Electric field ✓ Electricity

Current Electricity :-

OHM'S LAW :-

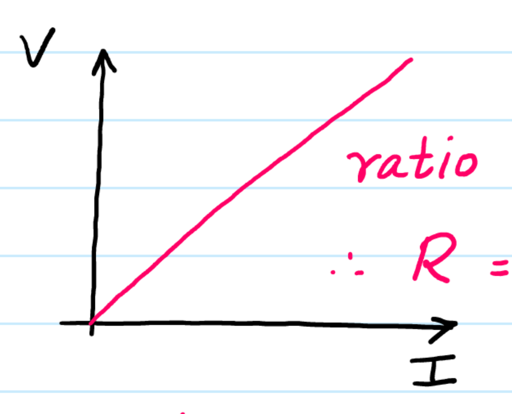
$V \propto I$ provided that Length, Area & Temp remains Constant

$V = IR$

define Resistance :- Ratio of $\frac{V}{I}$.

Conductors

Ohmic Conductors — Non-Ohmic conductor



ratio of $\frac{V}{I}$ = Const

∴ R = const

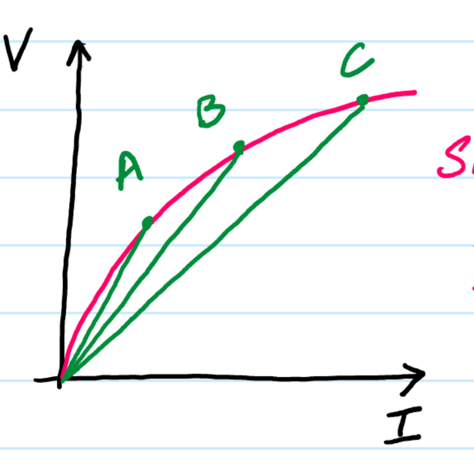
examples

1. fixed Resistors
2. All metals at **CONSTANT TEMPERATURE**

Non Ohmic Conductors

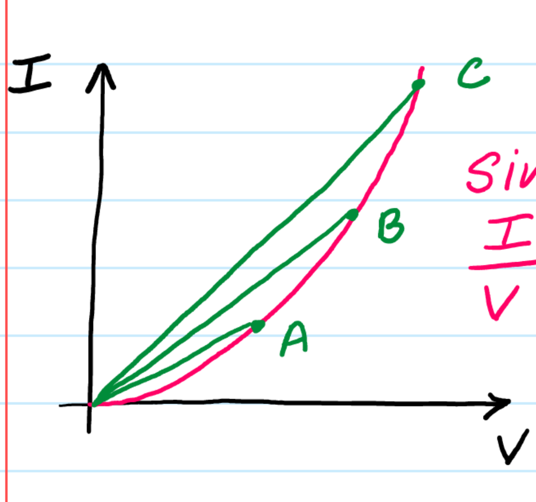
Thermistor ① — filament Lamp ② — Diode ③

as temp ↑, R ↓



Since ratio of $\frac{V}{I}$ decreases

∴ R decreases



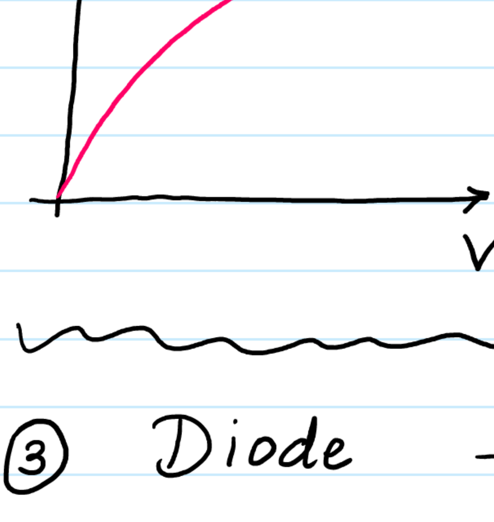
Since ratio of $\frac{I}{V}$ increases

∴ ratio of $\frac{V}{I}$ decreases

hence R decreases.

