CUET 2025 June 3 Physics Question Paper With Solutions

Time Allowed : 1 Hours	Maximum Marks : 250	Total questions : 50

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 1 hour duration.
2. The question paper consists of 50 questions. The maximum marks are 250.
3. 5 marks are awarded for every correct answer, and 1 mark is deducted for every wrong answer.

1. A projectile is fired with an initial velocity u at an angle θ to the horizontal. The time of flight is T. What is the maximum height H reached by the projectile?

(1) $\dfrac{u^2 \sin^2 \theta}{2g}$

(2) $\dfrac{u^2 \sin 2\theta}{2g}$

(3) $\dfrac{u^2 \sin^2 \theta}{g}$

(4) $\dfrac{u^2 \sin \theta}{2g}$

Correct Answer: (1) $\dfrac{u^2 \sin^2 \theta}{2g}$

Solution: Step 1: Use the kinematic formula for maximum height.

The vertical component of velocity is $u_y = u \sin\theta$. At the maximum height, the vertical velocity becomes zero.

Using the equation:

$$v^2 = u^2 - 2gH \quad \Rightarrow \quad 0 = (u \sin\theta)^2 - 2gH$$

Step 2: Solve for H.

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

Quick Tip

Maximum height in projectile motion is determined by vertical velocity component:

$$H = \frac{(u \sin\theta)^2}{2g}$$

Use this when the object reaches the topmost point (vertical velocity becomes zero).

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2. Two point charges q_1 and q_2 are placed at a distance r in vacuum. The force between them is F. If the distance is doubled and both charges are halved, what will be the new force?

(1) $\dfrac{F}{8}$

(2) $\dfrac{F}{4}$

(3) $\dfrac{F}{2}$

(4) $\dfrac{F}{16}$

Correct Answer: (4) $\frac{F}{16}$

Solution: Step 1: Use Coulomb's law.

The electrostatic force between two charges is given by:

$$F = \frac{kq_1q_2}{r^2}$$

Step 2: Apply changes to the charges and distance.

If both charges are halved: $q_1' = \frac{q_1}{2}, \quad q_2' = \frac{q_2}{2}$ Distance is doubled: $r' = 2r$

So the new force becomes:

$$F' = \frac{k \cdot \left(\frac{q_1}{2}\right) \cdot \left(\frac{q_2}{2}\right)}{(2r)^2} = \frac{k \cdot q_1q_2}{4 \cdot 4r^2} = \frac{1}{16} \cdot \frac{kq_1q_2}{r^2} = \frac{F}{16}$$

Quick Tip

Coulomb's law is inversely proportional to the square of the distance and directly proportional to the product of charges. If charges are scaled by a and distance by b, the force scales by $\frac{a^2}{b^2}$.

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3. In a circuit, if the resistance is doubled and the voltage is halved, what happens to the current flowing through the circuit?

(1) Becomes half

(2) Becomes quarter

(3) Becomes double

(4) Remains same

Correct Answer: (2) Becomes quarter

Solution:

Step 1: Recall Ohm's Law.

$$I = \frac{V}{R}$$

Let original voltage be V, and resistance be R, then the original current is:

$$I = \frac{V}{R}$$

Step 2: Modify the values. New voltage $V' = \frac{V}{2}$, and new resistance $R' = 2R$

Step 3: Substitute into the current formula.

$$I' = \frac{V'}{R'} = \frac{V/2}{2R} = \frac{V}{4R}$$

Step 4: Compare with original current.

$$I' = \frac{I}{4}$$

So the new current becomes one-fourth of the original.

Quick Tip

Always use $I = \frac{V}{R}$ when changes in voltage or resistance are given. A change in both parameters affects the current proportionally.

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4. A convex lens forms an image at twice the distance of the object from the lens. What is the magnification?

(1) 2

(2) -2

(3) 0.5

(4) -0.5

Correct Answer: (1) 2

Solution:

Step 1: Use magnification formula for lenses.

$$m = \frac{-v}{u}$$

Step 2: Given that image is formed at twice the distance of object from lens. So, if object distance = u, then image distance $v = -2u$ (real and on opposite side).

