CUET-UG Physics Sample Paper-20

Duration: 1 Hour **Maximum Marks: 250**

Instructions

- This paper contains a total of 50 Multiple Choice Questions.
- Each correct answer carries **+5 marks**.
- Each incorrect answer carries **-1 mark**.
- No negative marking for unattempted questions.

Q1. A point charge q is placed at a distance $a/2$ directly above the center of a square of side a. The electric flux through the square is:

(A) q/ϵ_0

(B) $q/6\epsilon_0$

(C) $q/4\epsilon_0$

(D) Zero

Q2. An electric dipole of moment $\vec{p}$ is placed in a uniform electric field $\vec{E}$. The coordinates of the points where the potential is maximum and minimum respectively are:

(A) $\theta = 0°$ and $\theta = 180°$

(B) $\theta = 180°$ and $\theta = 0°$

(C) $\theta = 90°$ and $\theta = 270°$

(D) $\theta = 0°$ and $\theta = 90°$

Q3. A parallel plate capacitor with air between the plates has a capacitance of 8 pF. What will be the capacitance if the distance between the plates is reduced by half and the space between them is filled with a substance of dielectric constant $k = 6$?

(A) 48 pF

(B) 96 pF

(C) 24 pF

(D) 8 pF

Q4. The electric potential at a point on the equatorial line of an electric dipole is:

(A) Directly proportional to r

(B) Inversely proportional to r

(C) Inversely proportional to r^2

(D) Zero

Q5. A capacitor is charged by a battery. The battery is removed and then the separation between the plates is increased. The energy stored in the capacitor:

(A) Decreases

(B) Increases

(C) Remains the same

(D) Becomes zero

Q6. Two charges $+3\mu$C and -3μC are placed at points A and B, 10 cm apart. The potential at the center of the line joining them is:

(A) Zero

(B) 5.4×10^5 V

(C) 10.8×10^5 V

(D) 2.7×10^5 V

Q7. A dipole is placed in a non-uniform electric field. It experiences:

(A) Only a force

(B) Only a torque

(C) Both a force and a torque

(D) Neither force nor torque

Q8. The electric field at a distance r from an infinitely long straight wire having linear charge density λ is E. If the distance is doubled, the field becomes:

(A) $2E$

(B) $E/2$

(C) $E/4$

(D) $4E$

Q9. The drift velocity v_d varies with the applied electric field E as:

(A) $v_d \propto \sqrt{E}$

(B) $v_d \propto E^2$

(C) $v_d \propto E$

(D) v_d is independent of E

Q10. A cell of emf E and internal resistance r is connected across an external resistance R. The graph of potential difference V across R versus R is:

(A) A straight line passing through origin

(B) A straight line with negative slope

(C) A curve reaching a maximum value E asymptotically

(D) A rectangular hyperbola

Q11. In a Wheatstone bridge, all four arms have equal resistance R. If the resistance of the galvanometer is also R, the equivalent resistance of the combination as seen by the battery is:

(A) $R/4$

(B) $R/2$

(C) R

(D) $2R$

Q12. Kirchhoff's second law (Loop Rule) is based on the conservation of:

(A) Charge

(B) Momentum

(C) Mass

(D) Energy

Q13. Two wires of the same material have lengths in the ratio 1 : 2 and diameters in the ratio 2 : 1. If they are connected in series, the ratio of potential differences across them is:

(A) 1 : 2

(B) 1 : 4

(C) 1 : 8

(D) 8 : 1

Q14. For a cell, the terminal potential difference is 2.2 V when circuit is open and reduces to 1.8 V when the cell is connected to a resistance of $R = 5\Omega$. The internal resistance of the cell is:

(A) $10/9\Omega$

(B) $9/10\Omega$

(C) 1.1Ω

(D) Zero

Q15. A circular coil of radius R carries a current I. The magnetic field at its center is B. At what distance from the center on the axis of the coil will the magnetic field be $B/8$?

(A) $\sqrt{2}R$

(B) $\sqrt{3}R$

(C) $2R$

(D) $3R$

Q16. A moving coil galvanometer can be converted into an ammeter by connecting:

(A) A low resistance in series

(B) A high resistance in parallel

(C) A low resistance in parallel

(D) A high resistance in series

Q17. A long solenoid has 1000 turns. When a current of 4 A flows through it, the magnetic flux linked with each turn of the solenoid is 4×10^{-3} Wb. The self-inductance of the solenoid is:

(A) 4 H

(B) 1 H

(C) 2 H

(D) 0.4 H

Q18. If a magnetic material is having susceptibility $\chi = -0.00015$, the material is:

(A) Paramagnetic

(B) Ferromagnetic

(C) Diamagnetic

(D) Non-magnetic

Q19. Two parallel wires carrying currents in the opposite directions:

(A) Attract each other

(B) Repel each other

(C) Neither attract nor repel

(D) Rotate around each other

Q20. At the Curie temperature, a ferromagnetic material becomes:

(A) Diamagnetic

(B) Paramagnetic

(C) Non-magnetic

(D) Strongly ferromagnetic

Q21. A square loop of side 10 cm and resistance 0.5Ω is placed vertically in the east-west plane. A uniform magnetic field of 0.10 T is set up across the plane in the north-east direction. The magnetic field is decreased to zero in 0.70 s. The induced emf is:

(A) 1.0 mV

(B) 2.0 mV

(C) 0.5 mV

(D) 4.0 mV

Q22. In a series LCR circuit, the phase difference between current and voltage at resonance is:

(A) 0

(B) $\pi/2$

(C) π

(D) $\pi/4$

Q23. A transformer is used to light a 140 W, 24 V lamp from 240 V AC mains. If the current in the mains is 0.7 A, the efficiency of the transformer is:

(A) 63.8%

(B) 83.3%

(C) 48%

(D) 90%

Q24. The core of a transformer is laminated to reduce:

(A) Hysteresis loss

(B) Copper loss

(C) Eddy current loss

(D) Magnetic flux leakage

Q25. An AC generator consists of a coil of 50 turns and area 2.5 m^2 rotating at an angular speed of 60 rad/s in a uniform magnetic field $B = 0.3$ T. The maximum emf is:

(A) 1250 V

(B) 2250 V

(C) 500 V

(D) 4500 V

Q26. Which of the following has the minimum reactance in a high-frequency AC circuit?

