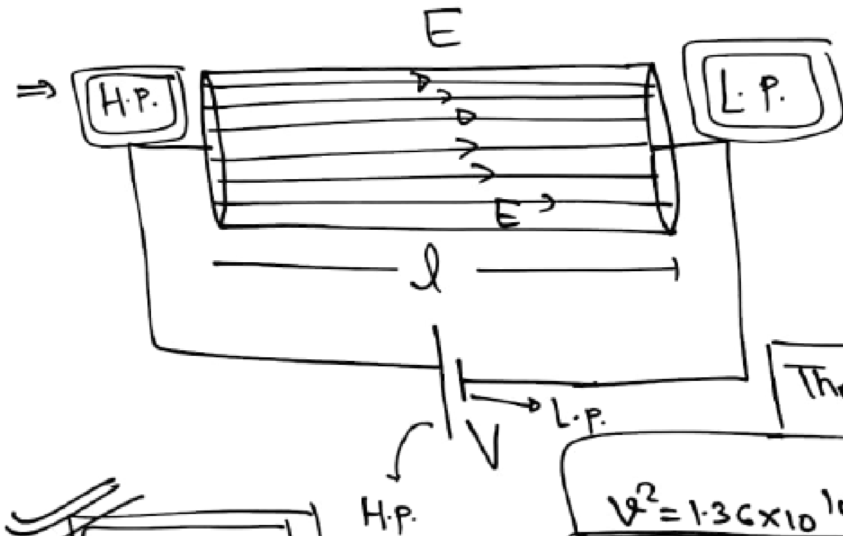


$\Rightarrow$ In conductor $\simeq 10^{28}$ electron/m^3

$\Rightarrow$ In Isolated Conductor, Energy of Electron $= \frac{3}{2} KT$

$\Downarrow$

thermal Energy of electron

$$\boxed{\text{Thermal Energy of an Electron} = \frac{3}{2} KT}$$

K = boltzmann constant

$K = 1.38 \times 10^{-23}$ J/K.

T = Temperature in kelvin

Speed of electron at Room temperature (27°C)

$$\boxed{T = 27 + 273 = 300 \text{ kelvin}}$$

$$K.E = \frac{3}{2} KT = \frac{3}{2} \times 1.38 \times 10^{-23} \times 300$$

$$\frac{1}{2} \times m_e v^2 = \frac{3}{2} \times 1.38 \times 10^{-23} \times 300$$

$$v^2 = \frac{3 \times 1.38 \times 3 \times 10^{-21}}{9.1 \times 10^{-31}}$$

$$v^2 = 1.36 \times 10^{10}$$

$$\boxed{v \simeq 10^5 \text{ m/s}}$$

$$\boxed{E = \frac{V}{l}}$$

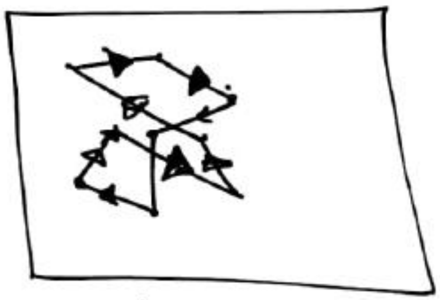
$$\boxed{\text{Electric field} = \frac{V}{l}}$$

