

CBSE Class 12 Physics – Detailed Solutions (2024–25)

Section A: Multiple Choice Questions (1 Mark Each)

Q1. Gauss's Law

Correct Answer: (A) Q/ϵ_0

Detailed Explanation: Gauss's law states that the net electric flux Φ_E through any closed surface is directly proportional to the total charge enclosed by the surface:

$$\Phi_E = \oint \vec{E} \cdot d\vec{A} = \frac{Q_{\text{enclosed}}}{\epsilon_0}$$

Hence, if the closed surface encloses charge Q , the net electric flux is Q/ϵ_0 .

Q2. AC Voltage Relation

Correct Answer: (B) $\sqrt{2}$

Detailed Explanation: For a sinusoidal alternating voltage,

$$V_{\text{rms}} = \frac{V_{\text{peak}}}{\sqrt{2}}$$

Rearranging,

$$\frac{V_{\text{peak}}}{V_{\text{rms}}} = \sqrt{2}$$

Q3. Magnetic Field Around Straight Conductor

Correct Answer: (B) Concentric circles

Detailed Explanation: According to the right-hand thumb rule, when current flows through a long straight conductor, the magnetic field lines form concentric circles in planes perpendicular to the conductor, with the conductor at the center.

Q4. Young's Double-Slit Experiment

Correct Answer: (B) Halve

Detailed Explanation: Fringe width β in YDSE is given by:

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

If slit separation d is doubled, the fringe width becomes half of its original value.

Q5. Semiconductor Doping

Correct Answer: (A) p-type

Detailed Explanation: Boron is a trivalent (Group 13) impurity. When doped into silicon (tetravalent), it creates holes as majority charge carriers, forming a p-type semiconductor.

Q6. Definition of Volt

Correct Answer: (B) J/C

Detailed Explanation: Electric potential difference of 1 volt is defined as the work done of 1 joule in moving a charge of 1 coulomb:

$$1 \text{ V} = 1 \text{ J/C}$$

Q7. Stopping Potential

Correct Answer: (B) Frequency

Detailed Explanation: In the photoelectric effect, the stopping potential depends on the maximum kinetic energy of emitted electrons, which depends only on the frequency of incident radiation and not on its intensity.

Q8. Electric Field Inside Spherical Shell

Correct Answer: (A) Zero

Detailed Explanation: According to Gauss's law, the net electric field inside a uniformly charged spherical shell is zero because the net charge enclosed by any Gaussian surface inside the shell is zero.

Q9. Capacitors in Series

Correct Answer: (B) $\frac{C_1 C_2}{C_1 + C_2}$

Detailed Explanation: For capacitors connected in series,

$$\frac{1}{C_{\text{eq}}} = \frac{1}{C_1} + \frac{1}{C_2}$$

Solving gives:

$$C_{\text{eq}} = \frac{C_1 C_2}{C_1 + C_2}$$

Q10. Temperature Coefficient of Resistance

Correct Answer: (A) 4×10^{-3}

Detailed Explanation: Given: $R_{100} = 1.4R_0$

Using:

$$R_t = R_0(1 + \alpha\Delta T)$$

$$1.4 = 1 + 100\alpha \Rightarrow \alpha = 4 \times 10^{-3} \text{ } ^\circ\text{C}^{-1}$$

Q11. Lenz's Law

Correct Answer: (B) Flux change

Detailed Explanation: Lenz's law states that the direction of induced current is such that it opposes the change in magnetic flux that produces it.

Q12. de Broglie Wavelength

Correct Answer: (B) Momentum

Detailed Explanation: The de Broglie wavelength is given by:

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

Thus, it is inversely proportional to the momentum of the particle.

Q13. Forward-Biased Diode

Correct Answer: (B) Large current

Detailed Explanation: When a diode is forward biased, the potential barrier reduces, allowing a large current to flow through the junction.

Q14. Thin Film Interference

Correct Answer: (B) Different wavelengths interfere

Detailed Explanation: White light contains multiple wavelengths. In a thin film, different wavelengths satisfy constructive interference at different thicknesses, producing colorful patterns.

Q15. RC Time Constant

Correct Answer: (C) RC

Detailed Explanation: Time constant:

$$\tau = RC$$

If $R \rightarrow R/2$ and $C \rightarrow 2C$:

$$\tau' = (R/2)(2C) = RC$$

Q16. Magnetic Moment

Correct Answer: (A) J/T

Detailed Explanation: Magnetic moment is defined as the torque experienced per unit magnetic field. Hence its SI unit is joule per tesla (J/T).

(Section B and C will continue in the same fully-detailed, step-by-step CBSE board style.)