(A) Inductor

(B) Capacitor

(C) Resistor

(D) L-C combination

Q27. The displacement current flows in the dielectric of a capacitor when the potential difference across its plates:

(A) Is changing with time

(B) Is constant

(C) Becomes zero

(D) Is very high

Q28. Which of the following electromagnetic waves has the highest frequency?

(A) Radio waves

(B) Microwaves

(C) Gamma rays

(D) X-rays

Q29. A biconvex lens has a focal length f. If it is cut into two identical plano-convex lenses along the principal axis, the focal length of each part will be:

(A) f

(B) $f/2$

(C) $2f$

(D) $4f$

Q30. In Young's Double Slit Experiment, if the distance between the slits and the screen is doubled and the separation between the slits is halved, the fringe width becomes:

(A) Four times

(B) Two times

(C) Half

(D) Remains same

Q31. A person cannot see objects clearly beyond 2 m. The power of the lens required to correct his vision will be:

(A) +0.5 D

(B) −0.5 D

(C) +1.0 D

(D) −1.0 D

Q32. The magnifying power of an astronomical telescope in normal adjustment is 10 and the focal length of the objective is 100 cm. The focal length of the eyepiece is:

(A) 10 cm

(B) 1 cm

(C) 1000 cm

(D) 110 cm

Q33. When light travels from a rarer to a denser medium, the quantity that remains unchanged is:

(A) Velocity

(B) Wavelength

(C) Frequency

(D) Amplitude

Q34. The phenomenon of diffraction can be understood as:

(A) Superposition of waves from two coherent sources

(B) Superposition of secondary wavelets from different parts of the same wavefront

(C) Reflection of light from a polished surface

(D) Refraction through a prism

Q35. A ray of light is incident on a glass slab at the polarizing angle. The angle between the reflected and refracted rays is:

(A) $0°$

(B) $45°$

(C) $90°$

(D) $180°$

Q36. In a single slit diffraction experiment, the width of the central maximum is:

(A) Directly proportional to wavelength

(B) Inversely proportional to wavelength

(C) Independent of wavelength

(D) Directly proportional to the square of wavelength

Q37. For a total internal reflection, the angle of incidence must be:

(A) Equal to the critical angle

(B) Less than the critical angle

(C) Greater than the critical angle

(D) 90°

Q38. The work function of a metal is 2 eV. If light of wavelength 310 nm falls on it, the maximum kinetic energy of the ejected photoelectrons is: (Take $hc = 1240$ eV-nm)

(A) 1 eV

(B) 2 eV

(C) 3 eV

(D) 4 eV

Q39. The de-Broglie wavelength of an electron accelerated through a potential difference of V volts is proportional to:

(A) V

(B) V^2

(C) $1/\sqrt{V}$

(D) $\sqrt{V}$

Q40. If the intensity of light incident on a metal surface is doubled, the maximum kinetic energy of photoelectrons will:

(A) Be doubled

(B) Be halved

(C) Remain unchanged

(D) Become four times

Q41. A photon and an electron have the same de-Broglie wavelength. Which one has more total energy?

(A) Electron

(B) Photon

(C) Both have equal energy

(D) Cannot be determined

Q42. In Bohr's model of the Hydrogen atom, the ratio of kinetic energy to total energy of the electron in any orbit is:

(A) $1 : 1$

(B) $1 : -1$

(C) $2 : 1$

(D) $1 : -2$

Q43. The binding energy per nucleon is maximum for the nucleus:

(A) ^{4}He

(B) ^{56}Fe

(C) ^{235}U

(D) ^{2}H

Q44. When a Hydrogen atom emits a photon in a transition from $n = 3$ to $n = 2$, the photon belongs to:

(A) Lyman series

(B) Balmer series

(C) Paschen series

(D) Brackett series

Q45. The energy equivalent of 1 atomic mass unit (amu) is nearly:

(A) 931 MeV

(B) 931 eV

(C) 1.6×10^{-19} J

(D) 9.1×10^{-31} J

Q46. In the process of nuclear fission, the ratio of mass of products to the mass of reactants is:

(A) Equal to 1

(B) Greater than 1

(C) Less than 1

(D) Zero

Q47. In an intrinsic semiconductor, at 0 K temperature:

(A) The conduction band is completely empty

(B) The valence band is partially empty

(C) There are many holes in valence band

(D) It behaves like a conductor

Q48. A p-n junction diode acts as a closed switch when:

(A) It is forward biased

(B) It is reverse biased

(C) It is unbiased

(D) None of the above

Q49. The output frequency of a full-wave rectifier if the input frequency is 50 Hz is:

(A) 50 Hz

(B) 25 Hz

(C) 100 Hz

(D) 200 Hz

Q50. The depletion layer in a p-n junction is caused by:

(A) Drift of electrons

(B) Diffusion of charge carriers

(C) Application of forward bias

(D) Application of reverse bias

Detailed Solutions

Q1.

Solution

Concept: According to **Gauss's Law**, the total electric flux Φ_{total} through a closed surface is given by $\Phi_{total} = \frac{q_{enclosed}}{\epsilon_0}$. For a point charge q placed at the center of a cube, the flux is distributed equally across all six faces due to symmetry.

Solution: Imagine the square of side a as the base of a cube with side a. If a charge q is placed at a distance $a/2$ above the center of this square, it is effectively at the geometric center of the cube. The total flux through the entire cube is:

$$\Phi_{total} = \frac{q}{\epsilon_0}$$

Since a cube has 6 identical square faces and the charge is equidistant from each, the flux through the single square face is:

$$\Phi_{face} = \frac{1}{6}\Phi_{total} = \frac{q}{6\epsilon_0}$$

Final Answer: The electric flux through the square is $q/6\epsilon_0$.

Answer: (B)

Q2.

Solution

Concept: The potential energy U of an electric dipole of moment $\vec{p}$ placed in a uniform electric field $\vec{E}$ is given by the dot product:

$$U = -\vec{p} \cdot \vec{E} = -pE\cos\theta$$

where θ is the angle between the dipole moment and the direction of the electric field.

Solution: To find the maximum and minimum potential energy, we evaluate the function $U(\theta) = -pE\cos\theta$:

- **Maximum Potential:** This occurs when $\cos\theta$ is at its minimum value (-1).

$$-pE(-1) = +pE \text{ at } \theta = 180^\circ$$

- **Minimum Potential:** This occurs when $\cos\theta$ is at its maximum value $(+1)$.

$$-pE(1) = -pE \text{ at } \theta = 0^\circ$$

Thus, the potential is maximum at $\theta = 180^\circ$ and minimum at $\theta = 0^\circ$.

