

D II Physics Notes (Paper - II)

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Electronics

5th	6th	7th	8th
Period	Period	Period	Period



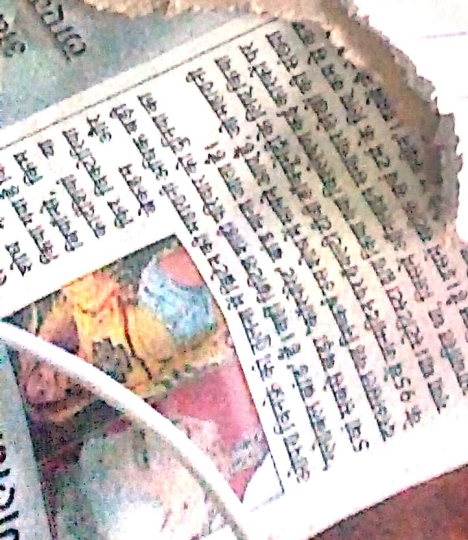
Clausius Mossootti Equation: Clausius and

Mossootti tried to correlate the macroscopic properties of a dielectric with its microscopic character. They established a relation between the dielectric constant (a macroscopic parameter) and the molecular polarisability (a microscopic parameter) of a non-polar dielectric. This relation is known as 'Clausius - Mossootti Equation'.

The polarisability α of a molecule is the dipole moment p induced in the molecule per unit polarising (local) field. That is

$$p = \alpha E_{local}$$

If there are n molecules per unit volume of the dielectric,



then the polarisation P is given by

$$P = n^2 \epsilon_0 E_{\text{local}}$$

We now know that $E_{\text{local}} = E + \frac{P}{3\epsilon_0}$, where

E is the macroscopic field within the dielectric,

$$\therefore P = n^2 \epsilon_0 \left(E + \frac{P}{3\epsilon_0} \right)$$

Now, the polarisation P is related to the dielectric constant K by the equation,

$$P = (K-1) \epsilon_0 E$$

Then we have

$$(K-1) \epsilon_0 E = n^2 \left[E + \frac{(K-1) \epsilon_0 E}{3\epsilon_0} \right]$$

$$\text{or, } (K-1) \epsilon_0 = n^2 \left(1 + \frac{K-1}{3} \right) = n^2 \left(\frac{K+2}{3} \right)$$

$$\text{or, } \boxed{\alpha = \frac{3\epsilon_0}{n} \frac{(K-1)}{(K+2)}} \quad \text{--- (iv)}$$

This is known as Classical-Lorentz-Lorentz Equation.