Static and Current Electricity

Fundamentals of Physics

Topics that can be grouped for ease of learning

Measurement and Laws of Motion

Fluids, Atmospheric Pressure , Heat and its transfer, Energy and its flow

Light, Mirrors, Sound, Electricity, Magnetism

Static and Current Electricity

Static Charge

- By friction
- Positive charge / ions
- Negative charge / ions
- Sparking is caused by ionisation of the air , during the flow of charge between two bodies

Atomic Structure model

- Electron
- Protons
- Neutrons
- Charge occurs as a whole number multiple of electron

Flow of charge as transfer of electrons

Charge is neither created nor destroyed, but is transferred from one body to another

Static Electricity and its transfer

The nucleus contains bonded protons and neutrons. The electrons with negative charge circle around the nucleus. When electrons move freely within a substance, they are called 'Free Electrons'. Electron in the outmost orbit easily leave the nucleus and move away.

In Electrostatic Induction, no charge is lost or gained by the charged body, but the positive and negative charges are concentrated on the opposite ends of the body , similar to the North and the South Poles

- Is produced by friction

- Positive charge or ion and Negative charge or ion is produced as a result of friction. When silk is rubbed with wood, silk is positively charged and wood is negatively charged.

- The body that loses electrons gets positively charged, and the body that gains electrons gets negatively charge.

STATIC ELECTRICITY

' P' = Proton, positive and No movement.

'N' = Neutrons with No charge

An Atom contains

(a) Electrons are negatively charged,

(b) Protons are positively charged

(c) Neutrons that have no charge

P + N in nucleus.

Both have the same Mass

The positive charge on a proton (+ e) is equal to the negative charge on an electron (-e) The elementary charge or the fundamental unit of charge is 'e'

Transfer of charge occurs due to movement of negatively charged electrons , from one object to another.

The positively charged protons do not move.

Charge flows when electrons are transferred or lost. After the loss, it gets positively charged because protons become more than electrons in that atom.

Electricity : Ch. 15, 16; Magnetism Ch. 17

1) A single electron behaves like a magnet. It therefore, exerts a magnetic field. It is 'static charge'.

- Electric current is a flow of electrons.
- This creates a electro- magnetic field that surrounds the flow of electric current.

2) The S. I. Unit of charge is coulomb (symbol = C). 1mC = 10^{-3} C. This value is to be used to measure the quantity of charge on a body by the formula 'q=ne'. Here, 'n' is the number of electrons in excess or deficit , and 'e' is the charge on an electron. The standing numerical value of charge on an electron e = 1.6 x 10^{-19}C.

Electric Current

Direct current (d. c.) is a current of constant magnitude, flowing in one direction

There are two sources of current (a) alternating (a.c.) as in a.c. Generator (b) direct current (d.c.)

A battery cell is a source of direct current. The brass cap acts as the positive terminal and base of the zinc case is the negative terminal. Two electrode within are the conducting rods, immersed in solution called the electrolyte

Current is the rate of flow of charge across a cross section normal to the direction of the flow of current. The rate of flow of the charge gives the magnitude of the current.

