CUET PG 2026 Physics Question Paper with Solutions(Memory Based)

Time Allowed :1 Hours 30 min	**Maximum Marks :**300	**Total Questions :**75

General Instructions

1. The exam lasts 90 minutes (1 hour 30 minutes).
2. There are 75 Multiple Choice Questions (MCQs) to be answered.
3. +4 marks for every correct answer. -1 mark (negative marking) for every incorrect answer. 0 marks for unanswered or un-attempted questions.
4. For any discrepancy in questions, the English version is considered final (except for language-specific papers).
5. Click one of the four options to choose an answer.
6. You must click "Save & Next" to confirm your response. Only saved answers are considered for evaluation.
7. Use "Mark for Review & Next" to flag a question for later. You can unselect or change your answer using the "Clear Response" button.
8. All calculations must be done on the Rough Sheets provided at the centre. These must be returned to the invigilator after the exam.

1. What is the value of the line integral of a magnetic field around a closed loop according to Ampère's Circuital Law?
(A) 0
(B) $\mu_0 I$
(C) $\frac{I}{\mu_0}$
(D) $B \times I$

Correct Answer: (2) $\mu_0 I$

Solution:

Concept:
Ampère's Circuital Law states that the line integral of the magnetic field $\vec{B}$ around any closed path is equal to the permeability of free space multiplied by the total current enclosed by that path.
The mathematical form of Ampère's Law is:

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 I_{\text{enc}}$$

where

- $\vec{B}$ = Magnetic field

- $d\vec{l}$ = Infinitesimal length element of the closed loop
- μ_0 = Permeability of free space
- I_{enc} = Current enclosed by the loop

Step 1: Identify the result of the line integral.
The line integral of the magnetic field around a closed path equals μ_0 multiplied by the enclosed current.

Step 2: Write the final value.

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 I$$

Thus, the value of the line integral is $\mu_0 I$.

Quick Tip

Ampère's Law: $\oint \vec{B} \cdot d\vec{l} = \mu_0 I$. The circulation of magnetic field around a closed loop depends on the enclosed current.

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2. A particle of mass m moves in a central force field $F(r)$. Which physical quantity remains conserved during this motion?
(A) Linear momentum
(B) Angular momentum
(C) Kinetic energy
(D) Velocity

Correct Answer: (2) Angular momentum

Solution:

Concept:
A **central force** is a force that is always directed along the line joining the particle and a fixed point (the center) and whose magnitude depends only on the distance r.
Examples include gravitational force and electrostatic force.

Step 1: Understand torque in a central force.
Torque is given by

$$\vec{\tau} = \vec{r} \times \vec{F}$$

In a central force field, the force $\vec{F}$ acts along the direction of $\vec{r}$.
Thus,

$$\vec{\tau} = \vec{r} \times \vec{F} = 0$$

Step 2: Apply angular momentum relation.
Since

$$\vec{\tau} = \frac{d\vec{L}}{dt}$$

and $\vec{\tau} = 0$,

$$\frac{d\vec{L}}{dt} = 0$$

Therefore,

$$\vec{L} = \text{constant}$$

Thus, **angular momentum remains conserved**.

Quick Tip

For any **central force**, torque about the center is zero, so **angular momentum is conserved**.

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3. What is the de Broglie wavelength of an electron accelerated through a potential difference of V volts?

(A) $\frac{h}{mv}$
(B) $\frac{h}{\sqrt{2meV}}$
(C) $\frac{h}{eV}$
(D) $\sqrt{\frac{2eV}{m}}$

Correct Answer: (2) $\frac{h}{\sqrt{2meV}}$

Solution:

Concept:
According to the **de Broglie hypothesis**, particles such as electrons exhibit wave-like behavior. The wavelength associated with a moving particle is given by

$$\lambda = \frac{h}{p}$$

where

- h = Planck's constant
- p = Momentum of the particle

Step 1: Determine the kinetic energy of the electron.
When an electron is accelerated through a potential difference V,

$$\text{K.E.} = eV$$

where e is the charge of the electron.

