CH: 13 - ELECTRICITY

CHAPTER AT A GLANCE

CHARGE

- Positive charge (Eg: Proton ($+1.6 \times 10^{-19}$C))
- Negative charge (Eg: Proton (-1.6×10^{-19}C))

- Unlike charges attract each other & like charges repel
- SI unit of charge is Coloumb(C)

Charge at rest → **Static electricity**

Charge in motion → **Current electricity**

- Flow of charge in a closed circuit
- Direction of flow of positive charge is the direction of convectional current
- Direction of current is opposite to the direction of flow of electron in a circuit

Flow of charge per unit time → Electric current, $I = Q/t$

- Flow of electrons in a conductor when cell or battery is connected across its end
- SI unit is Ampere (A)
- 1 A = 1 C/1 s
- Measured by ammeter

Work done in moving a unit charge from one point to another point → Electric potential difference $V = V_B - V_A = W_{AB}/Q$

- SI unit is Volt (V)
- 1 V = 1 J/1 C
- Measured by voltmeter
- Current will flow from a region of higher potential to a region of lower potential

Both are related by → Ohm's law: $I \alpha V$ i.e., $V \alpha I$ (at constant temperature)

- The ratio V/I is a constant
- Graph between V and I is a straight line inclined to x-axis
- Slope of V-I graph resistance of the given conductor at a given temperature

Proportionality constant is called → $I \alpha V$ and $I \alpha 1/R$ → Resistance, $R = V/I$

- It opposes the flow of current through the conductor
- SI unit is ohm (Ω)
- 1 Ω = 1 V/1 A

Depends on
- Length of conductor ($R \alpha l$)
- Area of cross section ($R \alpha 1/A$)
- Nature of its material

→ $R \alpha 1/A$ or $R = \rho l/A$

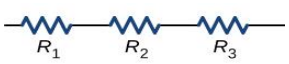
Where ρ is a constant known as → Resistivity or specific resistance, $\rho = RA/l$

- SI unit is ohm-meter (Ω-m)
- Low resistivity, good conductor
- Independent of length and thickness of wire

Depends on
- Nature of material
- Temperature of substance

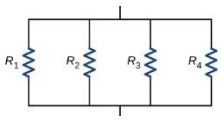
Connect in combinations of

Series



- Same current passes through each resistor
- Different potential difference across different resistor ($V \alpha I$)
- $V = V_1 + V_2 + V_3$
- $R_s = R_1 + R_2 + R_3$

Parallel



- Voltage across each resistor is same
- Current is divided in each branch ($I \alpha 1/R$)
- $I = I_1 + I_2 + I_3$
- $1/R_p = 1/R_1 + 1/R_2 + 1/R_3$