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

Time Allowed :1 Hours 30 minutes	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: (B) $\mu_0 I$

Solution:

Step 1: Understanding the Concept:
Ampère's Circuital Law states that the line integral of the magnetic field ($\vec{B}$) around any closed path or loop is directly proportional to the total steady current (I) enclosed by that path.

Step 2: Key Formula or Approach:
The mathematical representation of Ampère's Circuital Law is:

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

where μ_0 is the permeability of free space and I is the enclosed current.

Step 3: Detailed Explanation:
The integral $\oint \vec{B} \cdot d\vec{l}$ calculates the value of the magnetic field along the closed loop.
According to the formula, this integral evaluates exactly to the product of the permeability constant μ_0 and the current I passing through the loop.
Therefore, the value of the line integral is $\mu_0 I$.

Step 4: Final Answer:
The correct option is (B).

Quick Tip

Ampère's Circuital Law in this form is valid only for steady currents. For time-varying electric fields, Maxwell added a displacement current term ($\mu_0 \varepsilon_0 \frac{d\Phi_E}{dt}$).

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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: (B) Angular momentum

Solution:

Step 1: Understanding the Concept:
A central force is one that is always directed towards or away from a fixed central point and its magnitude depends only on the distance from that point.

Step 2: Key Formula or Approach:
The approach involves calculating the torque $\vec{\tau}$ acting on the particle.
Torque is given by the cross product of position vector and force:

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

Newton's second law for rotation states that torque equals the rate of change of angular momentum: $\vec{\tau} = \frac{d\vec{L}}{dt}$.

Step 3: Detailed Explanation:
For a central force field, the force vector $\vec{F}$ is purely radial, which means it is parallel to the position vector $\vec{r}$.
We can write $\vec{F} = f(r)\hat{r}$ and $\vec{r} = r\hat{r}$.

The cross product of two parallel vectors is zero:

$$\vec{\tau} = (r\hat{r}) \times (f(r)\hat{r}) = rf(r)(\hat{r} \times \hat{r}) = 0$$

Since the net torque is zero ($\vec{\tau} = 0$), the rate of change of angular momentum $\frac{d\vec{L}}{dt}$ must also be zero.
This implies that the angular momentum $\vec{L}$ is a constant vector.

Step 4: Final Answer:
The correct option is (B).

> Quick Tip
>
> Because the angular momentum vector remains constant in both magnitude and direction, the motion of a particle under a central force is always restricted to a single two-dimensional plane.

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

Solution:

Step 1: Understanding the Concept:
Every moving particle behaves like a wave, called matter waves. The wavelength associated with this wave is the de Broglie wavelength, which depends on the particle's momentum.

Step 2: Key Formula or Approach:
The fundamental de Broglie wavelength formula is:

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

The kinetic energy K gained by an electron of charge e accelerated through a potential difference V is $K = eV$.
The relation between momentum p and kinetic energy K is $p = \sqrt{2mK}$.

Step 3: Detailed Explanation:
First, find the momentum of the electron using its kinetic energy:

$$p = \sqrt{2m(eV)} = \sqrt{2meV}$$

Next, substitute this momentum back into the de Broglie wavelength equation:

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

This matches the expression in option (B).

Step 4: Final Answer:
The correct option is (B).

> Quick Tip
>
> For numerical problems involving an electron, you can use the shortcut formula $\lambda = \frac{1.227}{\sqrt{V}}$ nm or $\lambda = \frac{12.27}{\sqrt{V}}$ Å.

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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: (B) Fringe width decreases

Solution:

Step 1: Understanding the Concept:
In Young's Double Slit Experiment, the interference pattern consists of bright and dark fringes. The separation between consecutive bright or dark fringes is the fringe width.

Step 2: Key Formula or Approach:
The formula for fringe width β is:

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

where λ is the wavelength, D is the distance to the screen, and d is the slit separation.
When light enters a medium of refractive index μ, its new wavelength λ' is $\frac{\lambda}{\mu}$.