In Isolated Conductor

$\Rightarrow \simeq 10^{28}$ electron/m^3

$\Rightarrow$ Energy of electron $= \boxed{\frac{3}{2}KT}$

$\Rightarrow$ speed of electron at room temperature $\simeq 10^5\ m/s$

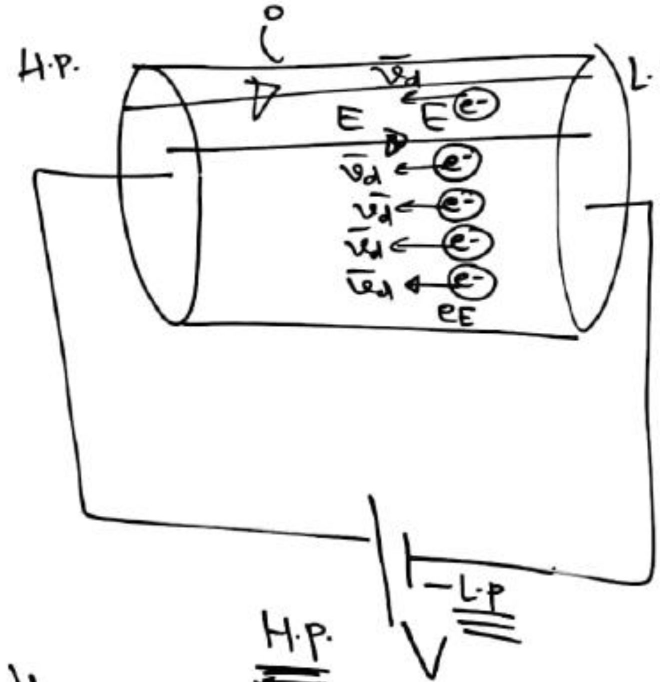


$\Rightarrow$ Average thermal velocity of electron is zero

$$\langle \bar{u}_T \rangle = 0$$

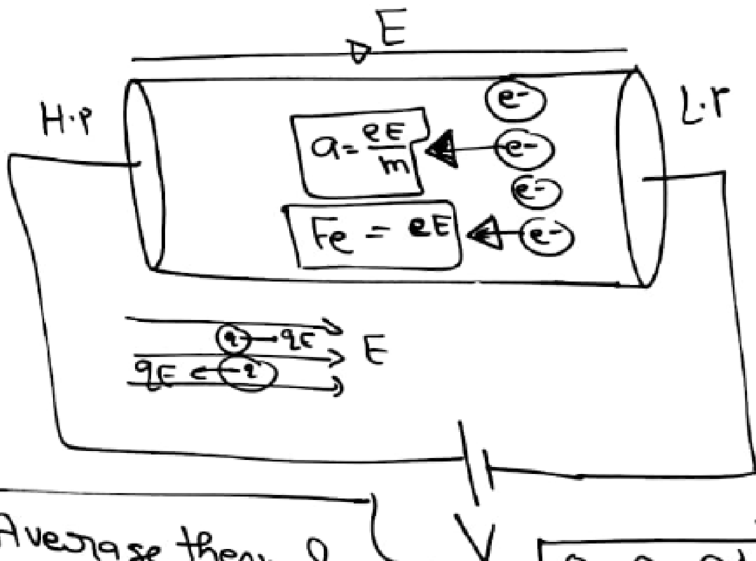
$$\langle u \rangle = \frac{\bar{u}_1 + \bar{u}_2 + \bar{u}_3 + \dots + \bar{u}_n}{N} = 0$$

$\boxed{\langle \bar{v} \rangle \neq 0}$

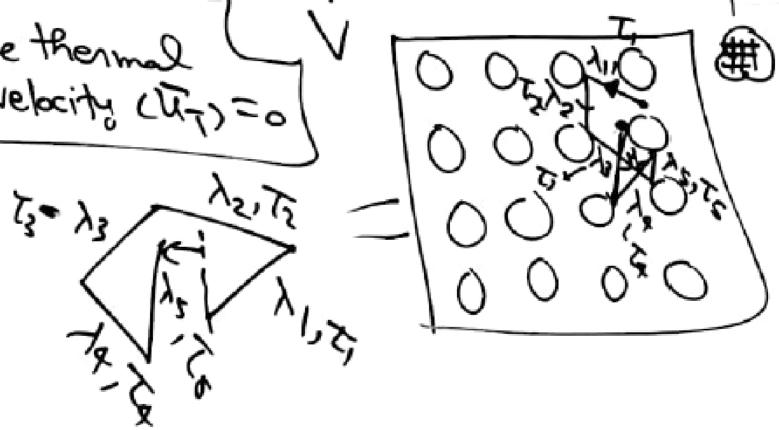


V_d = drift velocity

When Conductor Connected by battery:



