JEE (MAIN)-2025 (Online)

Physics Memory Based Answer & Solutions

MORNING SHIFT

DATE : 04-04-2025

Disclaimer

The questions and solutions provided for JEE Main 2025 Session-2 are based on students' memory. While every effort has been made to ensure accuracy, there may be discrepancies or variations from the actual exam. These materials are intended for reference and educational purposes only. They do not represent the official question paper or solutions provided by the exam conducting authority.

We recommend cross-verifying with official sources and using this content as a supplementary resource for your preparation.

MEMORY BASED QUESTIONS JEE–MAIN EXAMINATION – APRIL, 2025

(Held On Friday 4th April, 2025) TIME : 9 : 00 AM to 12 : 00 PM

PHYSICS

TEST PAPER WITH SOLUTION

SECTION-A

1. Find the dimension of $\frac{\phi_E}{\phi_B} = c$ where, ϕ_E represents electric flux and ϕ_B represents magnetic flux. Then dimension of c is given by $M^aL^bC^c$:-

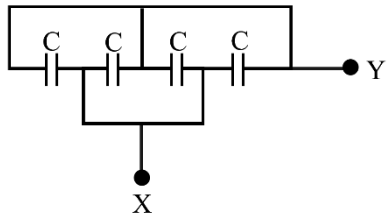
(1) a = 1, b = 1, c = –1 (2) a = 0, b = 1, c = –1

(3) a = 1, b = 2, c = –1 (4) a = 1, b = 2, c = 2

Ans. **(2)**

Sol. $\left(\frac{\phi_E}{\phi_B}\right) = \left[\frac{EA}{BA}\right] = LT^{-1}$

2. Find the equivalent capacitance between X and Y, where $C = 16\ \mu F$

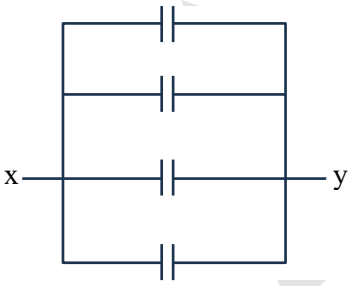


(1) 8 μF (2) 16 μF

(3) 64 μF (4) 32 μF

Ans. **(3)**

Sol.



$C_{eq} = 4C$

$= 64\ \mu F$

3. Mean free path for an ideal gas is to be observed 20 μm while average speed of molecules of gas is observed to be 600 m/s, then frequency (Hz) of collision is near by

(1) 2×10^{-7} (2) 3×10^{7}

(3) 4.2×10^{-7} (4) 6×10^{7}

Ans. **(2)**

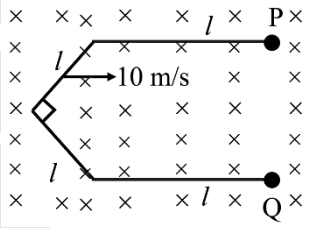
Sol. $\lambda = 20\mu m$

$v = 600\ m/s$

$\tau = \frac{\lambda}{v}$

$f = \frac{1}{\tau} = 3 \times 10^7\ Hz$

4. 4 rods of equal length are joined as shown in the figure. Combined system is moving with speed 10 m/s in a perpendicular magnetic field of $\frac{1}{\sqrt{2}}$ tesla. Find emf induced between point P and Q (l = 10 cm)



(1) $\sqrt{2}$ Volt (2) 1 Volt

(3) 0.1 Volt (4) 2 Volt

Ans. **(2)**

Sol. $E = vBL = 10 \times \frac{1}{\sqrt{2}} \times \frac{10\sqrt{2}}{100} = 1 volts$

5. The current in a AC circuit is given as $i = 100\sqrt{2}\sin(100\pi t)A$. Find rms current and frequency.

(1) 100 A, 100 Hz (2) 200 A, 50 Hz

(3) 100 A, 50 Hz (4) $50\sqrt{2}$ A, 200 Hz

Ans. **(3)**

Sol. $i_{rms} = 100A$

$f = \frac{\omega}{2\pi} = 50Hz$

6. A real object placed in front of a spherical mirror forms an image whose magnification is $-\frac{1}{3}$. If the distance between the image and object is 30 cm. The focal length of the mirror is _____ cm.

(1) –22.5 cm (2) –11.25 cm

(3) –45 cm (4) –50 cm

Ans. **(2)**

Sol. $m = \frac{-1}{3}$

$v = \frac{u}{3}$

$v - u = 30$

$u = -45$ cm

$v = -15$ cm

$f = \frac{-45}{4}$ cm

7. Dipole of length 20 cm and charge 20 μC is placed in an electric field of infinite sheet of charge density 200 C/m^2, making an angle 30° with electric field, find torque experienced by dipole.

