Topic 5B: Current, Resistance, Ohm's Law, Power

Skill 38: Electric Current

Current (represented by "I") is the rate of charge (in coulombs) that pass a point each second. Measured in Amperers A

$I = \frac{q}{t}$

* If charge is given as electrons (e) convert to Coulombs by $\times \frac{1.6\times10^{-19}\text{C}}{1\text{e}}$
* Time must be given in seconds

Ex: 1.5×10^{21} electrons passing a point in 3 minutes is a current of

$I = \frac{q}{t}$

$q = 1.5\times10^{21}\text{e} \times \frac{1.6\times10^{-19}\text{C}}{1\text{e}} = 2.4\times10^{2}\text{C}$

$t = 3\text{min} \times \frac{60\text{s}}{1\text{min}} = 180\text{s}$

$I = \frac{2.4\times10^{2}\text{C}}{180\text{s}} = 1.33\text{C/s} = 1.33\text{A}$

Skill 39: Resistance – the difficulty an electric current experiences as it moves through a circuit

Resistance (R) measured in ohms (Ω)

$R = \frac{\rho L}{A} = \frac{\rho L}{\pi r^2}$

Factors that determine resistance include:

- Length of wire (L) the shorter the wire the easier the path. Resistance does the same thing as length
- Type of material - Resistivity (ρ) the greater the resistivity the greater the resistance. Resistivity for each material is listed on PRT for 20°C. Units Ωm
- Cross-sectional Area of wire
  - The thinner the wire the greater the difficulty
  - Cross-section of a wire is a circle so area is πr^2
  - Resistance and cross-sectional area have an inverse relationship $R = \frac{\rho L}{A}$
  - Resistance and radius (or diameter) have an inverse square relationship $R = \frac{\rho L}{\pi r^2}$
- Temperature - Not in equation. If temp increases the molecules move faster making it harder

Low Resistance is SHORT, FAT, COLD, GOLD (Metallic)

For any given voltage as Resistance increases Current decreases

$I = \frac{V}{R}$ (Ohm's Law)