Final Answer: The potential is maximum at $\theta = 180^\circ$ and minimum at $\theta = 0^\circ$.

Answer: (B)

Q3.

Solution

Concept: The capacitance of a parallel plate capacitor is given by $C = \frac{k\epsilon_0 A}{d}$, where k is the dielectric constant, A is the area of the plates, and d is the separation distance. For air, $k \approx 1$.
Solution: Initially, $C_0 = \frac{\epsilon_0 A}{d} = 8$ pF. In the second case, the new distance $d' = d/2$ and the new dielectric constant $k = 6$. The new capacitance C' is:

$$C' = \frac{k\epsilon_0 A}{d'} = \frac{6\epsilon_0 A}{d/2} = 12\left(\frac{\epsilon_0 A}{d}\right)$$

Substituting the initial value:

$$C' = 12 \times 8 \text{ pF} = 96 \text{ pF}$$

Final Answer: The new capacitance will be 96 pF.

Answer: (B)

Q4.

Solution

Concept: The electric potential V at a point due to a dipole is $V = \frac{1}{4\pi\epsilon_0}\frac{p\cos\theta}{r^2}$, where θ is the angle between the dipole moment and the position vector of the point.
Solution: The equatorial line (or perpendicular bisector) of a dipole consists of points where the angle $\theta = 90^\circ$. Substituting this into the potential formula:

$$V = \frac{1}{4\pi\epsilon_0}\frac{p\cos 90^\circ}{r^2}$$

Since $\cos 90^\circ = 0$, the potential V at any point on the equatorial line is zero. This is because the point is equidistant from the positive and negative charges, and their individual potentials cancel out.
Final Answer: The electric potential at a point on the equatorial line is zero.

Answer: (B)

Q5.

Solution

Concept: When a battery is removed after charging a capacitor, the charge Q on the plates remains constant. The energy stored is given by $U = \frac{Q^2}{2C}$.
Solution: The capacitance is $C = \frac{\epsilon_0 A}{d}$. If the separation d is increased, the capacitance C decreases. Looking at the energy formula $U = \frac{Q^2}{2C}$, since Q is constant and C decreases, the energy U must increase. This increase in energy comes from the work done by an external agent to pull the oppositely charged plates apart against their mutual electrostatic attraction.
Final Answer: The energy stored in the capacitor increases.

Answer: (B)

Q6.

Solution

Concept: The electric potential V at a point due to a system of charges is the algebraic sum of the potentials created by each individual charge: $V = \sum \frac{1}{4\pi\epsilon_0}\frac{q_i}{r_i}$. Potential is a scalar quantity, so we include the sign of the charges.

Solution: Let the center of the line AB be point O. The distance of O from point A (r_1) is 5 cm and from point B (r_2) is also 5 cm. The potential due to $+3\mu$C at O is:

$$V_A = \frac{1}{4\pi\epsilon_0}\frac{+3\times 10^{-6}}{0.05}$$

The potential due to -3μC at O is:

$$V_B = \frac{1}{4\pi\epsilon_0}\frac{-3\times 10^{-6}}{0.05}$$

The total potential at the center O is:

$$V_{net} = V_A + V_B = \frac{1}{4\pi\epsilon_0}\left(\frac{3\times 10^{-6}}{0.05} - \frac{3\times 10^{-6}}{0.05}\right) = 0$$

Final Answer: The potential at the center is zero.

Answer: (B)

Q7.

Solution

Concept: In a non-uniform electric field, the magnitude and direction of the field $\vec{E}$ vary from point to point. A dipole consists of two equal and opposite charges ($+q$ and $-q$) separated by a small distance.

Solution: 1. **Force:** Since the field is non-uniform, the electric field $\vec{E}_1$ at the location of $+q$ is different from the field $\vec{E}_2$ at the location of $-q$. Therefore, the forces $\vec{F}_1 = q\vec{E}_1$ and $\vec{F}_2 = -q\vec{E}_2$ do not cancel each other out, resulting in a net translational force. 2. **Torque:** Unless the dipole is perfectly aligned with the direction of the field gradient, the two forces will generally act along different lines of action, creating a couple or torque that tends to rotate the dipole. Consequently, the dipole experiences both a net force and a net torque.

Final Answer: It experiences both a force and a torque.

Answer: (B)

Q8.

Solution

Concept: The electric field E due to an infinitely long straight charged wire at a radial distance r is given by the formula:

$$E = \frac{\lambda}{2\pi\epsilon_0 r}$$

where λ is the linear charge density. This shows that $E \propto \frac{1}{r}$.

Solution: Let the initial electric field be $E_1 = \frac{\lambda}{2\pi\epsilon_0 r}$. When the distance is doubled, the new distance becomes $r' = 2r$. The new electric field E' is:

$$E' = \frac{\lambda}{2\pi\epsilon_0(2r)} = \frac{1}{2}\left(\frac{\lambda}{2\pi\epsilon_0 r}\right) = \frac{E}{2}$$

Therefore, the electric field becomes half of its original value.

Final Answer: The field becomes $E/2$.

Answer: (B)

Q9.

Solution

Concept: Drift velocity v_d is the average velocity attained by charged particles (such as electrons) in a material due to an electric field. The standard formula for drift velocity is:

$$v_d = \frac{eE\tau}{m}$$

where e is the charge of an electron, E is the electric field, τ is the relaxation time, and m is the mass of the electron.

Solution: From the formula $v_d = \left(\frac{e\tau}{m}\right)E$, it is evident that for a given conductor at a constant temperature (where τ remains constant), the drift velocity is directly proportional to the applied electric field:

$$v_d \propto E$$

Final Answer: The drift velocity varies as $v_d \propto E$.

Answer: (B)

Q10.

Solution

Concept: For a cell of emf E and internal resistance r connected to an external resistance R, the terminal potential difference V is given by:

$$V = IR = \left(\frac{E}{R+r}\right)R = \frac{E}{1+\frac{r}{R}}$$

Solution: We analyze the behavior of V as R changes:

- When $R = 0$, $V = 0$ (the graph starts at the origin).
- As R increases, the term $\frac{r}{R}$ decreases, causing V to increase.
- As $R \to \infty$ (open circuit), the term $\frac{r}{R} \to 0$, and V approaches the value E.

The graph is a curve that starts at the origin and rises toward the horizontal asymptote $V = E$.
Final Answer: A curve reaching a maximum value E asymptotically.

Answer: (B)

Q11.

