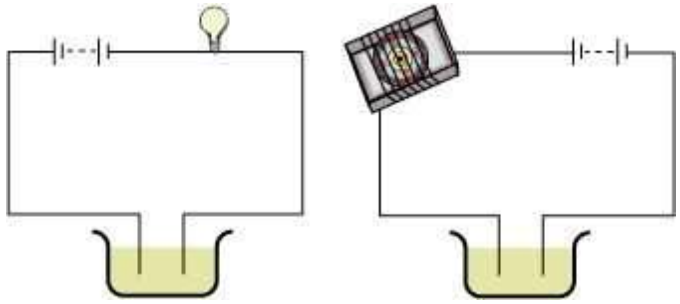
3. Current Electricity

- 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

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



- 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).

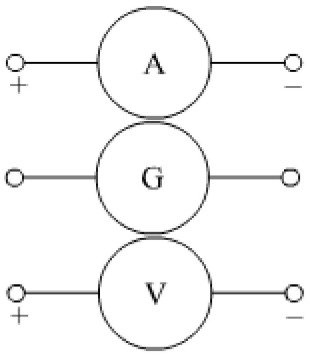
1. **Symbols of Electric components**

Electric component	**Symbol**
Electric cell	
Electric bulb	
Battery	
Wire	
Switch in ON position	
Switch in OFF position	

Ammeter

Galvanometer

Voltmeter



2. **Combination of cells**

Positive (or negative) terminal of a cell is connected to the negative (or positive) terminal of the other cell. This combination is called a **battery**.
3.An unbroken path or line that makes electrical current flow possible through conducting wires connected to other resistances is known as an electric circuit.
4. The circuits where the appliances in connection operates simultaneously once the switch is closed are known as series circuits. In series circuit, the working of each appliance is dependent on each other.
5. The circuits where the working of each appliance present in the circuit is independent on each other are known as parallel circuits.

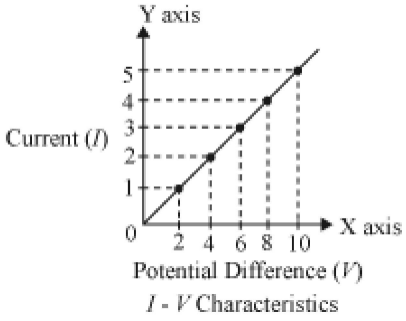
- Materials which allow electric current to pass through them are called **conductors** of electricity.
- Materials which do not allow electric current to pass through them are called **insulators**.
- Differences between Conductors and Insulators:

Electrical conductors	**Electrical insulators**
Electricity can pass through certain materials. These materials are known as electrical conductors.	Electricity cannot pass through certain materials. These materials are known as electrical insulators.
All metals (for example, aluminium, copper, iron, and steel) are good conductors of electricity. Therefore, electrical wires are made up of metals such as aluminium and copper.	Few examples of good electrical insulators are plastic, wood, glass, and rubber. Therefore, plastic or rubber is often used to cover electrical wires.

- Conductors and insulators are equally important for us.

- **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

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

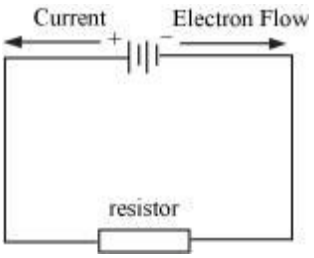
- **Ohmic resistors:**

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).

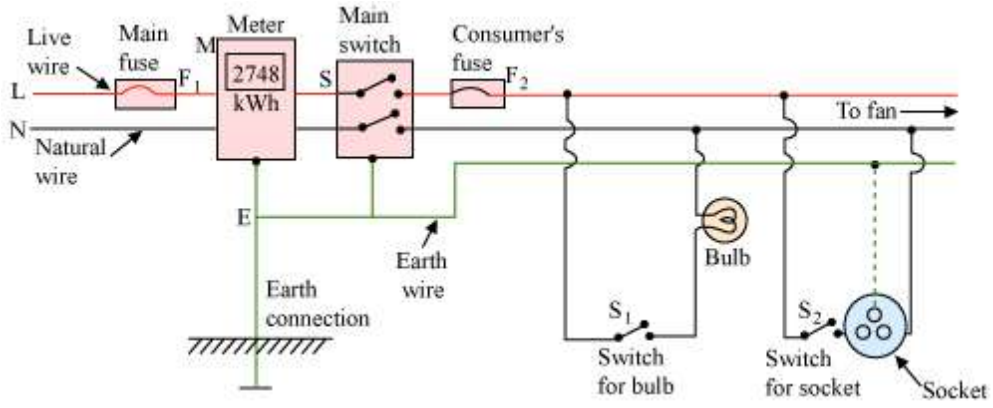
- Resistance in a series connection: When n resistors R_1, R_2, R_3, ..., R_n are connected in series, then their equivalent resistance (R_s) is given as
  $R_s = R_1 + R_2 + R_3 + ... + R_n$

- 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

- $1RP=1R1+1R2+1R3+.....+1Rn$

- **Domestic wiring**

Electricity is transferred to our homes through a pair of wires consists of a red colour wire (called **live wire, L),** and a black colour wire (called **neutral wire, N).** In addition to these wires, a green colour wire known as the **Earth wire, E** is also connected with the circuit. In India, 220 V potential is supplied through live wire, while neutral wire has ground potential of zero volts.



- **Switches**: It is a device which is connected in the live wire so as to turn 'ON' or 'OFF' the current in the circuit.

  Types of switches:
  1) Single pole switch:
  2) Double pole switch:
- Fuse is the most important safety device, used for protecting the circuit due to short-circuiting or overloading of the circuit.

Characteristic of electric fuse

- Fuse wire has low melting point. It is generally made up of an alloy of lead and tin.
- Fuse wire is always connected in the series with the live wire. Its resistance is higher than that of the copper wires. So it gets heated up much faster than the copper wire when excessive current flows through it.
- Current rating of the fuse wire decides its thickness. More the current rating of the fuse wire, more will be its thickness.