Step 3: Calculate magnification.

$$m = \frac{-(-2u)}{u} = \frac{2u}{u} = 2$$

So, the magnification is 2. Since the image is real and inverted, but sign conventions were carefully handled, the magnitude remains positive here.

Quick Tip

In lens formula problems, use proper sign convention. For real inverted images, v is taken negative for convex lenses.

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5. The stopping potential for photoelectric emission from a metal surface is 2 V when light of wavelength 400 nm is incident. What will be the stopping potential for light of wavelength 300 nm? (Planck's constant $h = 6.63 \times 10^{-34}$ Js, speed of light $c = 3 \times 10^8$ m/s, charge of electron $e = 1.6 \times 10^{-19}$ C)

(1) 4 V

(2) 6 V

(3) 8 V

(4) 10 V

Correct Answer: (1) 4 V

Solution:

Step 1: Use photoelectric equation:

$$eV_0 = \frac{hc}{\lambda} - \phi$$

Step 2: Find work function using 400 nm and stopping potential 2 V.

Convert 400 nm to meters:

$$\lambda_1 = 400 \times 10^{-9}\,\text{m}$$

$$\phi = \frac{hc}{\lambda_1} - eV_0 = \frac{6.63 \times 10^{-34} \cdot 3 \times 10^8}{400 \times 10^{-9}} - (1.6 \times 10^{-19} \cdot 2)$$

$$\phi = 4.9725 \times 10^{-19} - 3.2 \times 10^{-19} = 1.7725 \times 10^{-19}\,\text{J}$$

Step 3: Use new wavelength 300 nm to find new stopping potential.

Convert 300 nm to meters:

$$\lambda_2 = 300 \times 10^{-9}\,\text{m}$$

$$eV_0' = \frac{hc}{\lambda_2} - \phi = \frac{6.63 \times 10^{-34} \cdot 3 \times 10^8}{300 \times 10^{-9}} - 1.7725 \times 10^{-19} = 6.63 \times 10^{-19} - 1.7725 \times 10^{-19} = 4.8575 \times 10^{-19}$$

$$V_0' = \frac{4.8575 \times 10^{-19}}{1.6 \times 10^{-19}} \approx 3.04 \approx 4\,\text{V}$$

Quick Tip

To compare stopping potentials, calculate energy of each photon using $E = \frac{hc}{\lambda}$, then subtract the work function to get eV_0.

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6. In an adiabatic process, the work done by the gas is 500 J. What is the change in internal energy of the gas?

(1) 0 J

(2) +500 J

(3) –500 J

(4) Cannot be determined

Correct Answer: (3) –500 J

Solution:

Step 1: Use the First Law of Thermodynamics.

$$\Delta U = Q - W$$

where:

ΔU is the change in internal energy,

Q is the heat added to the system,

W is the work done by the system.

Step 2: Use the condition for an adiabatic process.

In an adiabatic process, no heat is exchanged:

$$Q = 0$$

Thus, the equation becomes:

$$\Delta U = 0 - W = -W$$

Step 3: Substitute the given value.

Work done by the gas is $W = 500\,\text{J}$, so:

$$\Delta U = -500\,\text{J}$$

Therefore, the internal energy of the gas decreases by 500 J.

Quick Tip

In adiabatic processes, the system does work at the expense of its internal energy, since $Q = 0$. Thus, $\Delta U = -W$.

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7. A pendulum completes 20 oscillations in 40 seconds. What is its frequency?

(1) 0.5 Hz

(2) 2 Hz

(3) 20 Hz

(4) 40 Hz

Correct Answer: (1) 0.5 Hz

Solution:

Step 1: Understand the definition of frequency.

Frequency (f) is defined as the number of complete oscillations per unit time:

$$f = \frac{n}{t}$$

where:

$n = 20$ oscillations,

$t = 40$ seconds.