Solution

Concept: A Wheatstone bridge is said to be balanced when the product of the resistances of opposite arms is equal, or the ratio of the resistances of adjacent arms is the same. In a balanced condition, no current flows through the galvanometer arm.
Solution: In this case, the four arms have resistances $P = R, Q = R, R = R, S = R$. Since $P/Q = R/S = 1$, the bridge is balanced. Thus, no current flows through the galvanometer resistance ($R_g = R$). We can ignore the galvanometer arm. The circuit simplifies to two parallel branches:

- Top branch: Two resistors in series ($R + R = 2R$)
- Bottom branch: Two resistors in series ($R + R = 2R$)

The equivalent resistance R_{eq} is the parallel combination of these two $2R$ branches:

$$\frac{1}{R_{eq}} = \frac{1}{2R} + \frac{1}{2R} = \frac{2}{2R} = \frac{1}{R}$$

Therefore, $R_{eq} = R$.
Final Answer: The equivalent resistance is R.

Answer: (B)

Q12.

Solution

Concept: Kirchhoff's Second Law, also known as the Loop Rule, states that the algebraic sum of the changes in potential around any closed loop in a circuit must be zero: $\sum \Delta V = 0$.

Solution: Electric potential is defined as potential energy per unit charge. When a charge moves around a closed loop and returns to its starting point, it must have the same potential energy it started with. Therefore, the total work done on the charge (the sum of potential gains and losses) must be zero. This is a direct consequence of the law of conservation of energy in an electrostatic field.

Final Answer: Kirchhoff's second law is based on the conservation of energy.

Answer: (B)

Q13.

Solution

Concept: The resistance of a wire is given by $R = \rho\frac{L}{A} = \rho\frac{L}{\pi(d/2)^2} = \frac{4\rho L}{\pi d^2}$. For wires connected in series, the current I is the same through both, so the potential difference $V = IR$ is directly proportional to the resistance ($V \propto R$).

Solution: Given ratios: $L_1/L_2 = 1/2$ and $d_1/d_2 = 2/1$. The ratio of their resistances is:

$$\frac{R_1}{R_2} = \frac{L_1}{L_2} \times \left(\frac{d_2}{d_1}\right)^2$$

Substituting the given values:

$$\frac{R_1}{R_2} = \left(\frac{1}{2}\right) \times \left(\frac{1}{2}\right)^2 = \frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$$

Since $V_1/V_2 = R_1/R_2$ in series:

$$\frac{V_1}{V_2} = \frac{1}{8}$$

Final Answer: The ratio of potential differences is 1 : 8.

Answer: (B)

Q14.

Solution

Concept: When a cell is in an open circuit, the terminal potential difference is equal to its emf (E). When connected to an external resistance R, the terminal potential difference V is less than E due to the internal resistance r. The relationship is given by $V = E - Ir$, or more conveniently, $r = R\left(\frac{E}{V} - 1\right)$.

Solution: Given:

- Emf $E = 2.2$ V (Open circuit voltage)
- Terminal Voltage $V = 1.8$ V
- External Resistance $R = 5\Omega$

Using the formula for internal resistance:

$$r = 5\left(\frac{2.2}{1.8} - 1\right) = 5\left(\frac{11}{9} - 1\right)$$

$$r = 5\left(\frac{11-9}{9}\right) = 5\left(\frac{2}{9}\right) = \frac{10}{9}\Omega$$

Final Answer: The internal resistance is $10/9\Omega$.

Answer: (B)

Q15.

Solution

Concept: The magnetic field at the center of a circular coil is $B = \frac{\mu_0 I}{2R}$. The magnetic field at a distance x from the center on the axis of the coil is given by:

$$B_{axis} = \frac{\mu_0 I R^2}{2(R^2 + x^2)^{3/2}}$$

Solution: We are given that $B_{axis} = B/8$. Substituting the formulas:

$$\frac{\mu_0 I R^2}{2(R^2 + x^2)^{3/2}} = \frac{1}{8}\left(\frac{\mu_0 I}{2R}\right)$$

Canceling common terms $(\mu_0, I, 2)$:

$$\frac{R^2}{(R^2 + x^2)^{3/2}} = \frac{1}{8R}$$

$$8R^3 = (R^2 + x^2)^{3/2}$$

Taking the cube root of both sides:

$$(8R^3)^{1/3} = ((R^2 + x^2)^{3/2})^{1/3}$$

$$2R = (R^2 + x^2)^{1/2}$$

Squaring both sides:

$$4R^2 = R^2 + x^2$$

$$3R^2 = x^2 \implies x = \sqrt{3}R$$

Final Answer: The distance is $\sqrt{3}R$.

Answer: (B)

Q16.

Solution

Concept: A galvanometer is a very sensitive device that can only measure small currents. To measure larger currents (i.e., to convert it into an ammeter), we must provide an alternative path for the excess current so that the galvanometer coil does not get damaged.

Solution: To convert a galvanometer into an ammeter, a **low resistance**, called a **shunt** (S), is connected in **parallel** with the galvanometer coil.

- The parallel connection ensures that the majority of the current flows through the low-resistance shunt.
- This arrangement also decreases the overall equivalent resistance of the device, which is necessary for an ideal ammeter so that it does not significantly alter the current in the main circuit.

Final Answer: A low resistance in parallel.

Answer: (B)

Q17.

Solution

Concept: Self-inductance (L) is defined as the ratio of the total magnetic flux (Φ_{total}) linked with the coil to the current (I) flowing through it:

$$L = \frac{\Phi_{total}}{I} = \frac{N\phi}{I}$$

where N is the number of turns and ϕ is the flux linked with each individual turn.

Solution: Given:

- Number of turns $N = 1000$
- Current $I = 4$ A
- Flux per turn $\phi = 4 \times 10^{-3}$ Wb

Total flux linked with the solenoid:

$$\Phi_{total} = N \times \phi = 1000 \times 4 \times 10^{-3} = 4 \text{ Wb}$$

Using the self-inductance formula:

$$L = \frac{\Phi_{total}}{I} = \frac{4 \text{ Wb}}{4 \text{ A}} = 1 \text{ H}$$

Final Answer: The self-inductance of the solenoid is 1 H.

Answer: (B)

Q18.

Solution

Concept: Magnetic susceptibility (χ) is a measure of how much a material will become magnetized in an applied magnetic field. Materials are classified based on the sign and magnitude of χ:

- **Diamagnetic:** Small and negative.
- **Paramagnetic:** Small and positive.
- **Ferromagnetic:** Large and positive.

