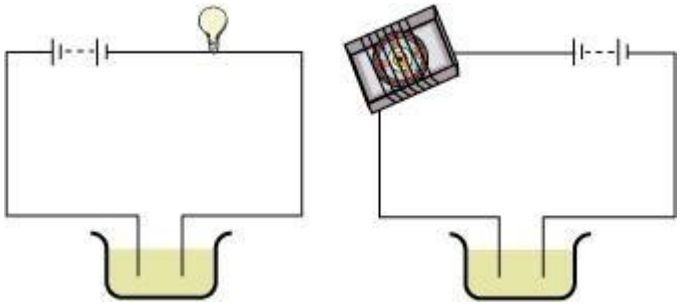
Electricity

- **Electric potential**: The Electric potential of a point in an electric field is defined as the work to be done to move a unit positive charge from infinity to that point.
- **Potential difference**: The potential difference between two separate points is defined as the work done to move a unit positive charge from one point to another.

$$V = \frac{W}{Q}$$

Unit: Volt

$$1 \text{ Volt} = \frac{1 \text{ joule}}{1 \text{ coulomb}} \qquad \boxed{1\,V = 1\,J\,C^{-1}}$$



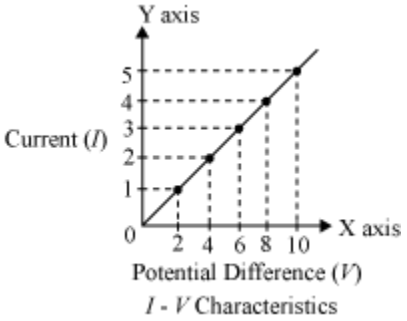
- The bulb will glow or the magnetic needle will show deflection if the liquid in the beaker is a good conductor of electricity.
- Greater the deflection of needle or brighter the light, better is the conductivity of the liquid.

Good conductor	Poor conductor
Lemon Juice	Coal tar
Vinegar	Distilled water
Acid solutions	Honey
Basic solutions	Vegetable oil
Salty water	Kerosene

- Conducting liquids are also called electrolytes.
- The electric current passing through a conducting liquid (electrolyte) causes chemical reactions (electrolysis).

- **Ohm' law**: Under constant physical conditions (i.e., constant temperature, pressure etc.), the current flowing through a conductor is directly proportional to the potential difference across the conductor.

- $V \propto I$
- ***V = IR*** *(R* = resistance)
- **Unit** (R) → Ω (Ohm)



I - V Characteristics

$1\Omega = \frac{1V}{1A}$

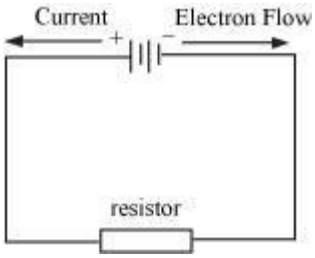
- **Ohmic resistors:**

  Conductors which follow the ohm's law at constant temperature are called ohmic resistors. Examples: All metallic conductors (Copper, Aluminium, silver etc.), copper sulphate solution with copper electrodes, and dilute sulphuric acid etc.

- **Non-ohmic resistors:**

  Conductors which do not follow the ohm's law are called non-ohmic resistors. Examples: LED, solar cell, junction diode, transistor, bulb filament etc.

- Potential difference (which is measured in Voltage) is the cause of current (which is measured in Ampere).
- In conductors, flow of electrons constitutes the current. In a circuit current flow from the positive terminal of the battery to the negative terminal, but electrons travel from negative terminal to the positive terminal. The negative terminal of a battery is said to be at lower potential and the positive terminal is said to be at higher potential.



- When a battery is not connected to any circuit, the potential difference across the terminals of the battery is equal to the EMF of the battery. (EMF = Electro Motive Force).

- Resistance in a series connection: When n resistors R_1, R_2, R_3, ..., R_n are connected in series, then their equivalent resistance (R_s) is given as
  $R_s = R_1 + R_2 + R_3 + ... + R_n$
- Resistance in parallel connection: When n resistors R_1, R_2, R_3, ..., R_n are connected in parallel, then their equivalent resistance (R_p) is given as
- 1RP=1R1+1R2+1R3+.....+1Rn
- **Joule's heating** law suggests that heat produced in a resistor is directly proportional to the

1. square of the current flowing through the resistor i.e., $H \propto I^2$
2. resistance of the resistor i.e., $H \propto R$
3. time for which the current flows through the resistor i.e., $H \propto t$

- Electric energy = VIt

$$\text{Heat, } H = VIt$$
$$= I^2Rt$$

- **Application:**

  Electric iron, toaster, fused wire,bulb

- **Fused wire:** a low-melting point wire connected in series with electric devices for safety.

- **Electric power:** Electric power is defined as the rate of consumption of energy or simply the rate of doing work.

$$P = VI = I^2R = \frac{V^2}{R}$$

- **SI unit of power is watts (W)**
- **1 kWh is the commercial unit of electric energy.**
  - **1 Unit** – 1 kWh = 3.6×10^6 J
- 1 W = 1V × 1A