Step 3: Detailed Explanation:
When the apparatus is immersed in water, the refractive index of water is $\mu \approx 1.33$, which is greater than 1.
The new wavelength of the light in water becomes:

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

Because $\mu > 1$, the wavelength decreases ($\lambda' < \lambda$).
Since the fringe width β is directly proportional to the wavelength ($\beta \propto \lambda$), a decrease in wavelength results in a proportional decrease in the fringe width:

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

Thus, the fringe width decreases.

Step 4: Final Answer:
The correct option is (B).

> Quick Tip
>
> Frequency of light remains constant when it changes mediums, but its speed and wavelength decrease in a denser medium. Since fringe width relies on wavelength, it always decreases in a denser medium.

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

Solution:

Step 1: Understanding the Concept:
Maxwell's equations summarize the fundamental laws of electromagnetism. The non-existence of magnetic monopoles implies that magnetic poles always occur in North-South pairs.

Step 2: Key Formula or Approach:
The approach is to evaluate the physical meaning behind the divergence of a vector field. Divergence ($\nabla \cdot$) measures the net source or sink of field lines in a given volume.

Step 3: Detailed Explanation:
Let's analyze the options:
(A) $\nabla \cdot \vec{E} = \frac{\rho}{\varepsilon_0}$ is Gauss's Law for electricity, showing electric charges act as sources/sinks for electric fields.
(C) $\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$ is Faraday's Law of Induction.
(D) $\nabla \times \vec{B} = \mu_0 \vec{J} + \mu_0 \varepsilon_0 \frac{\partial \vec{E}}{\partial t}$ is the Ampère-Maxwell Law.
(B) $\nabla \cdot \vec{B} = 0$ is Gauss's Law for magnetism. It states that the divergence of the magnetic field over any volume is exactly zero. This means there are no net magnetic sources or sinks. Consequently, magnetic field lines must form continuous, closed loops, proving that an isolated magnetic monopole cannot exist.

Step 4: Final Answer:
The correct option is (B).

Quick Tip
If a magnetic monopole were ever discovered, equation (B) would be modified to $\nabla \cdot \vec{B} = \mu_0 \rho_m$, where ρ_m is the magnetic charge density.

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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: (C) $PV^\gamma = \text{constant}$

Solution:

Step 1: Understanding the Concept:
An adiabatic process is a thermodynamic process in which there is no heat transfer into or out of the system ($dQ = 0$).

Step 2: Key Formula or Approach:
The approach starts with the First Law of Thermodynamics ($dQ = dU + dW$) and the ideal gas equation ($PV = nRT$).
Setting $dQ = 0$ gives $0 = nC_v dT + PdV$.
Using the differential form of the ideal gas law ($PdV + VdP = nRdT$) and combining these equations yields a separable differential equation.

Step 3: Detailed Explanation:
When integrating the combined differential equation, we use the fact that the specific heat ratio

is defined as $\gamma = \frac{C_p}{C_v}$ and $R = C_p - C_v$.
The integration leads directly to Poisson's equation for a reversible adiabatic process of an ideal gas:

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

This relationship signifies that during an adiabatic expansion or compression, the pressure and volume change such that their product, with the volume raised to the power of γ, remains constant.
Option (A) $PV = \text{constant}$ is Boyle's law, which applies to isothermal processes, not adiabatic.

Step 4: Final Answer:
The correct option is (C).

> Quick Tip
>
> There are three common relations for adiabatic processes you must memorize: $PV^\gamma = \text{constant}$, $TV^{\gamma-1} = \text{constant}$, and $T^\gamma P^{1-\gamma} = \text{constant}$.

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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: (A) -13.6 eV

Solution:

Step 1: Understanding the Concept:
In the Bohr model of the hydrogen atom, an electron orbits the nucleus in fixed, quantized circular paths called energy levels or shells. The ground state is the lowest energy level closest to the nucleus.

Step 2: Key Formula or Approach:
The energy of an electron in the n-th energy level of a hydrogen-like atom is given by the formula:

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

where Z is the atomic number (for hydrogen, $Z = 1$) and n is the principal quantum number.