Solution: The given value is $\chi = -0.00015$. Since the value is negative, it indicates that the material develops a weak magnetization in a direction opposite to the applied magnetic field. This is the characteristic property of diamagnetic substances.
Final Answer: The material is diamagnetic.

Answer: (B)

Q19.

Solution

Concept: According to Ampere's circuital law and the Lorentz force law, two parallel current-carrying wires exert forces on each other. The nature of the force depends on the relative directions of the currents.
Solution: When currents flow in **opposite directions** (anti-parallel), the magnetic field produced by one wire at the location of the other wire results in a force that pushes the wires away from each other.

- Parallel currents (same direction) **attract**.
- Anti-parallel currents (opposite directions) **repel**.

Final Answer: The wires repel each other.

Answer: (B)

Q20.

Solution

Concept: Ferromagnetism is a temperature-dependent property. As the temperature of a ferromagnetic material increases, the thermal agitation begins to disrupt the alignment of magnetic domains.

Solution: The **Curie temperature** (T_c) is the critical temperature above which a ferromagnetic material loses its spontaneous magnetization and its long-range magnetic order is destroyed. Above this point, the material behaves as a **paramagnetic** substance, where the magnetic susceptibility follows the Curie-Weiss Law.

Final Answer: At the Curie temperature, a ferromagnetic material becomes paramagnetic.

Answer: (B)

Q21.

Solution

Concept: According to Faraday's Law of Induction, the induced emf is given by $\varepsilon = -\frac{\Delta\Phi}{\Delta t}$. The magnetic flux is $\Phi = BA\cos\theta$, where θ is the angle between the magnetic field vector and the area vector (normal to the plane of the loop).

Solution: 1. **Area:** $A = (0.10 \text{ m})^2 = 0.01 \text{ m}^2$. 2. **Angle:** The loop is in the east-west plane, so its normal points North. The field is in the North-East direction, which is 45° from the North. Thus, $\theta = 45°$. 3. **Initial Flux:** $\Phi_i = BA\cos 45° = (0.10)(0.01)\left(\frac{1}{\sqrt{2}}\right) \approx \frac{0.001}{1.414} \approx 0.000707$ Wb. 4. **Final Flux:** $\Phi_f = 0$ (since B becomes zero). 5. **Induced Emf:**

$$\varepsilon = \frac{\Delta\Phi}{\Delta t} = \frac{0.000707 - 0}{0.70} \approx 0.00101 \text{ V} = 1.01 \text{ mV}$$

Final Answer: The induced emf is 1.0 mV.

Answer: (B)

Q22.

Solution

Concept: In a series LCR circuit, the phase difference ϕ between voltage and current is given by $\tan\phi = \frac{X_L - X_C}{R}$, where X_L is inductive reactance and X_C is capacitive reactance.

Solution: At resonance, the inductive reactance and capacitive reactance are equal ($X_L = X_C$). Substituting this into the phase formula:

$$\tan\phi = \frac{0}{R} = 0 \implies \phi = 0$$

This means that at resonance, the circuit behaves as a purely resistive circuit, and the current and voltage are in phase.

Final Answer: The phase difference is 0.

Answer: (B)

Q23.

Solution

Concept: Efficiency (η) of a transformer is the ratio of output power (P_{out}) to input power (P_{in}), expressed as a percentage:

$$\eta = \left(\frac{P_{out}}{P_{in}}\right) \times 100\%$$

Solution: 1. **Output Power:** The lamp rating gives the output power directly, $P_{out} = 140$ W. 2. **Input Power:** $P_{in} = V_p I_p$, where V_p is the primary (mains) voltage and I_p is the primary current.

$$P_{in} = 240 \text{ V} \times 0.7 \text{ A} = 168 \text{ W}$$

3. **Efficiency:**

$$\eta = \left(\frac{140}{168}\right) \times 100\% \approx 0.8333 \times 100\% = 83.3\%$$

Final Answer: The efficiency of the transformer is 83.3%.

Answer: (B)

Q24.

Solution

Concept: When a varying magnetic flux passes through a bulk piece of iron (like a transformer core), it induces circulating currents within the metal called **eddy currents**. These currents flow in closed loops and generate heat due to the resistance of the iron, leading to energy loss.
Solution: To minimize these losses, the core is made of thin sheets of iron called **laminations**, which are insulated from one another by a thin layer of varnish or oxide.

- The laminations are oriented perpendicular to the path of the potential eddy currents.
- This effectively breaks the large circulating loops into many smaller loops with much higher overall resistance.
- High resistance significantly reduces the magnitude of the eddy currents, thereby reducing the heat loss.

Final Answer: The core is laminated to reduce eddy current loss.

Answer: (B)

Q25.

Solution

Concept: The electromotive force (emf) induced in a rotating coil in a uniform magnetic field is given by the formula $\varepsilon = NBA\omega \sin(\omega t)$. The maximum emf ($\varepsilon_0$) occurs when $\sin(\omega t) = 1$.

$$\varepsilon_0 = NBA\omega$$

Solution: Given values:

- Number of turns $N = 50$
- Area $A = 2.5 \text{ m}^2$
- Magnetic field $B = 0.3 \text{ T}$
- Angular speed $\omega = 60 \text{ rad/s}$

Substituting these into the formula:

$$\varepsilon_0 = 50 \times 0.3 \times 2.5 \times 60$$

Multiplying the terms:

$$\varepsilon_0 = (50 \times 60) \times (0.3 \times 2.5)$$

$$\varepsilon_0 = 3000 \times 0.75 = 2250 \text{ V}$$

Final Answer: The maximum emf is 2250 V.

Answer: (B)

Q26.

Solution

Concept: Reactance refers to the opposition that an inductor or capacitor offers to the flow of alternating current.

- Inductive reactance: $X_L = \omega L = 2\pi f L$
- Capacitive reactance: $X_C = \frac{1}{\omega C} = \frac{1}{2\pi f C}$
- Resistance (R) is independent of frequency f.

Solution: In a high-frequency AC circuit, the frequency f is very large ($f \to \infty$):

- $X_L \propto f$: As frequency increases, the inductor offers very high reactance.
- $X_C \propto \frac{1}{f}$: As frequency increases, the capacitor offers very low (minimum) reactance.
- R: The resistance remains constant regardless of frequency.

Since X_C decreases as f increases, a capacitor provides the minimum reactance in high-frequency conditions.
Final Answer: The capacitor has the minimum reactance.