Step 2: Relate kinetic energy and momentum.

$$\text{K.E.} = \frac{p^2}{2m}$$

Thus,

$$eV = \frac{p^2}{2m}$$

Step 3: Solve for momentum.

$$p = \sqrt{2meV}$$

Step 4: Substitute into de Broglie equation.

$$\lambda = \frac{h}{p}$$

$$\lambda = \frac{h}{\sqrt{2meV}}$$

Thus, the de Broglie wavelength is

$$\lambda = \frac{h}{\sqrt{2meV}}$$

Quick Tip

For an electron accelerated through potential V:

$$\lambda = \frac{h}{\sqrt{2meV}}$$

or approximately

$$\lambda(\text{Å}) = \frac{12.27}{\sqrt{V}}$$

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4. In a classic Young's Double Slit Experiment, how does the fringe width change if the entire apparatus is immersed in water?
(A) Fringe width increases
(B) Fringe width decreases

(C) Fringe width remains unchanged
(D) Fringe width becomes infinite

Correct Answer: (2) Fringe width decreases

Solution:

Concept:
In Young's Double Slit Experiment (YDSE), the fringe width β is given by

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

where

- λ = wavelength of light
- D = distance between the screen and slits
- d = separation between the slits

Step 1: Effect of medium on wavelength.
When light enters a medium like water with refractive index n, its wavelength changes according to

$$\lambda' = \frac{\lambda}{n}$$

Step 2: Substitute new wavelength in fringe width formula.

$$\beta' = \frac{\lambda' D}{d}$$

$$\beta' = \frac{\lambda D}{nd}$$

Step 3: Compare fringe widths.

$$\beta' = \frac{\beta}{n}$$

Since $n > 1$ for water, the fringe width becomes smaller.
Thus, the **fringe width decreases**.

Quick Tip

In YDSE, if the experiment is performed in a medium with refractive index n, the new fringe width becomes

$$\beta' = \frac{\beta}{n}$$

Hence fringe width decreases.

5. Which Maxwell equation represents the non-existence of magnetic monopoles?
(A) $\nabla \cdot \vec{E} = \frac{\rho}{\varepsilon_0}$
(B) $\nabla \cdot \vec{B} = 0$
(C) $\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$
(D) $\nabla \times \vec{B} = \mu_0 \vec{J} + \mu_0 \varepsilon_0 \frac{\partial \vec{E}}{\partial t}$

Correct Answer: (2) $\nabla \cdot \vec{B} = 0$

Solution:

Concept:
Maxwell's equations describe the fundamental laws of electromagnetism. One of these equations states that the divergence of the magnetic field is zero.

$$\nabla \cdot \vec{B} = 0$$

Step 1: Interpret the equation.
The divergence of a field measures the net flow of the field out of a point.
If

$$\nabla \cdot \vec{B} = 0$$

it means magnetic field lines neither originate nor terminate at any point.

Step 2: Physical implication.
This indicates that **magnetic monopoles do not exist**. Magnetic field lines always form closed loops.

Step 3: Compare with other Maxwell equations.

- Gauss's law for electricity relates electric field divergence to charge density.
- Faraday's law describes electromagnetic induction.
- Ampère–Maxwell law relates magnetic fields to current and changing electric fields.

Thus, the equation representing the absence of magnetic monopoles is

$$\nabla \cdot \vec{B} = 0$$

Quick Tip

$\nabla \cdot \vec{B} = 0$ means magnetic field lines form **closed loops**, implying **no magnetic monopoles**.

6. For a thermodynamic system undergoing an adiabatic process, what is the relationship between pressure P and volume V?
(A) $PV = \text{constant}$
(B) $P/V = \text{constant}$
(C) $PV^\gamma = \text{constant}$
(D) $P^2V = \text{constant}$

Correct Answer: (3) $PV^\gamma = \text{constant}$

Solution:

Concept:
An **adiabatic process** is a thermodynamic process in which no heat is exchanged between the system and its surroundings.

$$Q = 0$$

For an ideal gas undergoing an adiabatic process, the relation between pressure and volume is given by

$$PV^\gamma = \text{constant}$$

where

- P = pressure
- V = volume
- $\gamma = \frac{C_p}{C_v}$ = adiabatic index

Step 1: Use the first law of thermodynamics.

$$dQ = dU + dW$$

For adiabatic process

$$dQ = 0$$

$$dU = -dW$$

Step 2: Derive the pressure–volume relation.
Using ideal gas relations and thermodynamic identities, the final relation becomes

$$PV^\gamma = \text{constant}$$

Step 3: Interpretation.
During adiabatic expansion, volume increases and pressure decreases more rapidly compared to an isothermal process.

Thus, the correct relation is

$$PV^{\gamma} = \text{constant}$$

Quick Tip

Adiabatic process relations:

$$PV^{\gamma} = \text{constant}, \quad TV^{\gamma-1} = \text{constant}$$

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7. What is the energy of the ground state of a hydrogen atom according to the Bohr model?

(A) -13.6 eV
(B) -3.4 eV
(C) -1.51 eV
(D) 0 eV

Correct Answer: (1) -13.6 eV

Solution:

Concept:
According to the **Bohr model**, the electron in a hydrogen atom can occupy only certain discrete energy levels. The energy of the n^{th} orbit is given by

$$E_n = -\frac{13.6}{n^2} \text{ eV}$$

where $n = 1, 2, 3, \ldots$ is the principal quantum number.