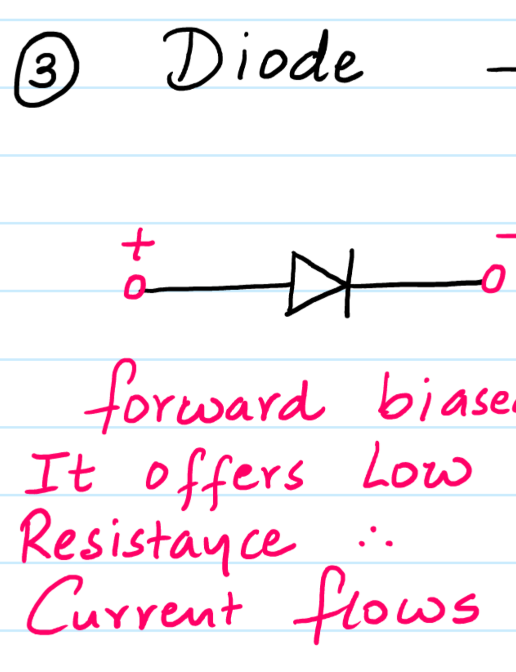
② filament Lamp —⊗—

as temp ↑, R ↑



ratio of $\frac{V}{I}$ increases

∴ R increases



ratio of $\frac{I}{V}$ decreases

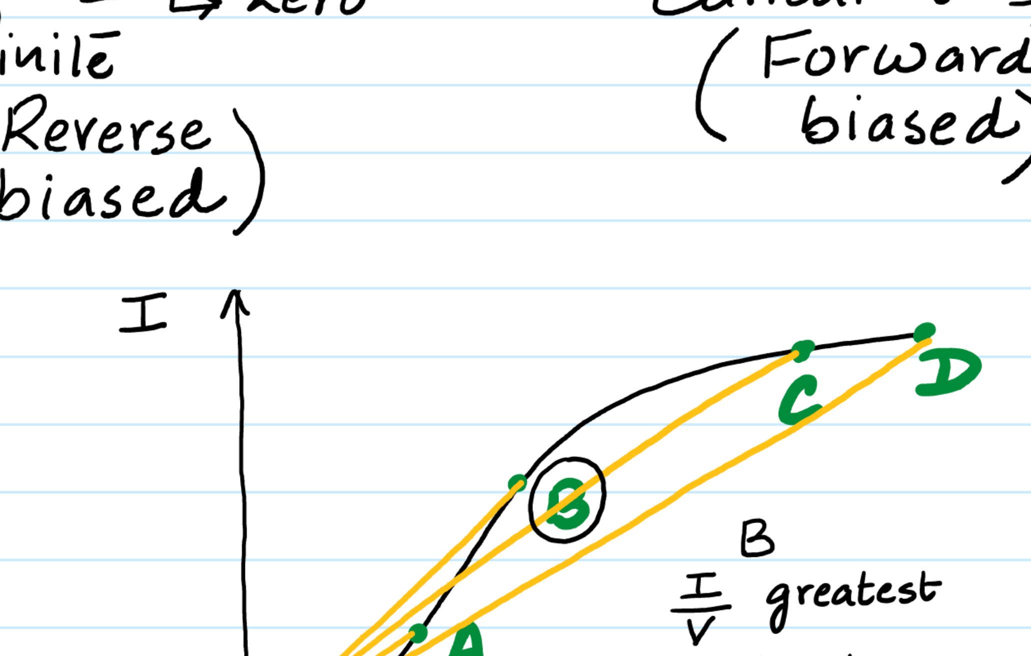
∴ $\frac{V}{I}$ increases

∴ R increases.

