charge density λ is placed along y-axis. The locus of equipotenti

(1) $x^2 + y^2 + z^2$ = constant (2) $x^2 + z^2$ = constant

(3) xyz = constant (4) xy + yz + xz = constant

Ans. **(2)**

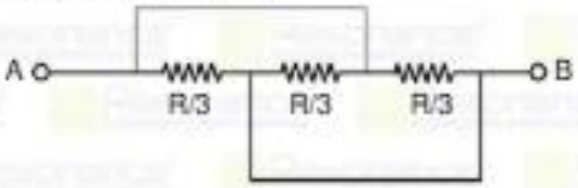
Sol.



locus of equipotential surface will be cylinder in x – z plane

$x^2 + z^2$ = constant

4. Find the equivalent resistance across A and B.

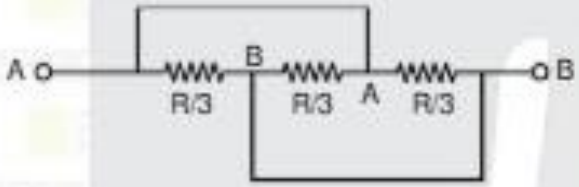


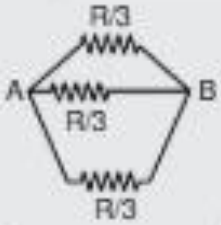
(1) R (2) R/6 (3) R/3 (4) R/9

Ans. (4)

Sol. All three resistance in parallel

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$





$$\frac{1}{R_{eq}} = \frac{1}{\frac{R}{3}} + \frac{1}{\frac{R}{3}} + \frac{1}{\frac{R}{3}}$$

$$\frac{1}{R_{eq}} = \frac{3}{R} + \frac{3}{R} + \frac{3}{R}$$

$$\frac{1}{R_{eq}} = \frac{9}{R}$$

$$\frac{1}{R_{eq}} = \frac{R}{9}\Omega$$

5. Two disc of radius R and 2R having moment of Inertia I_1 & I_2 respectively about centre of di

[Given: Mass density of both disc is same] Find out $\left(\frac{I_1}{I_2}\right)$.

(1) $\frac{1}{16}$ (2) $\frac{1}{8}$ (3) $\frac{1}{2}$ (4) $\frac{1}{4}$

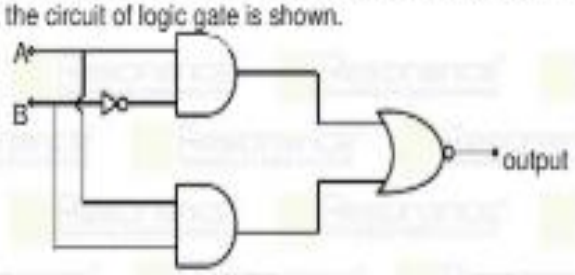
Ans. (1)

Sol. $I_1 = \frac{1}{2}M_1R_1^2 = \frac{1}{2} \times \left(\pi R_1^2 \rho\right) \times R_1^2$

$I_2 = \frac{1}{2}M_1R_2^2 = \frac{1}{2} \times \left(\pi R_2^2 \rho\right) \times R_2^2$

$$\frac{I_1}{I_2} = \left(\frac{R_1}{R_2}\right)^4 = \left(\frac{1}{2}\right)^4 = \frac{1}{16}$$

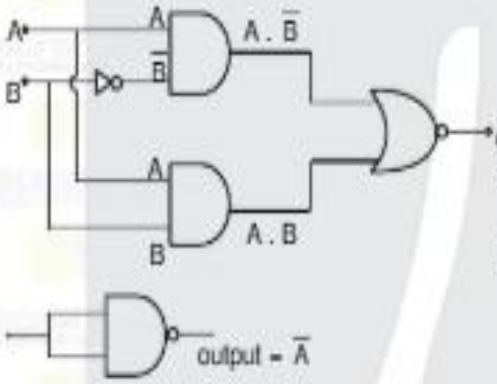
6. In the diagram, the circuit of logic gate is shown.