Step 1: Identify the ground state.
The ground state corresponds to the lowest possible energy level, which occurs when

$$n = 1$$

Step 2: Substitute into the energy formula.

$$E_1 = -\frac{13.6}{1^2}$$

$$E_1 = -13.6 \text{ eV}$$

Thus, the energy of the ground state of hydrogen is -13.6 eV.

Quick Tip

Energy levels of hydrogen follow

$$E_n = -\frac{13.6}{n^2} \text{ eV}$$

The ground state ($n = 1$) has energy -13.6 eV.

8. In a p-n junction diode, what happens to the width of the depletion layer under reverse bias?

(A) It decreases
(B) It increases
(C) It remains constant
(D) It becomes zero

Correct Answer: (2) It increases

Solution:

Concept:
A **p-n junction diode** contains a depletion region near the junction where mobile charge carriers are absent. This region forms due to recombination of electrons and holes.

Step 1: Effect of reverse bias.
In reverse bias, the positive terminal of the battery is connected to the n-side and the negative terminal to the p-side.
This pulls electrons and holes away from the junction.

Step 2: Resulting change in depletion region.
Since carriers move away from the junction, the depletion region expands and the potential barrier increases.

Step 3: Conclusion.
Therefore, under reverse bias, the **width of the depletion layer increases**.

> Quick Tip
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> Forward bias $\rightarrow$ depletion region decreases.
> Reverse bias $\rightarrow$ depletion region increases.

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9. What is the Boolean expression for a two-input NAND gate?

(A) $Y = A + B$
(B) $Y = AB$
(C) $Y = \overline{AB}$
(D) $Y = \overline{A} + \overline{B}$

Correct Answer: (3) $Y = \overline{AB}$

Solution:

Concept:
A **NAND gate** is a digital logic gate that performs the NOT operation on the output of an AND gate.

Step 1: Write the AND gate expression.
For two inputs A and B,

$$Y_{AND} = AB$$

Step 2: Apply the NOT operation.
Taking the complement of the AND output,

$$Y = \overline{AB}$$

Step 3: Interpretation.
The output of a NAND gate becomes 0 only when both inputs are 1. In all other cases, the output is 1.
Thus, the Boolean expression of a two-input NAND gate is

$$Y = \overline{AB}$$

> **Quick Tip**
>
> NAND gate = NOT(AND).
> Boolean expression:
>
> $$Y = \overline{AB}$$
>
> It is also known as a **universal logic gate**.

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10. A frame of reference moving with constant velocity relative to an inertial frame is also known as what?
(A) Non-inertial frame
(B) Accelerated frame
(C) Inertial frame
(D) Rotating frame

Correct Answer: (3) Inertial frame

Solution:

Concept:
An **inertial frame of reference** is a frame in which Newton's laws of motion hold true. In such frames, objects either remain at rest or move with constant velocity unless acted upon by an external force.

Step 1: Understand the transformation between inertial frames.
If one frame moves with a constant velocity relative to another inertial frame, it also behaves as an inertial frame.

Step 2: Reason for this property.

Because the relative velocity between the frames is constant (no acceleration), Newton's laws remain valid in both frames.
Thus, a frame moving with constant velocity relative to an inertial frame is also an **inertial frame**.

Quick Tip

All frames moving with **constant velocity relative to each other** are **inertial frames**.

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11. Which phenomenon confirms the transverse nature of electromagnetic waves?
(A) Interference
(B) Diffraction
(C) Polarization
(D) Reflection

Correct Answer: (3) Polarization

Solution:

Concept:
Polarization is a phenomenon in which the vibrations of a wave are restricted to a particular direction.

Step 1: Understand wave behavior.
Only **transverse waves** can exhibit polarization because their oscillations occur perpendicular to the direction of propagation.

Step 2: Implication for electromagnetic waves.
When light waves are polarized, it proves that their electric field oscillates in directions perpendicular to the direction of propagation.

Step 3: Conclusion.
Thus, the phenomenon that confirms the transverse nature of electromagnetic waves is **polarization**.

Quick Tip

Polarization occurs only in transverse waves. Its observation proves that light is a **transverse electromagnetic wave**.