⇒ $\boxed{\text{Average thermal velocity } (\vec{u}_T) = 0}$



⇒ Mean free Path:

$$\boxed{\lambda = \frac{\lambda_1 + \lambda_2 + \text{---------} + \lambda_N}{N}}$$

⇒ Relaxation time: (τ)

$$\boxed{\tau = \frac{\tau_1 + \tau_2 + \tau_3 + \tau_4 + \text{-----} + \tau_N}{N}}$$

Force on electron $= eE$

acceleration of electron $= \frac{eE}{m}$

Conductor Connected by battery :-

$\tau \rightarrow$ Relaxation time

$\lambda \rightarrow$ Mean free path

$$\boxed{v_d = \frac{eE}{m}\tau}$$

$$\boxed{a_e = \frac{eE}{m}}$$

$\Rightarrow$ $\boxed{v = u + at}$

$\bar{v} = \langle \bar{u}_T \rangle + \bar{a}\,(t_{av})$

$$\boxed{\bar{v} = 0 + \frac{eE}{m}\tau}$$

$$\boxed{v_d = \frac{eE}{m}\tau}$$

$\Rightarrow$ drift velocity of $\xrightarrow{E}$ Electron :- $\boxed{v_d = \frac{eE}{m}\tau}$

*** Mobility of Electron

$$\mu = \frac{v_d}{E} = \frac{\frac{e\cancel{E}}{m}\tau}{\cancel{E}}$$

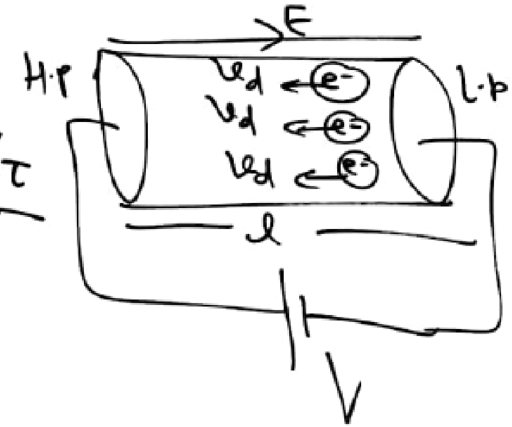
$$\boxed{\mu = \frac{e}{m}\tau}$$

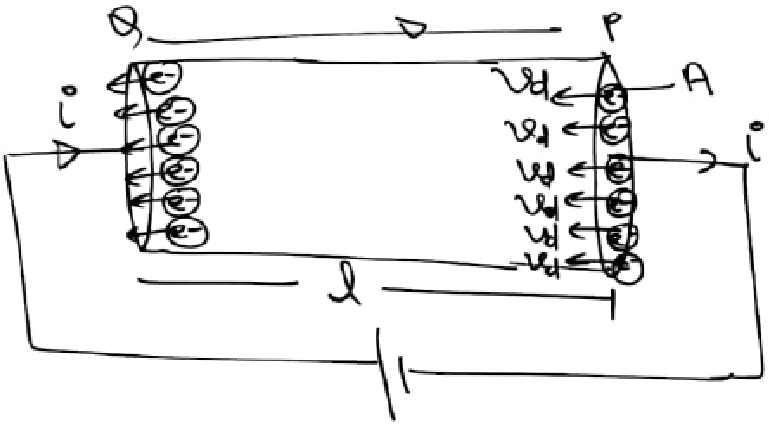
$\Rightarrow$ Mobility of electron :-

factor which define Path resistence.