Answer: (B)

Q27.

Solution

Concept: Displacement current (I_d) is a quantity appearing in Maxwell's equations that is defined in terms of the rate of change of electric flux (Φ_E):

$$I_d = \epsilon_0 \frac{d\Phi_E}{dt}$$

In a parallel plate capacitor, the electric field $E = \frac{V}{d}$, so the flux $\Phi_E = EA = \frac{VA}{d}$.
Solution: The displacement current is given by:

$$I_d = \epsilon_0 \frac{d}{dt}\left(\frac{VA}{d}\right) = \left(\frac{\epsilon_0 A}{d}\right)\frac{dV}{dt} = C\frac{dV}{dt}$$

From this relation, it is clear that for I_d to be non-zero, $\frac{dV}{dt}$ must be non-zero. This means the potential difference V across the plates must be **changing with time**. If V is constant, $\frac{dV}{dt} = 0$, and no displacement current flows.
Final Answer: Displacement current flows when the potential difference is changing with time.

Answer: (B)

Q28.

Solution

Concept: The electromagnetic spectrum is classified based on wavelength or frequency. The relationship between speed (c), frequency (ν), and wavelength (λ) is $c = \nu\lambda$. In the spectrum, the order of increasing frequency (and decreasing wavelength) is: Radio waves, Microwaves, Infrared, Visible light, Ultraviolet, X-rays, and Gamma rays.
Solution: Comparing the given options:

- **Radio waves:** Lowest frequency, longest wavelength.
- **Microwaves:** Higher frequency than radio waves.
- **X-rays:** Very high frequency, used in medical imaging.
- **Gamma rays:** Highest frequency and highest energy in the electromagnetic spectrum, originating from nuclear transitions.

Final Answer: Gamma rays have the highest frequency.

Answer: (B)

Q29.

Solution

Concept: The focal length f of a lens is given by Lens Maker's Formula: $\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$.
For a symmetric biconvex lens, $R_1 = R$ and $R_2 = -R$, so $\frac{1}{f} = (n-1)\frac{2}{R}$.
Solution: When a biconvex lens is cut into two identical pieces along the principal axis (vertically), each part becomes a plano-convex lens.

- For the new plano-convex lens, one surface remains curved ($R_1 = R$) and the other surface becomes flat ($R_2 = \infty$).
- The new focal length f' is calculated as:

$$\frac{1}{f'} = (n-1)\left(\frac{1}{R} - \frac{1}{\infty}\right) = \frac{(n-1)}{R}$$

Comparing this to the original focal length $\frac{1}{f} = \frac{2(n-1)}{R}$, we see that:

$$\frac{1}{f'} = \frac{1}{2f} \implies f' = 2f$$

Final Answer: The focal length of each part will be $2f$.

Answer: (B)

Q30.

Solution

Concept: The fringe width (β) in Young's Double Slit Experiment is the distance between two consecutive bright or dark fringes. It is given by the formula:

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

where λ is the wavelength of light, D is the distance between the slits and the screen, and d is the separation between the two slits.

Solution: Let the initial fringe width be $\beta = \frac{\lambda D}{d}$. According to the problem:

- New distance to screen $D' = 2D$
- New slit separation $d' = d/2$

The new fringe width β' is:

$$\beta' = \frac{\lambda D'}{d'} = \frac{\lambda(2D)}{d/2} = 4\left(\frac{\lambda D}{d}\right) = 4\beta$$

Thus, the fringe width becomes four times the original value.

Final Answer: The fringe width becomes four times.

Answer: (B)

Q31.

Solution

Concept: A person who cannot see objects clearly beyond a certain distance suffers from **Myopia** (short-sightedness). To correct this, a concave (diverging) lens is used so that an object at infinity forms a virtual image at the person's far point. The power of a lens is $P = 1/f$ (in meters).

Solution: For a myopic eye, to see distant objects (object distance $u = \infty$), the lens must form an image at the far point ($v = -2$ m). Using the lens formula $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$:

$$\frac{1}{f} = \frac{1}{-2} - \frac{1}{\infty} = -\frac{1}{2} - 0 = -0.5 \text{ m}^{-1}$$

Since Power $P = \frac{1}{f}$:

$$P = -0.5 \text{ D}$$

The negative sign indicates a concave lens.

Final Answer: The power of the lens required is -0.5 D.

Answer: (B)

Q32.

Solution

Concept: For an astronomical telescope in normal adjustment (where the final image is formed at infinity), the magnifying power M is given by the ratio of the focal length of the objective f_o to the focal length of the eyepiece f_e:

$$M = \frac{f_o}{f_e}$$

Solution: Given:

- Magnifying power $M = 10$
- Focal length of objective $f_o = 100$ cm

Using the formula:

$$10 = \frac{100 \text{ cm}}{f_e}$$

$$f_e = \frac{100}{10} = 10 \text{ cm}$$

Final Answer: The focal length of the eyepiece is 10 cm.

Answer: (B)

Q33.

Solution

Concept: When a wave (like light) travels from one medium to another, its properties change based on the optical density of the media. The relationship is governed by $v = f\lambda$, where v is velocity, f is frequency, and λ is wavelength.

Solution: 1. **Velocity:** Light slows down in a denser medium ($v = c/n$). 2. **Wavelength:** Since the velocity decreases and frequency stays the same, the wavelength also decreases ($\lambda' = \lambda/n$). 3. **Amplitude:** Generally decreases due to partial reflection at the boundary. 4. **Frequency:** Frequency is a fundamental property of the source of light. As light enters a new medium, the number of oscillations per second remains constant to maintain continuity at the boundary.

Final Answer: The quantity that remains unchanged is frequency.

Answer: (B)

Q34.

Solution

Concept: Diffraction is the bending of waves around the corners of an obstacle or through an aperture into the region of geometrical shadow. According to **Huygens-Fresnel principle**, every point on a wavefront acts as a source of secondary spherical wavelets.

Solution: Diffraction occurs because of the interference of these secondary wavelets originating from the same primary wavefront.

- **Interference** involves the superposition of waves from two (or more) discrete coherent sources.
- **Diffraction** involves the superposition of an infinite number of secondary wavelets originating from different parts of the *same* wavefront that are not blocked by the obstacle or slit.

Final Answer: The phenomenon is understood as the superposition of secondary wavelets from different parts of the same wavefront.

Answer: (B)

Q35.