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12. What is the relation between the group velocity and phase velocity in a non-dispersive medium?
(A) $v_g > v_p$
(B) $v_g < v_p$

(C) $v_g = v_p$
(D) $v_g = 2v_p$

Correct Answer: (3) $v_g = v_p$

Solution:

Concept:
Phase velocity v_p is the velocity with which a single wave phase propagates through space.

$$v_p = \frac{\omega}{k}$$

where

- ω = angular frequency
- k = wave number

Step 1: Define group velocity.
Group velocity v_g is the velocity at which the envelope of a wave packet (or energy) travels.

$$v_g = \frac{d\omega}{dk}$$

Step 2: Condition for a non-dispersive medium.
In a non-dispersive medium, the wave speed does not depend on frequency.
This means

$$\omega \propto k$$

Step 3: Resulting relationship.
Under this condition,

$$v_g = v_p$$

Thus, in a non-dispersive medium, the group velocity equals the phase velocity.

Quick Tip

In a **non-dispersive medium**:

$$v_g = v_p$$

In a **dispersive medium**:

$$v_g \neq v_p$$

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13. According to the Special Theory of Relativity, what happens to the length of an object as its velocity approaches the speed of light?

(A) It increases
(B) It decreases (length contraction)
(C) It remains unchanged
(D) It becomes infinite

Correct Answer: (2) It decreases (length contraction)

Solution:

Concept:
According to **Einstein's Special Theory of Relativity**, the length of an object measured in the direction of motion appears shorter to an observer when the object moves at a velocity comparable to the speed of light. This phenomenon is known as **length contraction**.
The relation for relativistic length contraction is

$$L = L_0\sqrt{1 - \frac{v^2}{c^2}}$$

where

- L_0 = proper length (length in the object's rest frame)
- L = observed length
- v = velocity of the object
- c = speed of light

Step 1: Analyze the velocity dependence.
As v approaches c,

$$\frac{v^2}{c^2} \to 1$$

Thus,

$$\sqrt{1 - \frac{v^2}{c^2}} \to 0$$

Step 2: Conclusion.
Therefore, the observed length L becomes smaller than the proper length.
Hence, the object appears **contracted in the direction of motion**.

Quick Tip

Relativistic length contraction:

$$L = L_0\sqrt{1 - \frac{v^2}{c^2}}$$

Objects moving close to the speed of light appear **shorter along the direction of motion**.

14. Which statistical distribution describes the behavior of identical, indistinguishable particles with half-integral spin?
(A) Maxwell–Boltzmann distribution
(B) Bose–Einstein distribution
(C) Fermi–Dirac distribution
(D) Gaussian distribution

Correct Answer: (3) Fermi–Dirac distribution

Solution:

Concept:
Particles with **half-integral spin** $(\frac{1}{2}, \frac{3}{2}, \ldots)$ are known as **fermions**. Examples include electrons, protons, and neutrons.
These particles obey the **Pauli Exclusion Principle**, which states that no two identical fermions can occupy the same quantum state simultaneously.

Step 1: Identify the appropriate statistics.
The statistical distribution that describes the behavior of fermions is the **Fermi–Dirac distribution**.

Step 2: Write the distribution function.

$$f(E) = \frac{1}{e^{(E-\mu)/kT} + 1}$$

where

- E = energy of the state
- μ = chemical potential
- k = Boltzmann constant
- T = absolute temperature

Step 3: Compare with other distributions.

- Maxwell–Boltzmann distribution applies to classical particles.
- Bose–Einstein distribution describes bosons (integral spin).

Thus, half-integer spin particles follow the **Fermi–Dirac distribution**.

Quick Tip

Fermions (half-integer spin) $\rightarrow$ Fermi–Dirac statistics
Bosons (integer spin) $\rightarrow$ Bose–Einstein statistics

15. What is the physical significance of the "Quality Factor" (Q-factor) in an LCR resonant circuit?
(A) It represents the resistance of the circuit
(B) It measures the sharpness of resonance
(C) It determines the supply voltage
(D) It gives the current amplitude directly

Correct Answer: (2) It measures the sharpness of resonance

Solution:

Concept:
The **Quality Factor (Q-factor)** of an LCR circuit indicates how sharply the circuit resonates at its resonant frequency.
Mathematically,

$$Q = \frac{\omega_0 L}{R}$$

or equivalently

$$Q = \frac{1}{R}\sqrt{\frac{L}{C}}$$

where

- L = inductance
- C = capacitance
- R = resistance
- ω_0 = resonant angular frequency

Step 1: Interpretation of Q-factor.
A high Q-factor means the circuit has:

- Low energy loss
- Narrow bandwidth
- Sharp resonance peak

Step 2: Bandwidth relation.

$$Q = \frac{\omega_0}{\Delta\omega}$$

where $\Delta\omega$ is the bandwidth.

Step 3: Conclusion.
Therefore, the Q-factor describes the **sharpness or selectivity of resonance** in the circuit.

Quick Tip

Higher Q-factor $\rightarrow$ sharper resonance and smaller bandwidth.
Lower Q-factor $\rightarrow$ broader resonance.
