

Current Electricity

$$I = V/R$$

$$\text{Current, } I = \frac{Q}{t}$$

$$Q = n \times e$$

$$I = \frac{n \times e}{t}$$

$$\text{Potential difference, } V = \frac{\text{work}(W)}{\text{charge}(Q)}$$

$$\text{According to Ohm's law: } V = IR$$

V → potential difference; I → current; R → resistance.

$$\text{Conductance} = 1/\text{Resistance}.$$

$$\text{Specific resistance, } \rho = \frac{Ra}{l}$$

R → resistance; a → area of cross section; l → length.

$$\text{Conductivity, } \sigma = \frac{1}{\text{specific resistance}(\rho)}$$

$$\text{Electro-motive force(e.m.f), } \varepsilon = \frac{\text{work done}(W)}{\text{charge}(q)}$$

$$\text{Terminal voltage, } V = \frac{W}{q}$$

$$\text{Voltage drop, } v = \frac{w}{q}$$

$$\varepsilon = V + v$$

$$\text{Internal resistance, } v = \text{current}(I) \times \text{internal resistance}(r)$$

$$\text{Total resistance of circuit} = R + r$$

$$\text{Current drawn from the cell, } I = \frac{\varepsilon}{R + r}$$

$$\text{Emf of a cell, } \varepsilon = I(R + r)$$

$$\text{The terminal voltage of the cell, } V = IR$$

$$\text{Voltage drop due to internal resistance, } v = Ir$$

$$\text{Internal Resistance, } r = \frac{v}{I} = \frac{\varepsilon - V}{I} = \frac{\varepsilon - V}{V/R} = \left(\frac{\varepsilon}{V} - 1 \right) R$$

Equivalent resistance in series,

$$R_s = R_1 + R_2 + R_3 + \dots + R_n$$

If there are n equal resistances each of value R, connected in series

$$R_s = nR$$

Equivalent resistance in parallel,

$$R_p = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots + \frac{1}{R_n}$$

If there are n equal resistances each of value R, connected in parallel

$$R_p = \frac{R}{n}$$

Electrical energy, $W = \text{potential difference}(V) \times \text{current}(I) \times \text{time}(t)$

$$\text{Electrical energy, } W = QV = VIt = I^2Rt = \frac{V^2t}{R}$$

$$\text{Electrical power, } P = \frac{W}{t} = VI = \frac{V^2}{R} = I^2R$$

Electrical energy, $W = \text{Power}(P) \times \text{time}(t)$

Cost of electricity = electrical energy in kWh \times cost per kWh

Heating effect, $H = I^2RT$

SI UNITS

- charge \rightarrow *coulomb (C)*
- Current \rightarrow *ampere(A) or (I)*
- Potential difference \rightarrow *volt(V)*
- resistance \rightarrow *ohm*
- conductance \rightarrow *ohm⁻¹*
- Specific resistance \rightarrow *ohm \times metre*
- conductivity \rightarrow *ohm⁻¹ \times metre⁻¹*
- Electrical energy \rightarrow *joule(J)*
- electrical power \rightarrow *volt \times ampere(VA) or watt(W) or Js⁻¹*
- e.m.f \rightarrow *volt(V)*