All formula

Superb

$R = \frac{\rho l}{A}$ — ρ: resistivity / Specific resistance

$\rho = \frac{m}{ne^2\tau}$

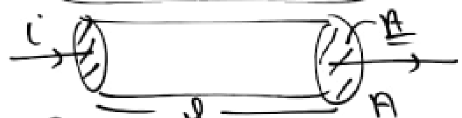
$v_d = \frac{eE}{m}\tau$

$\mu = \frac{v_d}{E}$

$\sigma = \frac{1}{\rho}$ — Conductivity of material

μ = mobility = $\frac{e}{m}\tau$

$i = neAv_d$

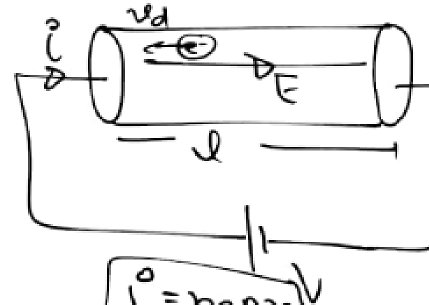


n = number of electron per unit volume

v_d = drift velocity [Range mm/sec]

e = Charge on electron

A = area of Cross-section



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

$i = neAv_d$

$J = \frac{i}{A\cos\theta}$ ⇒ $\vec{J}\cdot\vec{A} = i$

J: Current density

****

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

T↑, τ↓, μ↓

T↓ τ↑, μ↑

μ_e μ_p

$\mu_e = \frac{e\tau}{m_e}$ $\mu_p = \frac{e\tau}{m_p}$

$\mu_e > \mu_p$

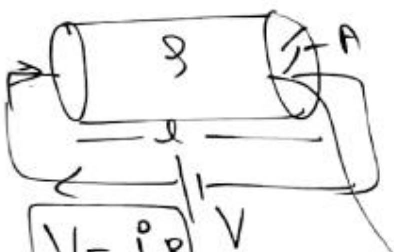
All formula

Ohm's law :- At constant temperature, pressure, shape & size of body & type of material fixed, current in conductor directly proportional to applied voltage across it.

$$V \propto i$$

$$V = Ri$$

$$V = iR$$



$$V = iR$$

$$R = \frac{\rho l}{A}$$

$$V = iR$$

R = Resistance of conductor

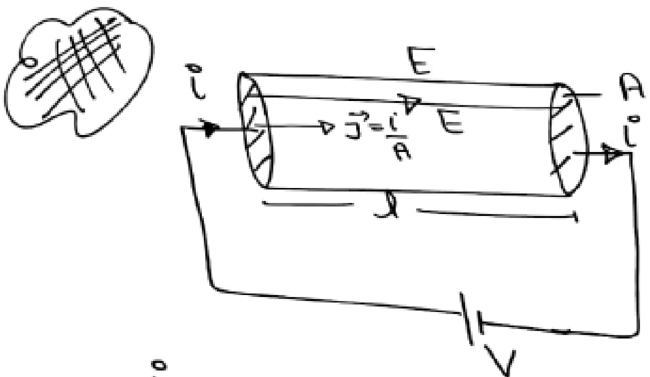
$$R = \frac{\rho l}{A}$$

$$\rho = \frac{m}{ne^2 \tau}$$

$$R = \frac{m l}{ne^2 A \tau}$$

Property of material

Relation b/w Current density & Electric field [Vector form of ohm's Law]



$$\frac{i}{A} = nev_d$$

$$J = ne \times \left[\frac{eE}{m}\tau\right]$$

$$J = \frac{ne^2\tau}{m} E$$

$$\rho = \frac{m}{ne^2\tau}$$

(Resistivity)

Conductivity $\sigma = \frac{1}{\rho} = \frac{1}{\frac{m}{ne^2\tau}} = \frac{ne^2\tau}{m}$

$$i = neAv_d$$

$$\boxed{\frac{i}{A} = nev_d}$$

$$\boxed{\vec{J} = \sigma\vec{E}}$$ — Vector form of ohm law [V=iR का vector form]

$$\vec{J} = \frac{1}{\rho}\vec{E}$$

$$\boxed{\vec{E} = \rho\vec{J}}$$

Q1) Two wires each of radius of cross-section is r but of different material are connected together in series. If the density of charge carriers in the two wires in the ratio of 1:4. the drift velocity of electrons in the two wires will be in the ratio

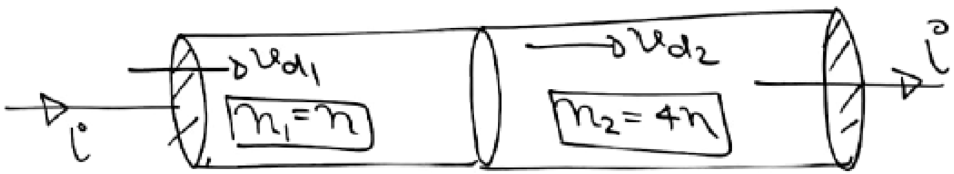
$n_1 : n_2 = 1 : 4$

(a) 1:2.

(b) 1:1.

(c) 4:1.

