21 February 2021 17:01

Electric field ✓ Electricity

Current Electricity :-

OHM'S LAW :-

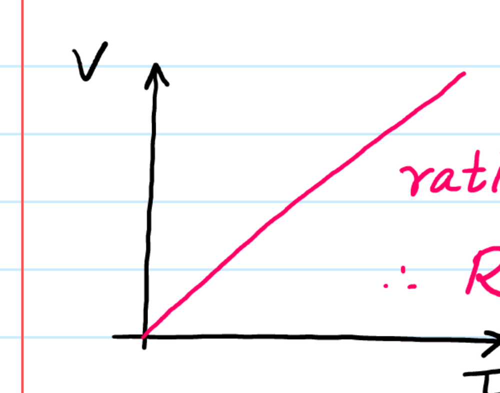
$V \propto I$ provided that Length, Area & Temp remains Constant

$V = IR$

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

Conductors

Ohmic Conductors | Non-Ohmic conductor



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

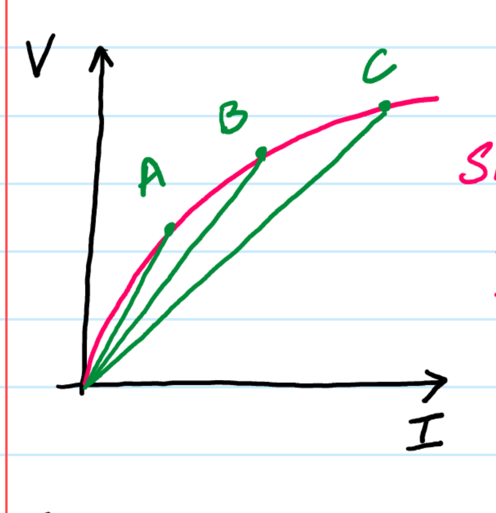
$\therefore R$ = const

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

Non Ohmic Conductors

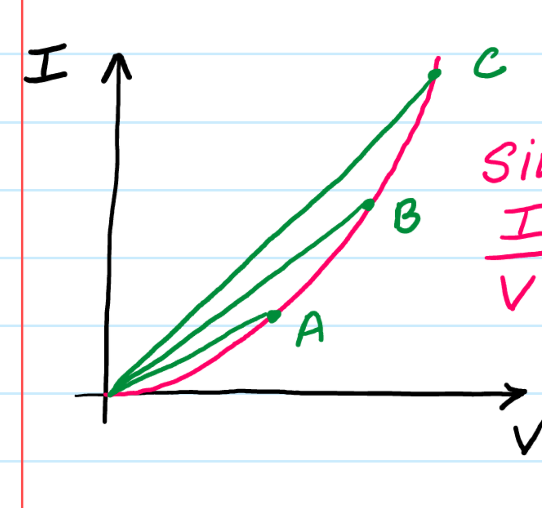
Thermistor (1) | filament Lamp (2) | Diode (3)

as temp ↑, R ↓



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

$\therefore$ R decreases



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

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

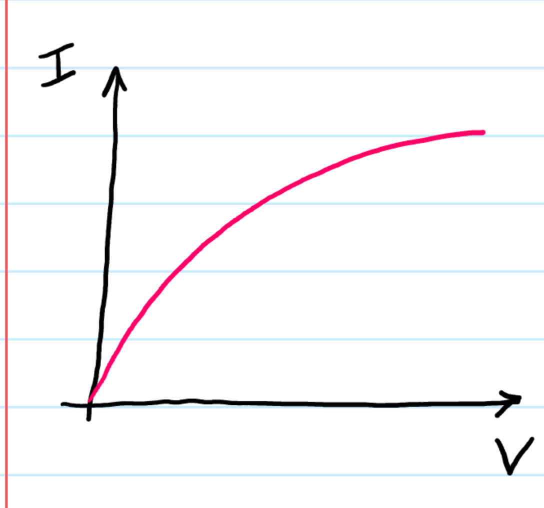
hence R decreases.

(2) filament Lamp —⊗—

as temp ↑, R ↑

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

$\therefore$ R increases

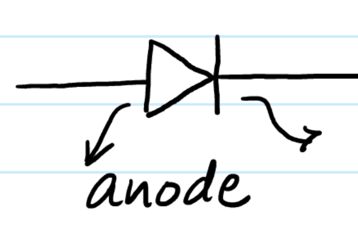


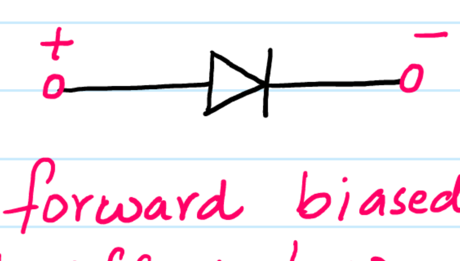
ratio of $\frac{I}{V}$ decreases

$\therefore \frac{V}{I}$ increases

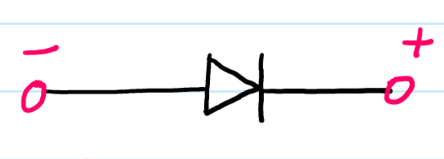
$\therefore$ R increases.

