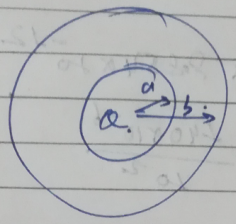
URBAN EDGE

Q2. Here,



Q → charge contained.

$$E = \frac{Q}{4\pi r^2 \epsilon_0 \epsilon_r}$$

$$V = \int \frac{Q}{4\pi \epsilon_0 \epsilon_r} \times \left(\frac{1}{a} - \frac{1}{b}\right)$$

$$C = \frac{Q}{V} = \frac{4\pi \epsilon_0 \epsilon_r}{\left(\frac{1}{a} - \frac{1}{b}\right)}$$

$$I = \iint J \cdot dA$$

$$= \sigma \iint E \cdot dA \quad \{\because J = \sigma E\}$$

$$= \frac{\sigma}{\epsilon_0 \epsilon_r} \iint D \cdot dA \quad \{D \rightarrow \text{Charge density}\}$$

$$\therefore \frac{\sigma}{\epsilon_0 \epsilon_r} \times Q$$

$$R = \frac{V}{I} = \frac{\left(\frac{1}{a} - \frac{1}{b}\right)}{4\pi\sigma}$$

$$\boxed{RC = \frac{\epsilon_0 \epsilon_r}{\sigma}}$$

Sol,

$$10^3 \times C = \frac{80 \times 8.854 \times 10^{-12}}{\frac{140 \times 10^{-6}}{10^{-2}}}$$

$$C = 5.059 \times 10^{-11} F$$

$$C = 50.59 \, pF$$