③ Diode —▷|— anode, cathode

forward biased (+ —▷|— −): It offers Low Resistance ∴ Current flows

Reverse biased (− —▷|— +): It offers infinite Resistance ∴ no Current flows



$\frac{I}{V}$ increases

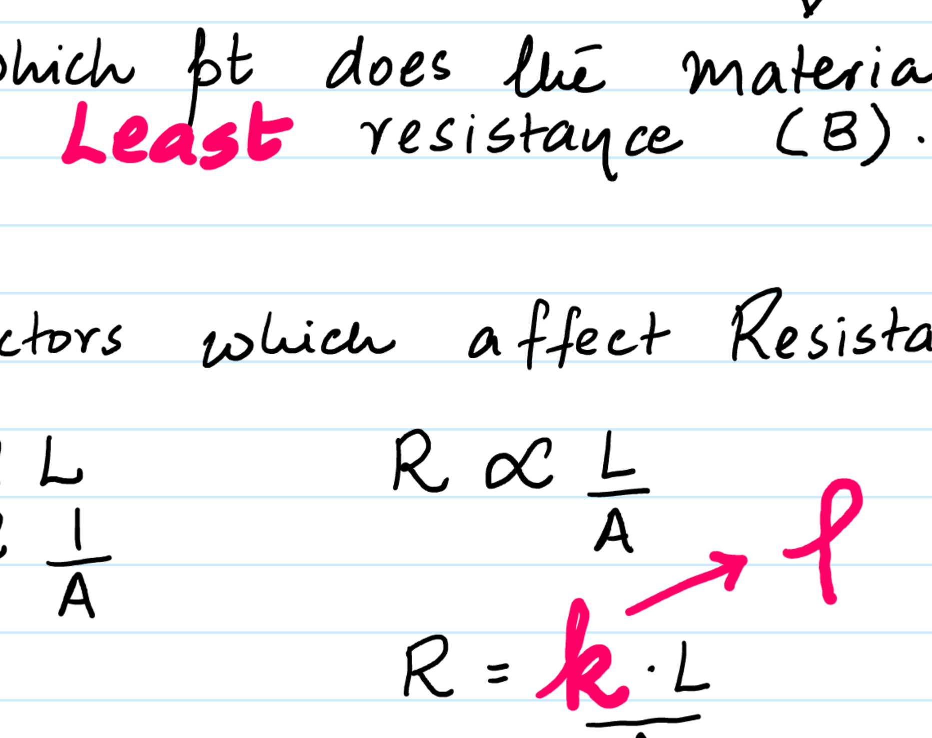
∴ $\frac{V}{I}$ decreases

hence R decreases which allows Current to flow. (Forward biased).

$I = 0$

$R = \frac{V}{I}$ → Zero, infinite (Reverse biased)

Ex



B: $\frac{I}{V}$ greatest, $\frac{V}{I}$ Least ∴ R (Least)

At which pt does the material offer **Least** resistance (B).

* factors which affect Resistance

$R \propto L$

$R \propto \frac{1}{A}$

$R \propto \frac{L}{A}$

$R = k \cdot \frac{L}{A}$, $k \rightarrow \rho$

$R = \rho \cdot \frac{L}{A}$

ρ is a constant known as Resistivity of the material.

units of ρ (Ωm)

$\rho = \frac{R \cdot A}{L} = \frac{\Omega m^2}{m}$

define resistivity ρ :- The resistivity of a material is said to be equal to its resistance provided that the material is of unit Length & offers a unit cross-sectional area

Conductivity (σ) Sigma :-

Conductivity is Inverse of Resistivity

formula $\sigma = \frac{L}{RA}$

units $(\Omega m)^{-1}$ or $\Omega^{-1} m^{-1}$.

Ex. A cylindrical material offers a resistance of 10Ω. Cal its new resistance if its Length is doubled & its volume remains unchanged.

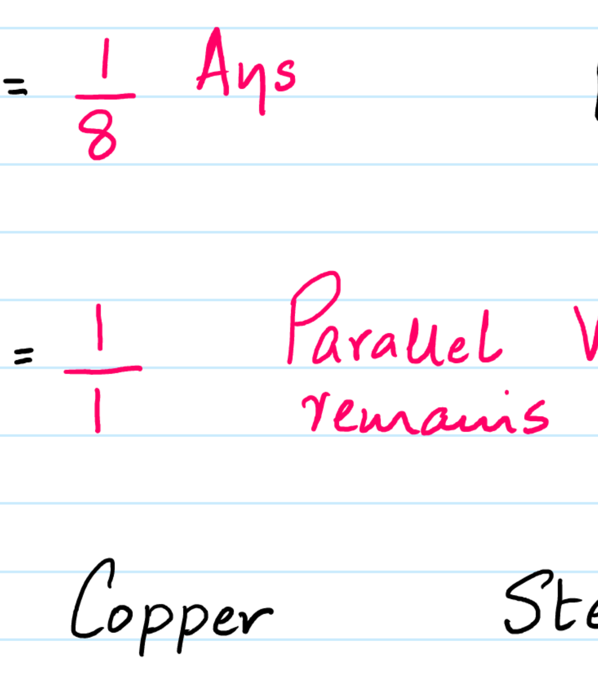
$V = A \times L$

Const, half, double

$R = \rho \frac{L(2)}{A\left(\frac{1}{2}\right)}$

R increases 4 times i.e 40Ω

Ex.2 Same material ρ = Same



$\frac{R_P = \rho \cdot \frac{2L}{A}}{R_Q = \rho \cdot \frac{L}{4A}}$

$\frac{R_P}{R_Q} = \frac{8}{1}$

Cal. the ratio of

(i) $\frac{I_P}{I_Q} = \frac{1}{8}$ Ans

(ii) $\frac{V_P}{V_Q} = \frac{1}{1}$ Parallel Voltage remains Same

Ex.3

Copper	Steel
2L	L
3R	R
ρ	2ρ

Cal ratio of $\frac{\text{diameter of Copper}}{\text{diameter of Steel}}$ $\frac{d_c}{d_s}$

Copper: $3R = \frac{\rho \cdot 2L}{\frac{\pi d_c^2}{4}}$

Steel: $R = \frac{2\rho \cdot L}{\frac{\pi d_s^2}{4}}$

$3\left(\frac{2\rho \cdot L}{\frac{\pi d_s^2}{4}}\right) = \frac{\rho \cdot 2L}{\frac{\pi d_c^2}{4}}$

$\frac{3}{d_s^2} = \frac{1}{d_c^2}$

$\frac{d_c}{d_s} = \sqrt{\frac{1}{3}}$ Ans