(1) $\frac{3}{\varepsilon_0} \times 10^{-4}$ N-m (2) $\frac{4}{\varepsilon_0} \times 10^{-4}$ N-m

(3) $\frac{2}{\varepsilon_0} \times 10^{-4}$ N-m (4) $\frac{12}{\varepsilon_0} \times 10^{-4}$ N-m

Ans. **(3)**

Sol. $\tau = PE\sin\theta$

$\tau = \left(20 \times 10^{-6} \times 0.2\right) \times \left(\frac{200}{2\varepsilon_0}\right) \sin 30$

$\tau = \frac{2 \times 10^{-4}}{\varepsilon_0}$

8. Statement-I : The minimum kinetic energy required to take a body of mass m from surface of earth to infinity is mgR.

Statement-II: Potential energy at surface of earth is zero.

(1) Statement-I is correct, statement-II is correct and statement-II is correct explanation of statement-I.

(2) Statement-I is correct, statement-II is correct and statement-II is not the correct explanation of statement-I.

(3) Statement-I is correct and statement-II is incorrect.

(4) Statement-I is incorrect and statement-II is correct.

Ans. **(3)**

Sol. Theoretical

9. If slit width is doubled then % change in fringe width

(1) Remain same (2) 150%

(3) 75% (4) 50%

Ans. **(4)**

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

10. Longitudinal sound waves travel in three different gases namely helium, methane and carbon dioxide. Mean temperature of three gases are equal then ratio of speeds of waves in 3 gases respectively is

(1) $\frac{1}{\sqrt{3}} : \frac{1}{\sqrt{5}} : \frac{1}{2}$ (2) $\sqrt{5} : 1 : \sqrt{\frac{21}{55}}$

(3) $\sqrt{3} : \sqrt{5} : \frac{1}{\sqrt{11}}$ (4) $\sqrt{5} : \sqrt{7} : \frac{1}{\sqrt{11}}$

Ans. **(2)**

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

11. **Assertion :** In photoelectric effect, if intensity of monochromatic light is increased then stopping potential increases.

Reason : Increased intensity results in increment of photocurrent.

(1) A is correct, R is correct and R is explanation of A

(2) A is correct, R is correct and R is not explanation of A

(3) A is incorrect and R is correct

(4) A is correct and R is incorrect

Ans. **(3)**

Sol. Theoretical

12. If $\frac{1}{5}$ *th* of volume of closed organ pipe is filled in water. Then % change in frequency

(1) 50% (2) 100%

(3) 25% (4) 400%

Ans. **(3)**

Sol. $f = \frac{v}{4L}$

$\frac{\Delta f}{f} \times 100 = \frac{\left(\frac{5}{4} - 1\right)}{1} \times 100$

$= 25\ \%$

13. Given I = 0.02 t + 0.01 A. Find charge flown between t = 1 sec to t = 2 sec.

(1) 0.04 C (2) 0.05 C

(3) 0.02 C (4) 0.03 C

Ans. **(1)**

Sol. $q = \int i\,dt$

$= \int_1^2 (0.02t + 0.01)dt$

$= 0.04$ C

14. Which of the following is incorrect expression for torque

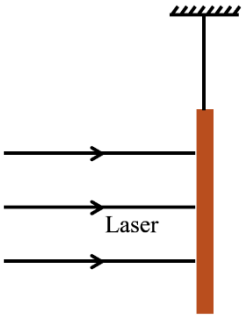
(1) $\vec{\tau} = \vec{r} \times \vec{L}$ (2) $\frac{d}{dt}(\vec{r} \times \vec{p})$

(3) $\vec{r} \times \frac{d}{dt}(\vec{p})$ (4) $\vec{\tau} = \vec{r} \times \vec{F}$

Ans. **(1)**

Sol. Theoretical

15. Laser ray having power P falls on a mirror having mass m. Find angle of deviation of mirror :-



(1) $\tan^{-1}\left(\frac{4P}{Cmg}\right)$ (2) $\tan^{-1}\left(\frac{P}{2Cmg}\right)$

(3) $\tan^{-1}\left(\frac{P}{Cmg}\right)$ (4) $\tan^{-1}\left(\frac{2P}{Cmg}\right)$

Ans. **(4)**

Sol. $\tan\theta = \frac{\frac{2P}{c}}{mg}$

16. Two simple pendulums with amplitudes θ_1 and θ_2 having length of strings ℓ_1 and ℓ_2 respectively. Choose the correct options if the maximum angular accelerations are same.