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

Ans. **(1)**

Sol.



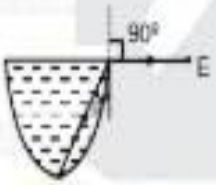
$$\text{output} = \overline{A.\overline{B} + A.B}$$
$$= \overline{A(B+\overline{B})} = \overline{A}$$
$$= \overline{A}$$

7. A coin placed at the bottom of a hemispherical container filled with a liquid of refractive index μ. Find the least refractive index if the coin is visible to an observer at E.

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

Ans. **(2)**

Sol.



$\mu \sin\theta = 1 \times \sin 9i$

$$\mu = \frac{1}{\sin\theta} = \frac{1}{\sin 45^\circ} = \sqrt{2}$$

8. In YDSE experiment when light of wavelength $\lambda_1 = 660$ nm is used, 10 maxima are observed at a distance 10 mm from geometrical centre, Now if light of wavelength $\lambda = 600$ nm is used then Find which order maxima is located at the same point

(1) 9 (2) 10 (3) 11 (4) 15

Ans. **(3)**

Sol. $y = 10\beta = 10 \times \frac{\lambda D}{d}$

$n_1\lambda_1 = n_2\lambda_2$

$\frac{10 \times 660}{600} = n_2$

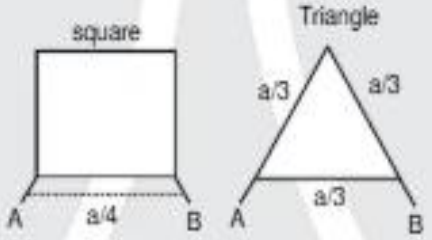
$n_2 = 11$

9. **Statement -1 :** Work done by central force is independent of path
Statement -2 : Potential energy does not associated with every force.
(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True

Ans. **(2)**

Sol. Watch Video Solution

10. In the given figure, the square and the triangle have same resistance per unit length. Find the ratio of their resistance about adjacent corners as shown



(1) $\frac{32}{27}$ (2) $\frac{27}{32}$ (3) $\frac{8}{9}$ (4) $\frac{9}{8}$

Ans. **(2)**

Sol. Resistance per unit length = λ.

$R_{square} = \frac{\left(\frac{3a}{4}\lambda\right)\left(\frac{a\lambda}{4}\right)}{a\lambda}$

$R_{square} = \frac{3}{16}a\lambda$ .....(1)

$R_{triangle} = = \frac{\left(\frac{2a}{3}\lambda\right)\left(\frac{\lambda a}{3}\right)}{a\lambda}$

$R_{triangle} = \frac{2}{9}a\lambda$ ....(2)

$\frac{R_{square}}{R_{triangle}} = \frac{\left(\frac{3a}{16}\right)a\lambda}{\left(\frac{2}{9}\right)a\lambda} = \frac{27}{32}$

11. The length of sheet is l = 5 mm, width b = 2.5 mm, measured by screw gauge. Number of division on circular scale is 15 and pitch is 0.75 mm. If fractional error in calculation of area of rectangular sheet is $\frac{x}{100}$, find x

Ans. **03.00**

Sol. $LC = \frac{P}{N} = \frac{0.75}{15} = .05\ mm$

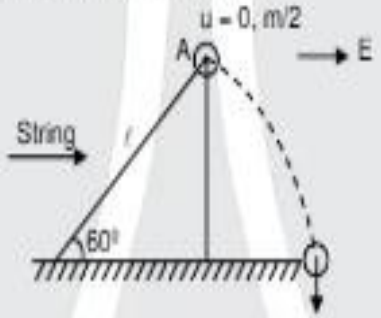
$A = \ell \times b$

$\frac{\Delta A}{A} = \frac{A\ell}{\ell} + \frac{Ab}{b}$

$= \frac{0.05}{5} + \frac{0.05}{2.5}$

$= \frac{1}{100}\left(1+\frac{5}{2.5}\right) = \left(\frac{3}{100}\right)$

12. A simple pendulum of mass m and length ℓ is given a charge +q, and it is placed on a smooth horizontal surface. A uniform electric field E is applied as shown in the figure. If the pendulum is released from rest, its maximum speed during subsequence motion will be :