Solution

Concept: When light is incident on a transparent surface at the **polarizing angle** (also known as **Brewster's angle**, i_p), the reflected light is completely plane-polarized. Brewster's law states that $\tan i_p = n$, where n is the refractive index of the medium.

Solution: According to Snell's Law: $n = \frac{\sin i_p}{\sin r}$. From Brewster's Law: $n = \tan i_p = \frac{\sin i_p}{\cos i_p}$. Equating the two:

$$\frac{\sin i_p}{\sin r} = \frac{\sin i_p}{\cos i_p} \implies \sin r = \cos i_p$$

This relationship implies that $r + i_p = 90°$. In the diagram of reflection and refraction:

- The angle of reflection is i_p (Law of reflection).
- The total angle of the interface line is 180°.
- The angle between the reflected and refracted ray is $\theta = 180° - (i_p + r)$.
- Since $i_p + r = 90°$, then $\theta = 180° - 90° = 90°$.

Final Answer: The angle between the reflected and refracted rays is 90°.

Answer: (B)

Q36.

Solution

Concept: In single slit diffraction, the angular width of the central maximum is defined by the positions of the first minima on either side. The condition for the first minimum is $a \sin\theta = \lambda$, where a is the slit width and λ is the wavelength.

Solution: For small angles, $\sin\theta \approx \theta$, so the angular position of the first minimum is $\theta = \frac{\lambda}{a}$. The total angular width of the central maximum is $2\theta = \frac{2\lambda}{a}$. The linear width W on a screen at distance D is given by:

$$W = 2\theta D = \frac{2D\lambda}{a}$$

From this formula, it is clear that $W \propto \lambda$. Therefore, the width of the central maximum is directly proportional to the wavelength of the light used.

Final Answer: The width is directly proportional to wavelength.

Answer: (B)

Q37.

Solution

Concept: Total Internal Reflection (TIR) is an optical phenomenon that occurs when a light ray traveling in a denser medium hits the boundary of a rarer medium.

Solution: For TIR to occur, two specific conditions must be met:

(a) The light must travel from an optically denser medium to an optically rarer medium.

(b) The angle of incidence (i) in the denser medium must be **greater than the critical angle** (i_c) for that pair of media.

If $i = i_c$, the refracted ray grazes the surface ($r = 90°$). If $i > i_c$, there is no refracted ray, and all the light is reflected back into the denser medium.

Final Answer: The angle of incidence must be greater than the critical angle.

Answer: (B)

Q38.

Solution

Concept: According to Einstein's photoelectric equation, the maximum kinetic energy (K_{max}) of ejected photoelectrons is given by:

$$K_{max} = E - \phi$$

where E is the energy of the incident photon and ϕ is the work function of the metal. The energy of a photon is calculated using $E = \frac{hc}{\lambda}$.

Solution: 1. **Calculate Photon Energy (E):** Using $hc = 1240$ eV-nm and $\lambda = 310$ nm:

$$E = \frac{1240 \text{ eV-nm}}{310 \text{ nm}} = 4 \text{ eV}$$

2. **Calculate Maximum Kinetic Energy (K_{max}):** Given the work function $\phi = 2$ eV:

$$K_{max} = 4 \text{ eV} - 2 \text{ eV} = 2 \text{ eV}$$

Final Answer: The maximum kinetic energy is 2 eV.

Answer: (B)

Q39.

Solution

Concept: The de-Broglie wavelength (λ) is given by $\lambda = \frac{h}{p}$, where p is the momentum. For a particle of mass m and charge e accelerated through a potential V, the kinetic energy gained is $K = eV$. The relationship between momentum and kinetic energy is $p = \sqrt{2mK}$.

Solution: Substituting $K = eV$ into the momentum formula gives $p = \sqrt{2meV}$. Now, substitute this into the de-Broglie wavelength formula:

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

Since h, m, and e are constants for an electron:

$$\lambda \propto \frac{1}{\sqrt{V}}$$

Final Answer: The de-Broglie wavelength is proportional to $1/\sqrt{V}$.

Answer: (B)

Q40.

Solution

Concept: According to Einstein's photoelectric equation, $K_{max} = h\nu - \phi$. The maximum kinetic energy depends only on the frequency (ν) of the incident light and the nature of the metal (work function ϕ).

Solution: Intensity of light refers to the number of photons striking the surface per unit area per unit time.

- Increasing the intensity increases the **number** of photoelectrons ejected (photoelectric current).
- However, as long as the frequency remains constant, the energy of each individual photon ($h\nu$) remains the same.

Therefore, the maximum kinetic energy of the photoelectrons remains unchanged when only the intensity is doubled.

Final Answer: The maximum kinetic energy remains unchanged.

Answer: (B)

Q41.

Solution

Concept: Let the common wavelength be λ. 1. **For a photon:** Energy $E_p = \frac{hc}{\lambda}$. 2. **For an electron:** The total energy E_e (including rest mass energy) is $E_e = \sqrt{p^2c^2 + m_0^2c^4}$. Since $\lambda = \frac{h}{p}$, then $p = \frac{h}{\lambda}$. So, $E_e = \sqrt{\left(\frac{hc}{\lambda}\right)^2 + m_0^2c^4}$.

Solution: We can see that:

$$E_e = \sqrt{E_p^2 + m_0^2c^4}$$

This mathematical relationship shows that the total energy of the electron is always greater than the energy of the photon because the electron possesses rest mass energy (m_0c^2). Even if we consider only kinetic energy, for non-relativistic speeds, $K_e = \frac{p^2}{2m} = \frac{h^2}{2m\lambda^2}$, and a comparison usually shows the photon carries more energy per unit momentum because it travels at the speed of light. However, in terms of **total energy**, the electron wins due to its mass.

Final Answer: The electron has more total energy.

Answer: (B)

Q42.

Solution

Concept: In Bohr's model, the electron is held in orbit by electrostatic attraction. The energies are related as follows:

- Potential Energy $(U) = -2\times$ Kinetic Energy (K)
- Total Energy $(E) = K + U = K - 2K = -K$

Solution: From the relation $E = -K$, we can find the ratio:

$$\frac{\text{Kinetic Energy}}{\text{Total Energy}} = \frac{K}{-K} = \frac{1}{-1}$$

The kinetic energy is always positive, while the total energy is negative (indicating a bound state).
Final Answer: The ratio is $1 : -1$.

Answer: (B)

Q43.