Step 3: Detailed Explanation:
The ground state corresponds to the first orbit, so the principal quantum number is $n = 1$. Substituting $Z = 1$ and $n = 1$ into the energy formula gives:

$$E_1 = -\frac{13.6 \times (1)^2}{(1)^2} \text{ eV}$$

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

The negative sign signifies that the electron is bound to the nucleus. An external energy of $+13.6$ eV must be supplied to completely remove the electron from this state (ionization energy).

Step 4: Final Answer:
The correct option is (A).

> Quick Tip
>
> Always memorize the first four energy levels of hydrogen: $E_1 = -13.6$ eV, $E_2 = -3.4$ eV, $E_3 = -1.51$ eV, and $E_4 = -0.85$ eV. It saves a lot of time in spectral line calculations.

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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: (B) It increases

Solution:

Step 1: Understanding the Concept:
A p-n junction features a depletion layer where mobile charge carriers have recombined, leaving behind uncovered immobile ions. A built-in electric field exists across this layer.

Step 2: Key Formula or Approach:
The approach is to analyze the direction of the applied electric field compared to the built-in field. In reverse bias, the p-side is connected to the negative terminal and the n-side to the positive terminal.

Step 3: Detailed Explanation:
When reverse bias is applied, the external battery creates an electric field that points in the same direction as the built-in electric field of the depletion region.
The negative terminal of the battery attracts the holes (majority carriers in the p-region) away from the junction.
Simultaneously, the positive terminal attracts the electrons (majority carriers in the n-region) away from the junction.
Because the majority carriers are pulled away from both sides of the junction, a larger region of immobile ions is left uncovered.
Consequently, the width of the depletion layer increases, preventing any significant current flow across the junction.

Step 4: Final Answer:
The correct option is (B).

> Quick Tip
>
> Forward bias pushes majority carriers *towards* the junction, narrowing the depletion layer. Reverse bias pulls carriers *away* from the junction, widening the depletion layer.

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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) $Y = \overline{A + B}$

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

Solution:

Step 1: Understanding the Concept:
A NAND gate is a universal digital logic gate. The term "NAND" is a contraction of "NOT AND", meaning its output is the exact opposite of an AND gate.

Step 2: Key Formula or Approach:
The logical AND operation for two inputs A and B is written as $A \cdot B$ or AB.
The logical NOT operation, which signifies inversion, is represented by a horizontal line (bar) over the expression.

Step 3: Detailed Explanation:
To construct the expression for a NAND gate, we first take the AND operation of inputs A and B, which gives AB.
Next, we apply the NOT operation to this result to invert it.

This results in placing a bar over the entire AND expression, giving:

$$Y = \overline{AB}$$

Reviewing the other options:
(A) $Y = A + B$ is the expression for an OR gate.
(B) $Y = AB$ is the expression for an AND gate.
(D) $Y = \overline{A + B}$ is the expression for a NOR gate.

Step 4: Final Answer:
The correct option is (C).

> Quick Tip
>
> According to De Morgan's theorem, the expression $Y = \overline{AB}$ is also perfectly equivalent to $Y = \overline{A} + \overline{B}$.

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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: (C) Inertial frame

Solution:

Step 1: Understanding the Concept:
An inertial frame of reference is a coordinate system in which an object experiences zero net force and moves at a constant velocity (or remains at rest), meaning Newton's first law of motion is fully valid.

Step 2: Key Formula or Approach:
The approach involves Galilean transformations. If the position in frame S is $\vec{r}$ and in frame S' is $\vec{r'} = \vec{r} - \vec{v}t$ (where $\vec{v}$ is constant relative velocity), taking the second derivative with respect to time gives the acceleration relationship.

Step 3: Detailed Explanation:
Let frame S be an established inertial frame.
Suppose frame S' is moving with a constant velocity $\vec{v}$ relative to frame S.
Because the relative velocity is constant, the derivative of velocity with respect to time is zero.
Hence, the relative acceleration between the frames is zero.

