

PHYSICS – GRADE 10

ELECTRICITY

Study of electricity is classified into two parts-

- 1) Static electricity
- 2) Current electricity

Conductors: Materials which allow charges to move freely.

Insulators: Materials which do not allow charges to move freely.

Electrostatic potential: The electrostatic potential (or potential) at any point is defined as the work done in bringing a unit positive charge from infinity to that point.

Potential difference: The potential difference between two points in an electric field is defined as the work done in moving a unit positive charge from one point to another point.

$$\text{Potential difference} = \frac{\text{work}}{\text{charge}}$$

$$V = \frac{W}{Q} \quad \text{or} \quad W = VQ$$

Unit of electric potential is 'volt' and its symbol is 'V'.

Definition of volt: 1 volt is the potential difference when 1 joule of work is done in moving 1 coulomb charge.

$$1 \text{ volt} = \frac{1 \text{ joule}}{1 \text{ coulomb}}$$

Note: 'Voltmeter' is used to measure potential difference. It is used in parallel.

Electric current: The rate of flow of charge is called electric current. It is represented by the symbol I and its SI unit is 'ampere' (A).

$$\text{electric current} = \frac{\text{charge}}{\text{time}}$$

$$I = \frac{Q}{T}$$

Note: 'Ammeter' is used to measure current. It is used in series.

Ohm's law: It states that, the current flowing through a conductor (copper wire) is directly proportional to the potential difference across the conductor.

$$\begin{aligned} V &\propto I \\ V &= R \times I \\ V &= IR \end{aligned}$$

Where, R is the constant of proportionality called 'resistance' of the conductor.

V – I graph: Refer to figure-5.6, page-57 NCERT.

Ohmic conductors: VI graph is a straight line.

Non-ohmic conductors: VI graph is not a straight line.

Resistance of a conductor: The property of a conductor due to which it opposes the flow of current through it is called resistance.

Symbol & unit of resistance:

The symbol of resistance is R and its SI unit is 'ohm' (Ω).

Definition of unit of resistance: The resistance is 1 ohm if a potential difference of 1 volt causes a current of 1 ampere.

Resistance of a conductor depends on:

- 1) Length of the conductor
- 2) Area of cross-section of the conductor
- 3) Nature of the conductor
- 4) Temperature.

Expression for resistance:

$$R = \frac{\rho L}{A}$$

Where, ρ is a proportionality constant called resistivity of the conductor.

Resistivity (def): It is defined as the resistance offered by 1m^3 of material. Its unit is 'ohm-metre' (Ωm).

Note:

- 1) Resistivity of metals and alloys is low.
- 2) Resistivity of insulators is high.
- 3) Materials with resistivities between conductors and insulators are called semi- conductors.
- 4) Semi-conductors are used for making micro-chips.
- 5) Resistivity of alloys is higher than metals.
- 6) Alloys do not oxidize (burn) at high temperature, hence are used in electric heating devices like electric irons, toasters etc.
- 7) Tungsten is used as filament of incandescent lamp because it loses energy in visible region.
- 8) Copper and aluminium are used in electrical transmission lines.

Resistors in series:

Diagram
formula

Resistors in parallel:

Diagram
formula