(1) $\sqrt{\frac{qE\ell}{m}}$ (2) $\sqrt{\frac{2qE\ell}{m}}$ (3) $\sqrt{\frac{E\ell}{2m}}$ (4) $\sqrt{\frac{E\ell}{m}}$

Ans. **(1)**

Sol. $V_{max} = ?$

$W = \Delta KE$

$qE\ell(1 - \cos 60^\circ) = \frac{1}{2}mV^2$

$\frac{qE\ell}{2} = \frac{mV^2}{2}$

$V = \sqrt{\frac{qE\ell}{m}}$ **Ans.**

13. The refractive index of two prism are respectively 1.54 and 1.72. The prism angle of first prism is 4°. If the total deviation is zero, then the prism angle of the second prism will be :

(1) 2° (2) 3° (3) 5° (4) 7°

Ans. **(2)**

Sol. $\delta = (\mu_1 - 1)A_1 - (\mu_2 - 1)A_2 = 0$

$\Rightarrow 4(1.54 - 1) - (1.72 - 1)A_2 = 0$

$\Rightarrow \frac{4 \times 0.54}{0.72} = A_2 = 3^\circ$

14. $\left[\frac{\text{Modulusof elasticity}}{\text{Torque}}\right] = [M^aL^{-2}T^c]$ Find the value of c.

(1) c = 0 (2) c = 1 (3) c = −1 (4) c = 2

Ans. (1)

Sol. Elasticity = $[M^1L^{-1}T^{-2}]$

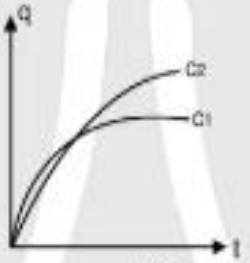
Torque = $[M^1L^2T^{-2}]$

$$\frac{[M^1L^{-2}T^{-2}]}{[M^1L^2T^{-2}]} = [M^aL^{-3}T^c]$$

$[M^0L^{-3}T^0] = [M^aL^{-3}T^c]$

c = 0

15. Two capacitor are charged with same battery. If graph between charge & time shown in figure than find correct option



(1) $C_2 > C_1$ $U_2 > U_1$ (2) $C_2 < C_1$ $U_2 > U_1$

(3) $C_2 < C_1$ $U_2 < U_1$ (4) $C_2 > C_1$ $U_2 < U_2$

Ans. (1)

Sol. $q_{max} = cV$

$q_{max} \propto C$

So $\Rightarrow \frac{q_2}{q_1} = \frac{c_2}{c_1}$

$c_2 > c_1$ **Ans.**

$u = \frac{1}{2}cV^2$

$u_2 > u_1$ **Ans.**

16. A proton of mass m_p has the same energy as a photon and wavelength λ. the ratio of the De-Broglie wavelength of the proton and the wavelength of the photon will be :

(1) $\frac{1}{c}\sqrt{\frac{E}{m_p}}$ (2) $\frac{1}{c}\sqrt{\frac{E}{2m_p}}$ (3) $\frac{1}{2c}\sqrt{\frac{E}{m_p}}$ (4) $\frac{1}{2c}\sqrt{\frac{E}{2m_p}}$

Ans. (2)

Sol. For proton $E = \frac{p^2}{2m_p} \Rightarrow p = \sqrt{2m_pE}$

$\lambda_{proton} = \frac{h}{p} = \frac{h}{\sqrt{2m_pE}}$

$\lambda_{photon} = \frac{hc}{E}$

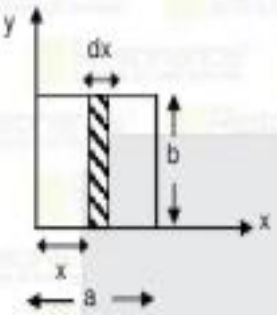
$\frac{\lambda_{proton}}{\lambda_{photon}} = \frac{h}{\sqrt{2m_pE}} \times \frac{E}{hc} = \frac{1}{c}\sqrt{\frac{E}{2m_p}}$