If an object has an acceleration $\vec{a}$ measured in frame S, its acceleration $\vec{a}'$ measured in frame S' will be exactly the same ($\vec{a}' = \vec{a}$).
If no forces act on an object, $\vec{a} = 0$, which means $\vec{a}' = 0$ as well.
Since Newton's first law holds true in frame S' just as it does in frame S, frame S' is also classified as an inertial frame.

Step 4: Final Answer:
The correct option is (C).

> Quick Tip
>
> Frames that are accelerating or rotating relative to an inertial frame are "Non-inertial frames", and they require the introduction of pseudo-forces (like centrifugal force) to apply Newton's laws.

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11. Which phenomenon confirms the transverse nature of electromagnetic waves?

(A) Interference
(B) Diffraction
(C) Polarization
(D) Reflection

Correct Answer: (C) Polarization

Solution:

Step 1: Understanding the Concept:
Waves propagate in two primary ways: longitudinal (oscillations parallel to the direction of travel) and transverse (oscillations perpendicular to the direction of travel).

Step 2: Key Formula or Approach:
The approach relies on eliminating wave phenomena that apply universally. We must identify a physical phenomenon that is mathematically and physically impossible for oscillations that lack perpendicular components.

Step 3: Detailed Explanation:
Phenomena such as reflection, interference, and diffraction are general wave properties. Both longitudinal waves (like sound) and transverse waves (like light) exhibit these effects. Therefore, they cannot definitively prove whether a wave is transverse or longitudinal.
Polarization is the process of restricting the vibrations of a wave to a single plane.
For a longitudinal wave, oscillations happen only along the single axis of propagation, so there are no multiple planes to restrict. Thus, longitudinal waves cannot be polarized.
Transverse waves have oscillations in the infinite planes perpendicular to the propagation axis. Passing them through a polarizer filters out all but one plane of oscillation.
Because electromagnetic waves can be polarized, it is absolute proof that their electric and

magnetic field oscillations are perpendicular to the direction of propagation (transverse).

Step 4: Final Answer:
The correct option is (C).

> Quick Tip
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> If a question ever asks for the exclusive or defining test of a transverse wave, the answer is always Polarization. Remember, sound waves cannot be polarized!

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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: (C) $v_g = v_p$

Solution:

Step 1: Understanding the Concept:
Phase velocity (v_p) represents the speed at which a single specific phase of a wave travels. Group velocity (v_g) represents the speed at which the overall envelope (or energy) of a wave packet travels.

Step 2: Key Formula or Approach:
The formulas defining these velocities are:
Phase velocity: $v_p = \frac{\omega}{k}$
Group velocity: $v_g = \frac{d\omega}{dk}$
where ω is the angular frequency and k is the wave number.

Step 3: Detailed Explanation:
From the phase velocity formula, we can express the angular frequency as:

$$\omega = v_p k$$

To find the group velocity, we differentiate ω with respect to k:

$$v_g = \frac{d\omega}{dk} = \frac{d}{dk}(v_p k)$$

By definition, a non-dispersive medium is one where the wave speed is completely independent

of the frequency or wave number. This means v_p is a constant.
Since v_p is constant, we can pull it out of the derivative:

$$v_g = v_p \frac{dk}{dk} = v_p(1)$$

Therefore, in a non-dispersive medium, the group velocity is exactly equal to the phase velocity ($v_g = v_p$).

Step 4: Final Answer:
The correct option is (C).

> Quick Tip
>
> In a standard dispersive medium like glass, $v_p > v_g$. In an anomalously dispersive medium, $v_g > v_p$. Vacuum is perfectly non-dispersive for electromagnetic waves, where $v_g = v_p = c$.

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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: (B) It decreases (length contraction)

Solution:

Step 1: Understanding the Concept:
One of the most famous consequences of Einstein's Special Theory of Relativity is that measurements of space and time are not absolute. They depend on the relative velocity between the observer and the object being measured.

Step 2: Key Formula or Approach:
The relativistic length contraction formula determines the observed length L:

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

where L_0 is the proper length (length measured by an observer at rest relative to the object), v is the relative velocity, and c is the speed of light.

