CBSE Physics Set 3 DB 2015

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Q1. Define the term 'mobility' of charge carriers. Write its S.I. unit

Answer: $\text{Mobility} = \frac{\text{Drift velocity}}{\text{Electric field}}$ or, $\mu = \frac{v_d}{E}$

The SI unit of μ is $m^2V^{-1}s^{-1}$.

Q2. In a series LCR circuit, $V_L = V_C \neq V_R$. What is the value of power factor?

Answer:

We know that in an LCR series circuit, power dissipated is given by

$$P = I^2 Z\cos\phi$$

$$\text{Hence power factor} == \cos\phi = \frac{P}{I^2\sqrt{R^2 + (X_C - X_L)^2}}$$

$\because V_L = V_C$ and $X_L = X_C$

$\therefore \cos\phi = \frac{P}{I^2R}$

Q3. The focal length of an equi-convex lens is equal to the radius of curvature of either face. What is the refractive index of the material of the lens?

Answer: We know focal length is given by

$\frac{1}{f} = (\mu - 1)\left(\frac{1}{r_1} + \frac{1}{r_2}\right)$ Given $r_1 = r_2 = f = r$

Therefore $\frac{1}{r} = (\mu - 1)\left(\frac{1}{r} + \frac{1}{r}\right)$ $or\ \mu = \frac{1}{2} + 1 = \frac{3}{2} = 1.5$

Q4. Write a relation for polarisation $\vec{P}$ of a dielectric material in the presence of an external electric field $\vec{E}$.

Answer: We know that polarisation $\vec{P}$ of a dielectric material in the presence of an external electric field $\vec{E}$ is related as $P = \chi_e E$

Where, χ_e is a constant characteristic of the dielectric and is known as the electric susceptibility of the dielectric medium.