Solution

Concept: The stability of a nucleus is determined by its binding energy per nucleon (ΔE_{bn}). A higher binding energy per nucleon means the nucleus is more tightly bound and more stable.
Solution: The graph of binding energy per nucleon versus mass number (A) shows that:

- For very light nuclei ($A < 30$), the binding energy per nucleon is relatively low.
- The curve rises and reaches a broad maximum of approximately 8.8 MeV per nucleon around the mass number $A = 56$.
- Iron-56 (^{56}Fe) is located at the peak of this curve, making it one of the most stable nuclei in nature.
- For heavier nuclei ($A > 100$), the value gradually decreases due to the increasing Coulombic repulsion between protons.

Final Answer: The binding energy per nucleon is maximum for ^{56}Fe.

Answer: (B)

Q44.

Solution

Concept: In the Hydrogen spectrum, transitions are categorized into series based on the final energy level (n_{final}) to which the electron drops.

Solution:

- **Lyman series:** $n_{final} = 1$ (Ultraviolet region)
- **Balmer series:** $n_{final} = 2$ (Visible region)
- **Paschen series:** $n_{final} = 3$ (Infrared region)

Since the transition is from $n = 3$ to $n = 2$, the final state is $n = 2$. This identifies the transition as the first line of the Balmer series (H_α line).

Final Answer: The photon belongs to the Balmer series.

Answer: (B)

Q45.

Solution

Concept: Einstein's mass-energy equivalence principle, $E = mc^2$, states that mass can be converted into energy. One atomic mass unit (1 amu or 1 u) is defined as $1/12$th the mass of a carbon-12 atom.

Solution: The mass of 1 amu $\approx 1.66 \times 10^{-27}$ kg. Using the speed of light $c \approx 3 \times 10^8$ m/s:

$$E = (1.66 \times 10^{-27} \text{ kg}) \times (3 \times 10^8 \text{ m/s})^2 \approx 1.49 \times 10^{-10} \text{ J}$$

To convert Joules to MeV, we divide by the charge of an electron (1.6×10^{-19} C) and then by 10^6:

$$E \approx \frac{1.49 \times 10^{-10}}{1.6 \times 10^{-13}} \text{ MeV} \approx 931.5 \text{ MeV}$$

Final Answer: The energy equivalent is nearly 931 MeV.

Answer: (B)

Q46.

Solution

Concept: Nuclear fission is a process where a heavy nucleus splits into smaller nuclei, releasing a large amount of energy. This energy is released because some mass is "lost" during the reaction (mass defect).

Solution: According to $E = \Delta mc^2$, the energy released in fission comes from the conversion of mass into energy. This means the total rest mass of the products (the fragments and neutrons) is slightly **less** than the total rest mass of the reactants (the original nucleus and the incident neutron).

$$\text{Ratio} = \frac{\text{Mass of Products}}{\text{Mass of Reactants}} < 1$$

Final Answer: The ratio is less than 1.

Answer: (B)

Q47.

Solution

Concept: In an intrinsic (pure) semiconductor, the conductivity depends on the thermal excitation of electrons from the valence band to the conduction band across the energy band gap (E_g).

Solution: At absolute zero (0 K):

- Electrons do not have enough thermal energy to cross the band gap.
- Consequently, all electrons remain in the valence band, making it **completely full**.
- No electrons reach the conduction band, making it **completely empty**.
- Since there are no mobile charge carriers, the semiconductor behaves as a perfect insulator.

Final Answer: The conduction band is completely empty.

Answer: (B)

Q48.

Solution

Concept: An ideal p-n junction diode behaves like a one-way valve for current. Its resistance depends on the direction of the applied external voltage.

- **Forward Bias:** The positive terminal of the battery is connected to the p-side and the negative to the n-side. This reduces the depletion layer width, allowing current to flow easily (low resistance). It acts as a **closed switch**.
- **Reverse Bias:** The positive terminal is connected to the n-side and the negative to the p-side. This widens the depletion layer, preventing current flow (high resistance). It acts as an **open switch**.

[Image of p-n junction diode in forward and reverse bias]
Solution: A diode acts as a closed switch (conducting state) when it is forward biased.
Final Answer: It is forward biased.

Answer: (B)

Q49.

Solution

Concept: Rectification is the process of converting alternating current (AC) to direct current (DC).

- A **half-wave rectifier** conducts during only one half-cycle of the AC input. The output frequency is the same as the input frequency ($f_{out} = f_{in}$).
- A **full-wave rectifier** converts both half-cycles of the AC input into a unidirectional output.

Solution: In a full-wave rectifier, for every one full cycle of AC input, the output pulse repeats twice (two peaks in the same direction).
Therefore, the output frequency (f_{out}) is double the input frequency (f_{in}):

$$f_{out} = 2 \times f_{in}$$

Given $f_{in} = 50$ Hz:

$$f_{out} = 2 \times 50 \text{ Hz} = 100 \text{ Hz}$$

Final Answer: The output frequency is 100 Hz.

Answer: (B)

Q50.

Solution

Concept: A p-n junction is formed when a p-type semiconductor is brought into contact with an n-type semiconductor. Because the n-side has a high concentration of electrons and the p-side has a high concentration of holes, a concentration gradient exists at the interface.

Solution: The formation of the depletion layer involves the following steps:

(a) **Diffusion:** Due to the concentration gradient, electrons from the n-side **diffuse** across the junction into the p-side, and holes from the p-side diffuse into the n-side.

(b) **Recombination:** Near the junction, these diffusing electrons and holes recombine with each other.

(c) **Immobile Ions:** This recombination leaves behind uncovered immobile positive ions (donor atoms) on the n-side and immobile negative ions (acceptor atoms) on the p-side.

(d) **Depletion Region:** This region near the junction, which is now "depleted" of mobile charge carriers (electrons and holes) and contains only immobile ions, is called the depletion layer.

While reverse bias *increases* the width of an existing depletion layer, the fundamental cause of its initial formation is the diffusion of charge carriers.

Final Answer: The depletion layer is caused by the diffusion of charge carriers.

Answer: (B)

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	B	3	B	4	B	5	B
6	B	7	B	8	B	9	B	10	B
11	B	12	B	13	B	14	B	15	B
16	B	17	B	18	B	19	B	20	B
21	B	22	B	23	B	24	B	25	B
26	B	27	B	28	B	29	B	30	B
31	B	32	B	33	B	34	B	35	B
36	B	37	B	38	B	39	B	40	B
41	B	42	B	43	B	44	B	45	B
46	B	47	B	48	B	49	B	50	B