Step 3: Detailed Explanation:
Analyze the term inside the square root: $1 - \frac{v^2}{c^2}$.
As the velocity of the object v increases and approaches the speed of light c, the fraction $\frac{v^2}{c^2}$ approaches 1.
Consequently, the term $1 - \frac{v^2}{c^2}$ approaches 0.
The square root of a value approaching zero also approaches zero.
Multiplying the proper length L_0 by a factor approaching zero means the measured length L will approach zero.
Thus, the length of the object significantly decreases along the direction of motion as it approaches the speed of light. This phenomenon is called length contraction.

Step 4: Final Answer:
The correct option is (B).

Quick Tip
Remember the trinity of relativistic effects at high speeds: Length Contracts, Time Dilates (stretches out), and Relativistic Mass Increases.

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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: (C) Fermi–Dirac distribution

Solution:

Step 1: Understanding the Concept:
In statistical mechanics, large systems of particles are modeled using specific probability distributions. The choice of distribution depends entirely on the quantum properties of the particles, specifically whether they are distinguishable and what their intrinsic angular momentum (spin) is.

Step 2: Key Formula or Approach:
The approach involves matching the particle characteristics to the rules of the three primary statistical distributions in physics: Classical (MB), Bosonic (BE), and Fermionic (FD).

Step 3: Detailed Explanation:
Let's review the statistical distributions:
1. **Maxwell-Boltzmann statistics** apply to identical but *distinguishable* particles, such as

molecules in an ideal gas at high temperatures. Spin is irrelevant here.
2. **Bose-Einstein statistics** apply to identical, *indistinguishable* particles that have *integral* spin $(0, 1, 2, \ldots)$. These particles are called bosons (like photons) and do not obey the Pauli exclusion principle.
3. **Fermi-Dirac statistics** apply to identical, *indistinguishable* particles that have *half-integral* spin $(1/2, 3/2, 5/2, \ldots)$. These particles are called fermions (like electrons, protons, and neutrons).
Because fermions possess half-integral spin, they obey the Pauli exclusion principle, meaning no two particles can occupy the exact same quantum state simultaneously. This behavior is perfectly modeled by the Fermi-Dirac distribution.

Step 4: Final Answer:
The correct option is (C).

> Quick Tip
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> Mnemonic to remember: **B**osons = **B**ose-Einstein (Whole numbers). **F**ermions = **F**ermi-Dirac (**F**ractions/Half-integers).

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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: (B) It measures the sharpness of resonance

Solution:

Step 1: Understanding the Concept:
In an LCR (Inductor, Capacitor, Resistor) series circuit, resonance occurs at a specific frequency where the inductive reactance cancels the capacitive reactance, allowing maximum current to flow.

Step 2: Key Formula or Approach:
The Quality Factor (Q) is a dimensionless parameter formally defined as the ratio of the resonant frequency f_0 to the bandwidth Δf:

$$Q = \frac{f_0}{\Delta f} = \frac{\omega_0 L}{R}$$

where $\Delta f = f_2 - f_1$ is the difference between the half-power frequencies.

Step 3: Detailed Explanation:
The bandwidth Δf defines the range of frequencies around the resonant frequency where the power dissipated is at least half of its maximum peak value.
A large Q-factor means that the bandwidth Δf is very small.
Graphically, plotting current versus frequency for a circuit with a small bandwidth yields a very narrow, tall, and highly pointed peak.
Conversely, a low Q-factor results in a wide bandwidth, giving a flat and broad peak.
Because a high Q-factor creates a sharper peak, it allows the circuit to be highly selective in tuning to one specific frequency while rejecting others (like tuning a radio).
Therefore, the physical significance of the Q-factor is that it measures the sharpness of resonance.

Step 4: Final Answer:
The correct option is (B).

> **Quick Tip**
>
> To design a circuit with high selectivity (high sharpness), engineers aim for a high Q-factor by minimizing the resistance R in the LCR circuit.