17. Find centre of mass of rectangular plate of mass density $\sigma = \frac{\sigma_0 x}{ab}$ is

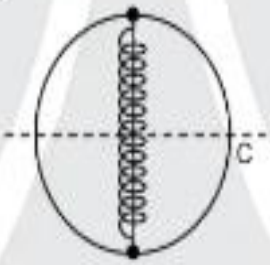
(1) $\frac{2a}{3}, \frac{b}{2}$ (2) $\frac{2a}{3}, \frac{2b}{3}$ (3) $\frac{a}{2}, \frac{b}{2}$ (4) $\frac{2a}{3}, \frac{2b}{3}$

Ans. (1)

Sol.



18. There is a smooth ring of radius R in vertical plane. A spring of natural length R and elastic constant K is vertical across along a diameter. The free end is connected to bead of mass m and when slightly disturbed it reaches point C with speed V is ?



(1) $\sqrt{\frac{KR^2\left(\sqrt{2}-1\right)+2mgR}{m}}$ (2) $\sqrt{\frac{2KR^2\left(\sqrt{2}-1\right)+2mgR}{m}}$

(3) $\sqrt{\frac{2KR^2\left(\sqrt{2}-1\right)+mgR}{m}}$ (4) $\sqrt{\frac{KR^2\left(\sqrt{2}-1\right)+mgR}{m}}$

Ans. (2)

Sol. Initial elongation = R

Final elongation = $\left(\sqrt{2}-1\right)R$

from energy conservation

$\Delta U = \Delta(K - \varepsilon)$

$$\frac{1}{2}K\left[R^2 - \left(\left(\sqrt{2}-1\right)R\right)^2\right] + mgR = \frac{1}{2}mV^2$$

$$\frac{KR^2}{m}\left(1-2+2\sqrt{2}-1\right)+2gR = V^2$$

$$V = \sqrt{\frac{2KR^2}{m}\left(\sqrt{2}-1\right)+2gR}$$

$$V = \sqrt{\frac{2KR^2\left(\sqrt{2}-1\right)+2mgR}{m}}$$

19. The first electromagnetic waves given by $E_1 = 100 \sin(kx - \omega t)$ is propagating axially in a cylinder c 100 cm and diameter D. Second electromagnetic is also propagating in a cylinder of same ler having a diameter D/2. the equation of the second electromagnetic wave should be :

(1) $E_2 = 200 \sin(kx - \omega t)$ (2) $E_2 = 50 \sin(kx - \omega t)$

(3) $E_2 = 400 \sin(kx - \omega t)$ (4) $E_2 = 25 \sin(kx - \omega t)$

Ans. (1)

Sol. Watch Video Solution

20. $E_1 \supset$ 273 K to 373 K $\supset \eta_1$

$E_2 \supset$ 373 K to 473 K $\supset \eta_2$

$E_3 \supset$ 273 K to 473 K $\supset \eta_3$

Find relation in efficiency of above engine work on Carnot cycle.

(1) $\eta_3 < \eta_1 + \eta_2$ (2) $\eta_3 > \eta_1 + \eta_2$

(3) $\eta_3 = \eta_1 + \eta_2$ (4) $\eta_3 = \eta_1 \times \eta_2$

Ans. (1)

Sol. Watch Video Solution

21. Which of the following statement is false:

(1) If temperature of liquid increases than viscosity increases.

(2) If temperature of gas increases than viscosity increases.

(3) Surface energy of surface molecule is greater than molecule inside liquid.

(4) Bulk modulus of gas depends on process.

Ans. (1)

Sol. Watch Video Solution