JEE (Main) 2020

COMPUTER BASED TEST (CBT)
Memory Based Questions & Solutions

Date: 06 September, 2020 (SHIFT-2)  |  TIME: (03.00 p.m. to 06.00 p.m)
Duration: 3 Hours  |  Max. Marks: 300
SUBJECT: PHYSICS

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1. Find distance of centre of mass of solid hemisphere of radius 6 cm from centre

(1) 3 cm  (2) \( \frac{3}{8} \) cm  (3) 4 cm  (4) 2 cm

Ans. (1)

Sol. \( h_{cm} = \frac{3R}{8} = \frac{3 \times 6}{8} = 3 \text{ cm} \)

2. Two charge +q_1 and +q_2 placed on x-axis at position A and B as shown in figure.

Which graph best represent the potential as a function of distance \( r \) from charge q_1.

(1) (2)
3. Magnetic field of an electromagnetic wave is \[ B = 12 \times 10^{-7} \sin(kx - \omega t) \hat{k} \, (T) \]. The equation of corresponding electric field should be:

(1) \[ E = 36 \sin(kx - \omega t) \hat{i} \, \text{N/C} \]
(2) \[ E = 3.6 \sin(kx - \omega t) \hat{i} \, \text{N/C} \]
(3) \[ E = 3.6 \sin(kx - \omega t) \hat{j} \, \text{N/C} \]
(4) \[ E = 36 \sin(kx - \omega t) \hat{j} \, \text{N/C} \]

Ans. (2)

4. Rain is falling vertically when car is at rest. When car moves with speed \( v \), rain appears at 60° with horizontal when car moves with speed \((\beta + 1)v\), rain appears at 45° with the horizontal. Find value of \( \beta \):

(1) 3
(2) 0.732
(3) 2
(4) 0.5

Ans. (2)

Sol. \[ E_0 = B_0 \times C = 12 \times 10^{-7} \times 3 \times 10^6 = 3.6 \]

As the light is propagating in \( x \) direction

\[ \vec{E} = B_0 \hat{k} \]

\[ \vec{E} \] should be in \( \hat{j} \) direction

So electric field \( \vec{E} = E_0 \sin(kx - \omega t) \hat{j} \)

\[ E = 3.6 \sin(kx - \omega t) \hat{j} \]

5. An equi-concave lens has power \( P \). Find power of plano-concave lens, when given lens is cut in such a way that two plano-concave lens are formed:

(1) \( P \)
(2) \( P/2 \)
(3) \( 2P \)
(4) \( P/4 \)

Ans. (2)

Sol. Theory Based
6. Find current in 10V cell.

\[ \begin{align*}
\text{2V} & \quad \text{5A} \\
\text{10V} & \quad \text{10A} \\
\text{20V} & \quad \text{5A}
\end{align*} \]

(1) 2A (2) 3A (3) 4A (4) 8A

Ans. (3)

Sol. So current in 10V cell is 4A.

7. In a electric circuit ammeter and voltmeter are used to verify ohm’s law which of the following is true.

(1) Ammeter connected in series and voltmeter connected in parallel.
(2) Voltmeter connected in series and ammeter connected in parallel.
(3) Both can be connected in parallel.
(4) Both can be connected in series.

Ans. (1)

Sol. Theory Based

8. Steady state temperature are shown in the diagram. Find ratio of thermal conductivity \( K_1 : K_2 \) if length of all rods are same.

\[ \begin{align*}
100^\circ C & \quad K_1 \\
70^\circ C & \quad K_2 \\
20^\circ C & \quad K_3
\end{align*} \]

(1) 3 : 2 (2) 3 : 5 (3) 4 : 2 (4) 5 : 2

Ans. (2)

Sol. \[ K_1(100 – 70) = K_2(70 – 20) = K_3(20 – 0) \]
\[ K_130 = K_250 = K_320 \]
\[ \Rightarrow K_1 : K_2 : K_3 = 10 : 6 : 15 \]
9. A particle of mass m moving with speed \( v \) collides elastically with another particle of mass 2m. Find speed of smaller mass after head on collision:

\[
\begin{align*}
(1) \quad & \frac{v}{3} \\
(2) \quad & \frac{v}{3} \\
(3) \quad & \frac{2v}{3} \\
(4) \quad & \frac{2v}{3}
\end{align*}
\]

**Ans.** (2)

**Sol.**

Apply conservation of linear momentum

\[ mv = m_1v_1 + m_2v_2 \]

\[ v_1 = \frac{2m_2 - m_1}{m_1 + m_2} v \]

**Alternate:**

\[
\begin{align*}
\frac{1}{m_1} &= \frac{2m_2 - m_1}{m_1 + m_2} v \\
\frac{2m_2 - m_1}{m_1 + m_2} &= \frac{v}{2m_2 - m_1} \\
\frac{2m_2 - m_1}{m_1 + m_2} &= \frac{v}{2m_2 - m_1} \\
\end{align*}
\]

\[ v = \frac{2m_2 - m_1}{m_1 + m_2} v \]

10. Half life of C\(^{14}\) is 5700 years. Find its decay constant.

\[
(1) \quad 1.216 \times 10^5 \text{ year}^{-1} \quad (2) \quad 1.216 \times 10^3 \text{ year}^{-1} \quad (3) \quad 6.52 \times 10^5 \text{ year}^{-1} \quad (4) \quad 6.53 \times 10^3 \text{ year}^{-1}
\]

**Ans.** (1)

**Sol.**

\[ \lambda = \frac{\ln 2}{T} = \frac{0.693}{5700} = 12.16 \times 10^5 \text{ year}^{-1} \]

11. Charge density of a sphere of radius \( R \) is \( \rho = \frac{Q}{4\pi R^2} \), where \( r \) is distance from centre of sphere. Total charge of sphere will be

\[
\begin{align*}
(1) \quad & \rho_1 = R^2 \\
(2) \quad & 2\rho_1 = R^2 \\
(3) \quad & 3\rho_1 = R^2 \\
(4) \quad & 4\rho_1 = R^2
\end{align*}
\]

**Ans.** (2)

**Sol.**

\[ Q = \int \rho \, dr = \int_0^R \rho_1 4\pi r^2 \, dr \]

\[ = \left[ \frac{\rho_1 4\pi r^3}{3} \right]_0^R = \frac{\rho_1 4\pi R^3}{3} \]

\[ Q = 4\rho_1 R^2 \]

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12. Two planets of mass M and 16M of radius a and 2a respectively, are at distance 10a. Find minimum speed of a particle of mass m at surface of smaller planet so that it can reached from smaller planet to larger planet.

\[
\begin{align*}
(1) \quad & \frac{5GM}{9a} \\
(2) \quad & \frac{4GM}{9a} \\
(3) \quad & \frac{3GM}{9a} \\
(4) \quad & \frac{2GM}{9a}
\end{align*}
\]

**Ans.** (1)

**Sol.**

[Diagram of two planets with speeds and masses]
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Medium of Teaching and Content would be only English

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