Chapter 26 :- Current & Resistance

- Def:- **Electric Current**:

A net flow of charge through a given surface

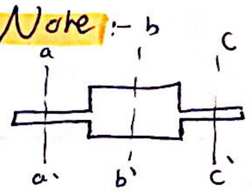
→ Electric current (I) = $\frac{dq}{dt}$ C/s → [A]

Scalar Quantity

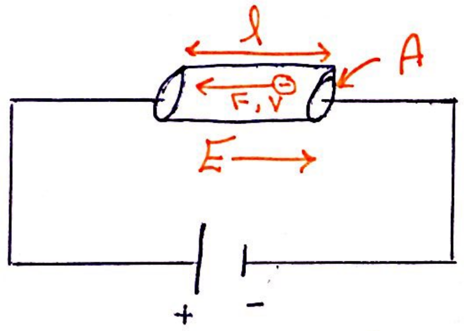
Electric Curren in a Conductor:-

l : is the length of Conductor
A : is the Cross section Area
n : number of Conduction electrons / m3

Note :-



I is the same for aa`, bb` and cc`



- E: Electric field
- F: Electric Force
- V: Electric Potential = El

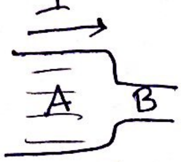
- The number of Conduction Electrons = $n\overbrace{Al}^{\text{Volume}}$
- The amount of Free charge = e n A l

Current Density :-

$J = I/A$ A/m²

Vector Quantity

$I = \int \vec{J} \cdot d\vec{A}$



- Here, current & charge are the same at A and B But J changes

Drift speed:-

vector Quantity

$\underline{I = neAV_d} \leftarrow$ Drift speed

Alaa [illegible]

So:-

$\vec{J} = (ne)\vec{V_d}$

$n = N_A\left(\frac{1}{M}\right)\rho_{mass}$

Molar Mass

Avogadro's Number

mass per Unit V (mass density)

Carrier charge density

→ if $q > 0$ → ne is positive and $\vec{J}$, $\vec{V_d}$ has the same Directi

→ if $q < 0$ → ne is negative and $\vec{J}$, $\vec{V_d}$ has the Opposite Direc

Resistance & Resistivity

$R = V/I \; [\Omega]$

$\rho = E/J \; [\Omega.m]$

Conductivity:-

$\sigma = \frac{1}{\rho}$

$\boxed{R = \frac{\rho L}{A}}$ → R depends on Geometry (L, A) & Type (ρ)

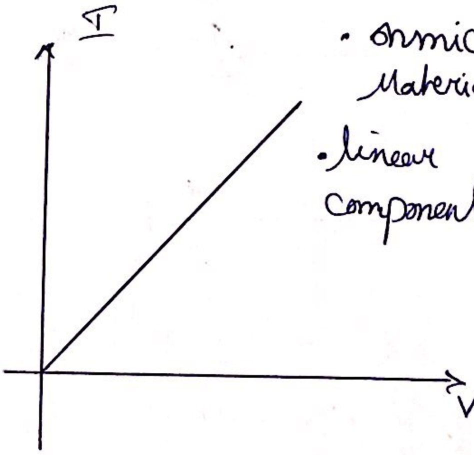
Note

(I) depends on:-

1- Type of Conductor (n)
2- Geometry of Conductor (l, A)
3- Applied E & V
4- Tempreture $\rho - \rho_0 = \rho_0 \alpha (T - T_0$

OHM's law :-

$R = \frac{V}{I}$ and $\vec{E} = \rho J$



- ohmic Material
- linear component.

Power in Electric Circuits

↳ rate of energy dissipation

Energy $= \Delta Q \, V$

$U_A > U_B$ and $V_A > V_B$

Power $P = I^2 R$ ← watt (J/s) → applies only on energy transfer to thermal energy

$= \boxed{I \, V}$ → applies to electrical energy transfer of all kinds

$= V^2/R$

125 Watt lamp means 125 watt each hour