(3) Diode

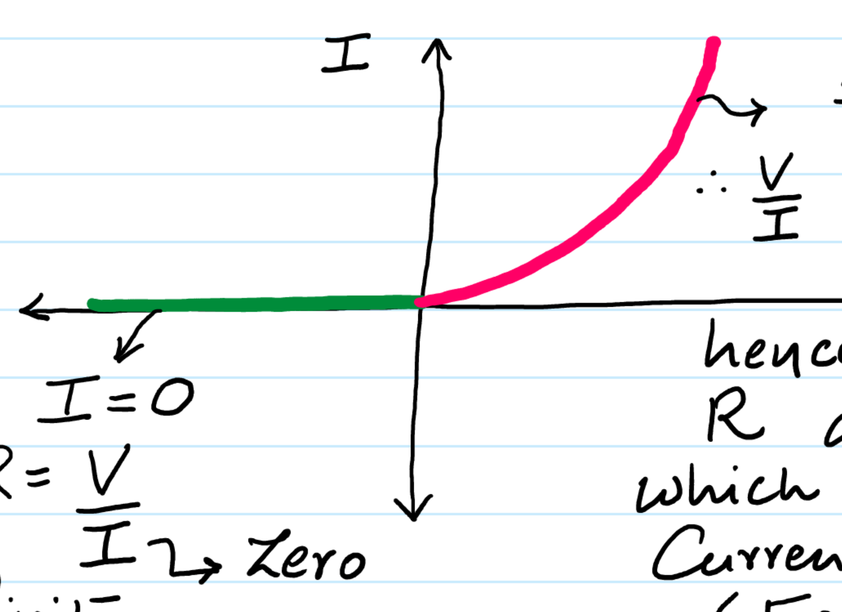




forward biased
It offers Low Resistance $\therefore$ Current flows



Reverse biased
It offers infinite Resistance $\therefore$ no Current flows



$\frac{I}{V}$ increases

$\therefore \frac{V}{I}$ decreases

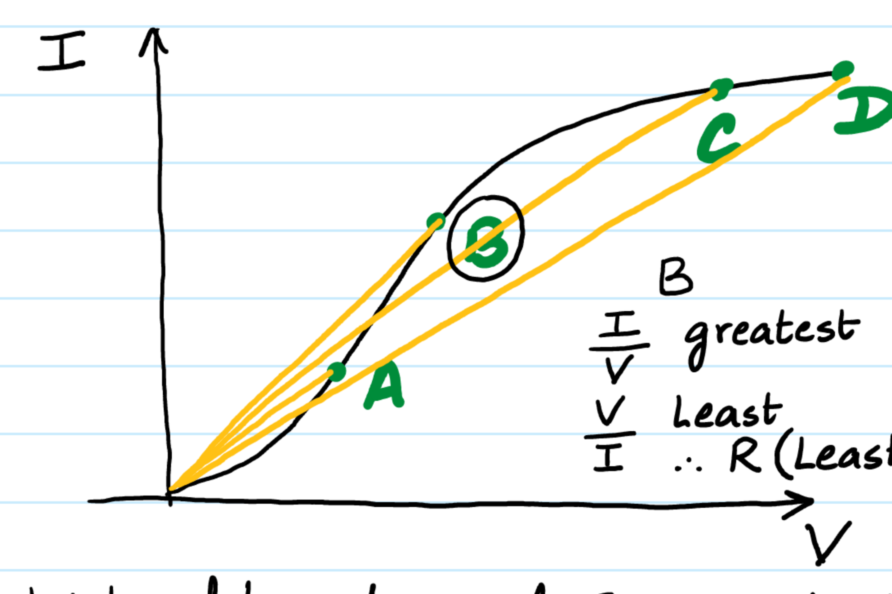
hence R decreases which allows Current to flow. (Forward biased).

I = 0

$R = \frac{V}{I}$ → zero

infinite (Reverse biased)

Ex



B $\frac{I}{V}$ greatest

$\frac{V}{I}$ Least $\therefore$ 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 → ρ)

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

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.

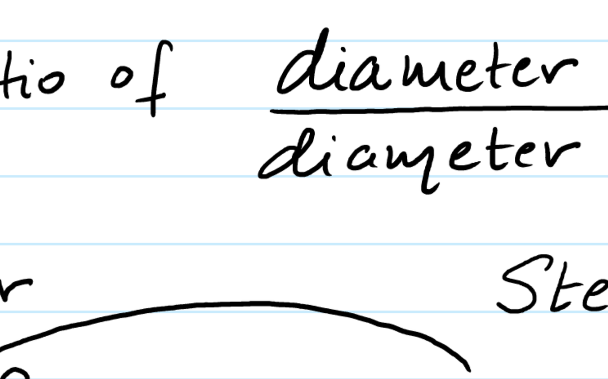
$V = A \times L$

Const, half, double

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

R increases 4 times i.e 40Ω

Ex.2 Same material ρ = Same



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

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

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

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

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

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

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

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