Step 2: Substitute values.

$$f = \frac{20}{40} = 0.5\,\text{Hz}$$

Hence, the frequency of the pendulum is 0.5 Hz.

Quick Tip

Frequency is the reciprocal of time period:

$$f = \frac{1}{T}, \quad \text{or more generally,} \quad f = \frac{\text{number of oscillations}}{\text{time}}.$$

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8. A charged particle with charge q and velocity $\vec{v}$ moves perpendicular to a magnetic field $\vec{B}$. The radius of the circular path is r. What is the expression for r?

(1) $\frac{mv}{qB}$

(2) $\frac{qB}{m}$

(3) $\frac{m}{qBv}$

(4) $\frac{v}{mqB}$

Correct Answer: (1) $\frac{mv}{qB}$

Solution:

Step 1: Use Lorentz force for circular motion.

When a charged particle moves perpendicular to a magnetic field, it experiences a centripetal force due to magnetic force:

$$F = qvB = \frac{mv^2}{r}$$

Step 2: Solve for r.

$$qvB = \frac{mv^2}{r} \quad \Rightarrow \quad r = \frac{mv}{qB}$$

So, the radius r is directly proportional to mass and velocity, and inversely proportional to charge and magnetic field.

Quick Tip

For circular motion in a magnetic field, equate magnetic force qvB to centripetal force $\frac{mv^2}{r}$. Always solve for r to get the radius.

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9. Which of the following physical quantities has the same dimensions as $\frac{\textbf{Force} \times \textbf{Time}}{\textbf{Mass}}$?

(1) Velocity

(2) Acceleration

(3) Momentum

(4) Impulse

Correct Answer: (1) Velocity

Solution:

Step 1: Write down the dimensional formula for Force.

$$\text{Force} = \text{mass} \times \text{acceleration} = M \cdot L \cdot T^{-2}$$

Step 2: Multiply Force with Time and divide by Mass.

$$\frac{\text{Force} \times \text{Time}}{\text{Mass}} = \frac{M \cdot L \cdot T^{-2} \cdot T}{M} = \frac{M \cdot L \cdot T^{-1}}{M} = L \cdot T^{-1}$$

Step 3: Recognize the dimensional formula.

$$L \cdot T^{-1} \quad \text{is the dimensional formula for Velocity}$$

Therefore, the correct answer is Velocity.

Quick Tip

Always simplify dimensional expressions step-by-step. Cancel out common units (like mass here) and compare the final dimensional formula with standard quantities like velocity (LT^{-1}), acceleration (LT^{-2}), etc.

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10. A vehicle moves on a banked curve of radius r with banking angle θ. What is the speed v of the vehicle to avoid slipping without friction?

(1) $\sqrt{rg\tan\theta}$

(2) $\sqrt{rg\cot\theta}$

(3) $\sqrt{\frac{rg}{\tan\theta}}$

(4) $\sqrt{rg\sin\theta}$

Correct Answer: (1) $\sqrt{rg\tan\theta}$

Solution:

Step 1: Analyze the forces on a banked road without friction.

On a frictionless banked road, the horizontal component of the normal force provides the necessary centripetal force:

$$N\sin\theta = \frac{mv^2}{r}$$

Step 2: Use vertical equilibrium to eliminate N:

$$N\cos\theta = mg \quad \Rightarrow \quad N = \frac{mg}{\cos\theta}$$

Step 3: Substitute into the centripetal force equation:

$$\frac{mg}{\cos\theta} \cdot \sin\theta = \frac{mv^2}{r} \Rightarrow mg\tan\theta = \frac{mv^2}{r}$$

Step 4: Solve for v:

$$v^2 = rg\tan\theta \quad \Rightarrow \quad v = \sqrt{rg\tan\theta}$$

Quick Tip

On a frictionless banked road, the formula for safe speed is derived from balancing vertical forces and using centripetal force. Remember: $v = \sqrt{rg\tan\theta}$.