(1) $\theta_1\ell_2^2 = \theta_2\ell_1^2$ (2) $\theta_1\ell_1^2 = \theta_2\ell_2^2$

(3) $\theta_1\ell_2 = \theta_2\ell_1$ (4) $\theta_1\ell_1 = \theta_2\ell_2$

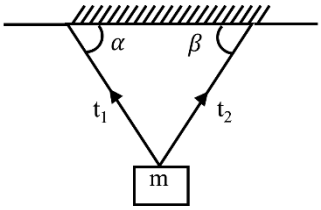
Ans. **(3)**

Sol. $\alpha = -\omega^2\theta$

$\omega_1^2\theta_1 = \omega_2^2\theta_2$

$\omega = \sqrt{\frac{g}{\ell}}$

17. A block of mass $m\,kg$ is connected to two strings as shown. If $T_1 = \sqrt{3}T_2$, then find ratio of angle α and angle β



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

(3) 1 (4) 4

Ans. **(1)**

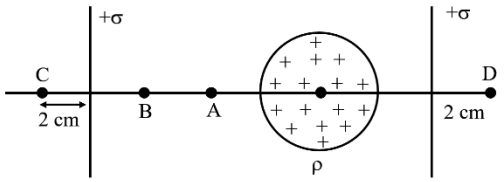
Sol. $T_1\cos\alpha = T_2\cos\beta$

$\sqrt{3} = \frac{\cos\beta}{\cos\alpha}$

$T_1\sin\alpha + T_2\sin\beta = mg$

$\beta = 30°$ $\alpha = 60°$

18. A non-conducting sphere with volume charge density ρ is placed between two non-conducting plane sheets with charge density σ as shown. Choose the correct relation between the magnitude of electric fields at A, B, C and D. Point A is at the middle of two sheets.



(1) $E_A = E_B$, $E_C \neq E_D$ (2) $E_A \neq E_B$, $E_C = E_D$

(3) $E_A > E_B$, $E_C = E_D$ (4) $E_A > E_B$, $E_C \neq E_D$

Ans. **(4)**

Sol. $E_B < E_A$

$E_C \neq E_D$

19. The Boolean expression $Y = A\bar{B}C + \bar{A}\bar{C}$ can be realised with which of the following gate configurations

(1) One-3 input AND gate, 3 NOT gate and one-2 input OR gate, one-2 input AND gate

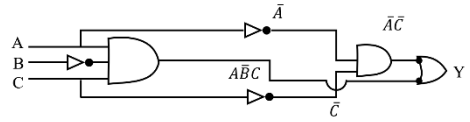
(2) 3-input AND gate, 3 NOT gates and one 2-input OR gate

(3) 3-input OR gate, 3 NOT gates and one 2-input AND gate

(4) One-3 input AND gate, 1 NOT gate, one-2 input NOR gate and one-2 input OR gates

Ans. **(1)**

Sol.



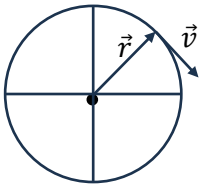
20. $\vec{L}$ and $\vec{p}$ are angular momentum about origin and linear momentum of a particle. If position vector of particle is given as $\vec{r} = a(\sin\omega t\hat{i} + \cos\omega t\hat{j})$ then direction of force is

(1) Opposite to $\vec{L} \times \vec{r}$ (2) Opposite to $\vec{p} \times \vec{r}$

(3) Opposite to $\vec{L}.\vec{r}$ (4) Opposite to $\vec{p} \times \vec{L}$

Ans. **(4)**

Sol.



SECTION – B

1. A ring and a solid sphere released from rest from same height on sufficient rough inclined surface. Ratio of their speed when they reach bottom is $\sqrt{\frac{7}{x}}$ m/s, then x is _____.

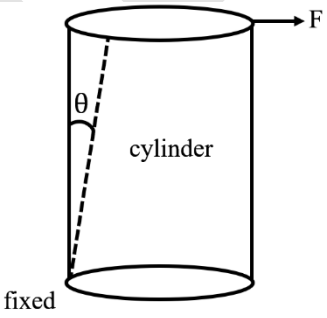
Ans. **(10)**

Sol. $a = \dfrac{g\sin\theta}{1+\dfrac{I}{MR^2}}$

$v = \sqrt{2as}$

$$\frac{V_{ring}}{V_{sphere}} = \frac{\sqrt{\frac{7}{5}}}{\sqrt{2}} = \sqrt{\frac{7}{10}}$$

2. Two different cylinders experience shear forces. If $d_1 = 2d_2$, $\theta_1 = 2\theta_2$, $F_1 = F_2$, $\eta_1 = 4 \times 10^9, \eta_2 = x \times 10^9$. Find x :-



Ans. **(32)**

Sol. $\eta = \dfrac{F}{\phi A}$