$\Rightarrow$ Definition of mobility :-

"drift velocity of electron in unit electric field"





$$\boxed{i = neAv_d}$$

Total charge flow in time $t = \frac{l}{v_d}$

$\underline{nAl}\,e$ = Total charge.

$$i = \frac{q_{total}}{time} = \frac{neA\cancel{l}}{\frac{\cancel{l}}{v_d}}$$

$$\boxed{i = neAv_d}$$

$$\boxed{i = neAv_d}$$

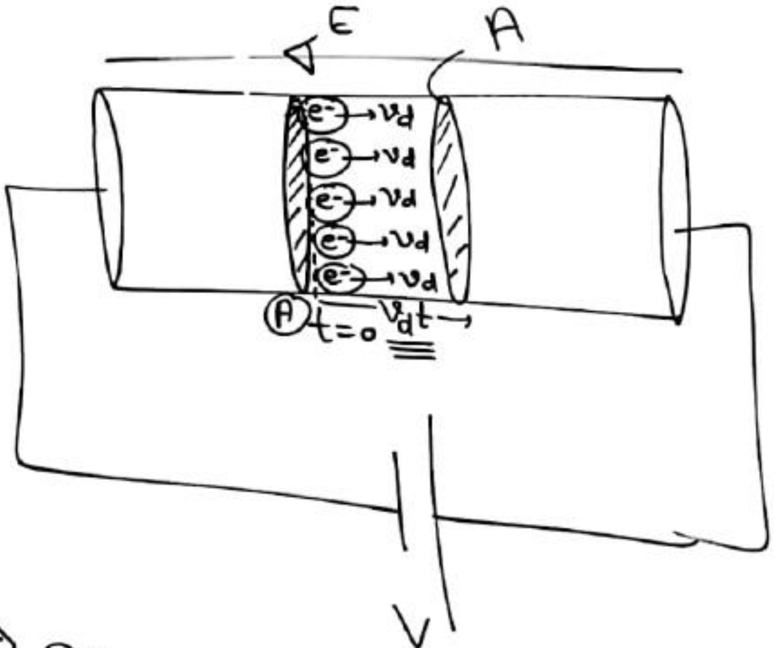
$\Rightarrow$ n = number of free electron per unit volume

v_d = drift velocity of electron

A = Area of cross-section

$$\boxed{t = \frac{l}{v_d}}$$

Charge flow in t time from Q



Charge flow in time t from (A)

$$q = (nAv_d)t \times e$$

$$i = \frac{q}{t} = \frac{neAv_d \times \cancel{t}}{\cancel{t}}$$

$$\boxed{i = neAv_d}$$

i = Current
n = number of ~~char~~ electron per unit volume
A = Area of cross-section
v_d = drift velocity

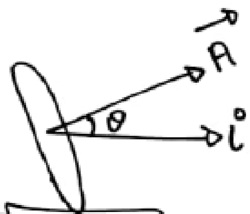
⇒ n → number of ~~ch~~ free electron per unit Volume

number of electron flow in time t from Area A = (n)A $v_d \cdot t$

Current density: (J): It is a vector quantity

$$\boxed{J = \frac{i}{A\cos\theta}}$$

$\boxed{\text{SI Unit} = \text{Amp}/m^2}$



$$\boxed{J = \frac{i}{A\cos\theta}}$$

$$\boxed{i = \vec{J}\cdot\vec{A}}$$

$$i = JA\cos\theta$$

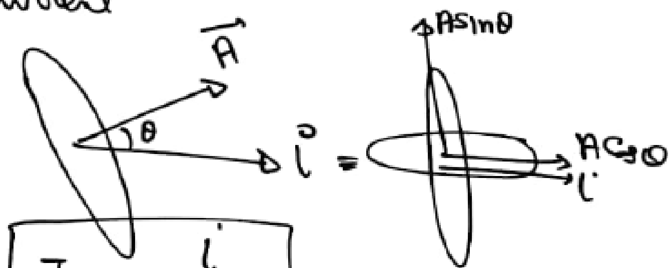
$$\boxed{J = \frac{i}{A\cos\theta}}$$

⟹ Defn: it is the ratio of Current flow through Area in dirn of current.

$$\boxed{J = \frac{i}{A\cos\theta}}$$

$$\boxed{J = \frac{i}{A\cos\theta}}$$

" θ = Angle b/w dirn of current & Area vector "



$$\boxed{J = \frac{i}{A_{\parallel}}}$$