



Class - X

2023-24

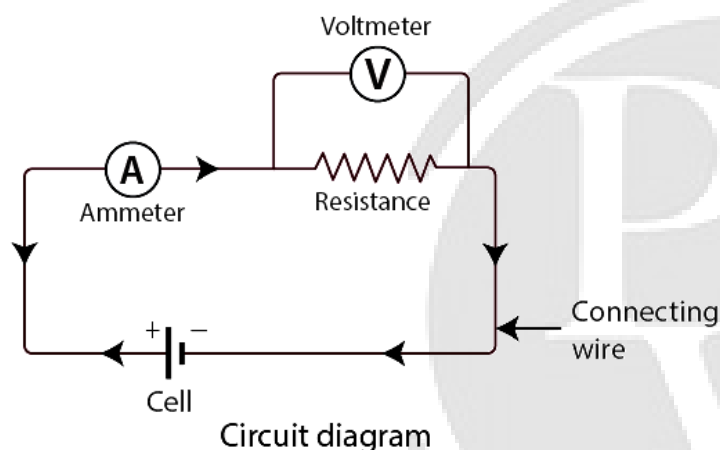
Board: CBSE

Electricity

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Electric Current: The flow of electric charge is known as Electric Current, Electric current is carried by moving electrons through a conductor.

- S.I. unit of electric current is ampere (A). Ampere is the flow of electric charge through a surface at the rate of one coulomb per second.
- Electric current is denoted by the letter 'I'. Electric current is expressed by the rate of flow of electric charges. Rate of flow means, the amount of charge flowing through a particular area in unit time.
- $I = Q/t$



Charge: Like mass, the charge is the fundamental property of matter. There are two types of charge

- (i) Positive charge.
- (ii) Negative charge.

- SI unit- Coulomb
- $e = 1.6 \times 10^{-19}$
- 1 coulomb = 1 ampere \times 1 second ($1C = 1A \times 1s$)

Properties of Electric Charge:

- (i) Unlike charges attract each other and like charges repel each other.
- (ii) The force between two charges varies directly as the product of two charges and inversely as the square of the distance (r) between both charges (q_1 and q_2).

Electric Potential: The amount of electric potential energy at a point is called electric potential.

Potential Difference: The difference in the amount of electric potential energy between two points in an electric circuit is called electric potential difference.

- Electric potential difference is known as voltage, which is equal to the amount of work done to move the unit charge between two points against a static electric field.
- Voltage or electric potential difference is denoted by V'. Therefore, $V = W/Q$
- S.I. Unit of Electric Potential Difference (Voltage).



Resistance: Resistance is a property of conductor due to which it resists the flow of electric current through it. A component that is used to resist the flow of electric current in a circuit is called a resistor.

In practical application, resistors are used to increase or decrease the electric current. Its unit is ohm (Ω).

$R = \rho L/A$... [Where ρ is proportionality constant called specific resistance of conductor]

Rheostat: This is a device which is used in a circuit to provide variable resistance.

Resistivity: It is defined as the resistance offered by a cube of a material of side 1m when current flows perpendicular to its opposite faces. Its S.I. unit is ohm-meter (Ωm). It only depends upon the nature (material) and temperature of the conductor.

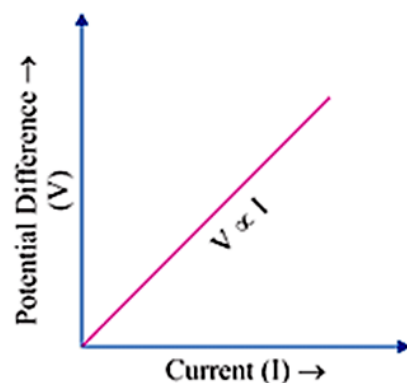
- Resistivity, $\rho = RA/l$
- Resistivity is also known as specific resistance.
- Resistivity depends on the nature of the material of the conductor.

Ohm's Law: According to this law "Under the constant physical condition the potential difference across the conductor is directly proportional to the current flowing through the conductor."

$$V \propto I$$

$$V = RI$$

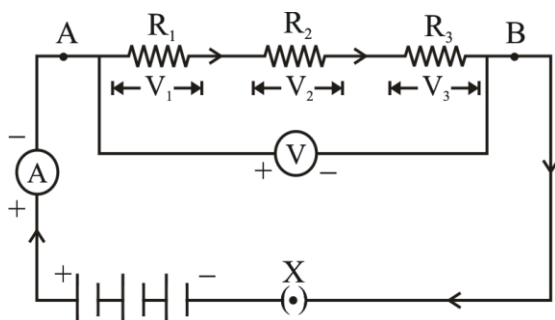
Where, R is constant for the given conductor at a given temperature and is called resistance.



Combination of Resistors

(i) Series combination: When resistors are joined from end to end, it is called in series. In this case, the total resistance of the system is equal to the sum of the resistance of all the resistors in the system.

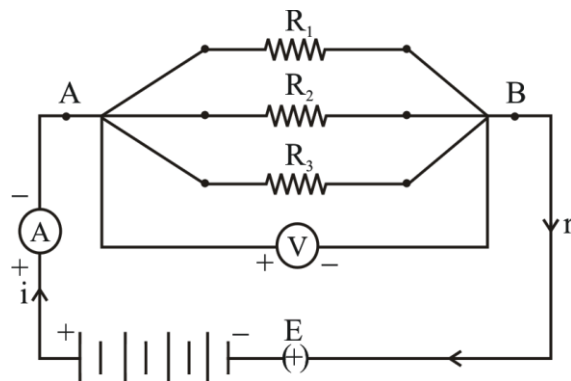
$$R_s = R_1 + R_2 + R_3$$





(ii) Parallel combination: When resistors are joined in parallel, the reciprocal of the total resistance of the system is equal to the sum of reciprocal of the resistance of resistors.

$$1/R_p = 1/R_1 + 1/R_2 + 1/R_3$$



The heat generated by electric current: The potential difference between two points in an electrical field is equal to the work done in moving a unit charge from one point to another.

$$H (\text{heat}) = I^2 R t \text{ Joule.}$$

Electric power (P): The electric work done per unit time is called electric power.

$$P = W/t = I^2 R = VI = V^2/R = E/t$$

- Electric power is also defined as the electric energy consumed per unit time.
- S.I. unit of electric power is Watt.
- The maximum value of electric current that can pass through an electric appliance without damaging the electric appliance is called current rating of electric appliance.
- The commercial unit of electric energy is kilowatt hour (kW h), commonly known as 'unit'.
- $1\text{kWh} = 1000 \text{ Wh} = 1000 \times 60 \times 60 \text{ Ws} = 3600000 \text{ Ws} = 3.6 \times 10^6 \text{ joule.}$