(d) 2:1.



$$i = n_1 e A v_{d_1} \qquad i = n_2 e A v_{d_2}$$

$$n_1 e A v_{d_1} = n_2 e A v_{d_2}$$

$$\frac{v_{d_1}}{v_{d_2}} = \frac{n_2}{n_1} = \frac{4n}{n} = 4:1$$

$[i = neAv_d]$

n → Charge per unit volume - density of charge carrier

Q2) The current I flows through a Uniform wire of diameter d then drift velocity of electrons is v. If the same current will through a wire of diameter $\frac{d}{2}$ (made of material) then the drift velocity of the electrons will be

*** ⇓ [(ρ, σ, n) same]

(a) $v/4$

(b) $v/2$

(c) $2v$

(d) $4v$ ✓

$i = neAv$

$i = ne\left(\frac{A}{4}\right)v_2$

$\cancel{neA}v = \cancel{ne}\left(\frac{A}{4}\right)v_2$

$v_2 = 4v$

$v_2 = 4v$

$A_1 = \pi\left[\frac{d}{2}\right]^2$

$A_1 = \frac{\pi d^2}{4}$

$A_1 = A$

$i = ne\frac{A}{4}v_2$

$A_2 = \pi r_2^2$

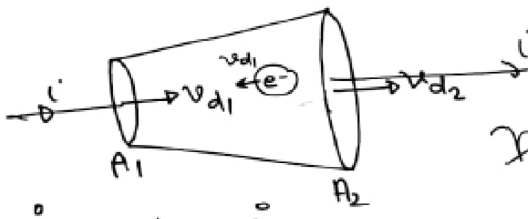
$= \pi\left[\frac{d}{4}\right]^2 = \frac{\pi d^2}{16}$

$A_2 = \frac{A}{4}$

Imp

Q) figure show below is representing a current carrying with with having non-uniform cross-section area. find the relation b/w physical quantity of their two ends

(i) i. ✓
(ii) v_d. ✓
(iii) J. ✓
Imp (iv) E. ✓



$i_1 = i_2$

$n e A_1 v_{d_1} = n e A_2 v_{d_2}$

$A_1 v_{d_1} = A_2 v_{d_2}$

$v_{d_1} > v_{d_2}$

$v_{d_1} = \frac{A_2}{A_1} v_{d_2}$

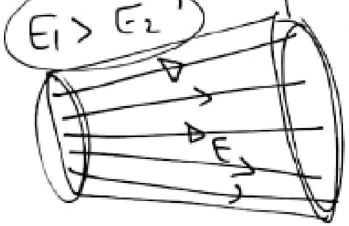
$v_{d_1} = \bigcirc\, v_{d_2}$

$i_1 = i_2 = i$

$\frac{i}{A_1} > \frac{i}{A_2}$

$J_1 > J_2$

$E_1 > E_2$

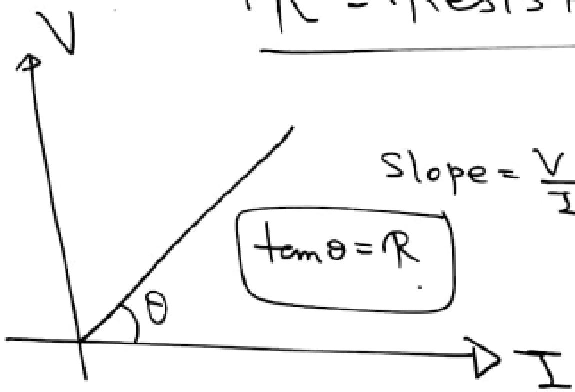


$v_d = \frac{eE}{m}\tau$

⇒ Ohm's Law

Ohmic devices ← $V = IR$ ⇒ $\boxed{\frac{V}{I} = R}$

R = Resistance Ω



Slope $= \frac{V}{I}$

$\boxed{\tan\theta = R}$

"Slope of $\frac{V}{I}$ graph gives resistance of conductor"

$\boxed{R = ?}$

$\boxed{\text{Slope} = \tan\theta = \frac{1}{R}}$

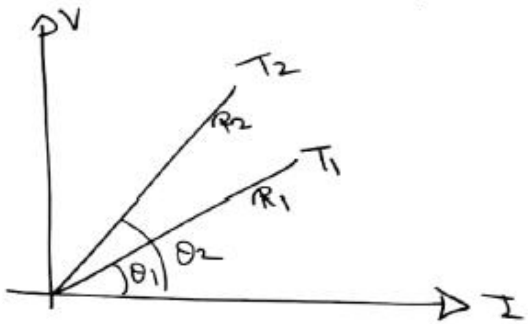
$\boxed{\frac{I}{V} = \frac{1}{R}}$

$\frac{1}{R} = \tan 30$

$\frac{1}{R} = \frac{1}{\sqrt{3}}$

$\boxed{R = \sqrt{3}\,\Omega}$

Q) ** In a Conductor



① $T_1 > T_2$.

② $T_1 < T_2$ [✓]

③ $T_1 = T_2$.

④ N.O.T.

$\Rightarrow$ $T\uparrow$ $R\uparrow$ $\longrightarrow$ Conductor

$T\downarrow$ $R\downarrow$ $\longrightarrow$ Conductor

Slope of V-I graph gives resistance

$\tan\theta_1 < \tan\theta_2$

$R_1 < R_2$

$$\boxed{T_1 < T_2}$$