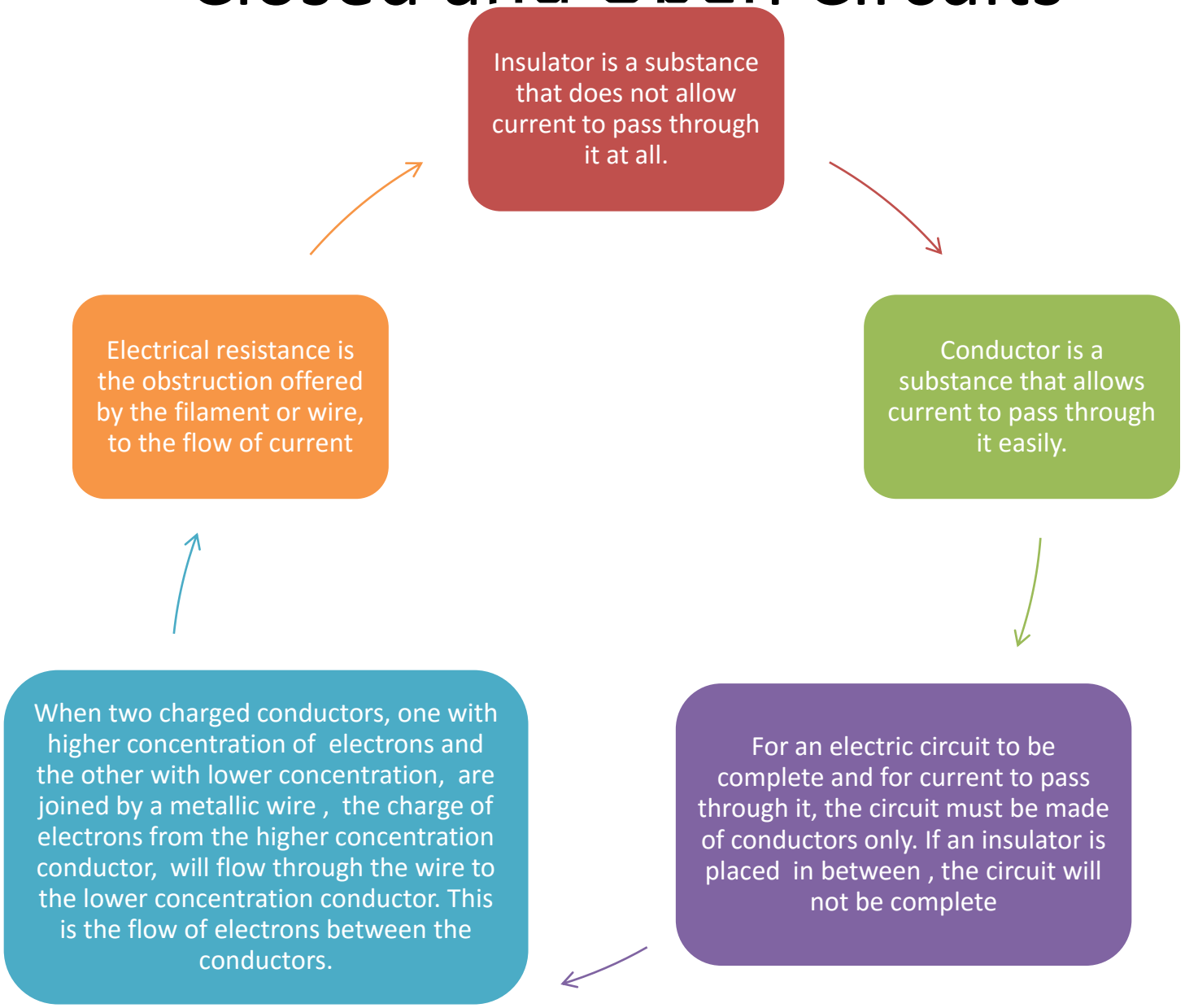
The current is the scalar quantity. In metals current flows due to movement of electrons. Each electron carries a negative charge of

$e = 1.6 \times 10^{-19} C$.

If 'n' electrons pass through the metal conductor in time 't' , then total charge passed would be Q=n x e, and the current in conductor would be I = Q/t = ne/t . Therefore , the Unit of current = Unit of charge / Unit of time. S.I. Unit of charge is coulomb and S. I. Unit of time is second. As such, unit of current is coulomb per second , called Ampere. 1 ampere = 1 coulomb / 1 second.

Direction of conventional or simple current is opposite to the direction of flow of electrons. The direction is taken as positive due to the direct flow of positive charge. The current will be negative in the direction of flow of electrons.

Closed and Open Circuits



Conductors of electricity

- (-) Pure water does not conduct electricity.

(+) Good conductors

- Pure water + pinch of salt = good conductor
- Tap water is a good conductor of electricity because it contains some mineral salts that makes it a solution.
- All solutions – whether Acids or Bases – are good conductors of electricity
- Human body is a good conductor of electricity.
- All metals , except lead, are good conductors.

Implementation

1. The Firemen cut off the main electric supply in the area, where a fire is to be doused.
2. During rains, an electrician cannot carry out electrical repairs outdoors.
3. Crackling sound and tiny sparkles are seen when woollen clothes are removed during winters
4. While repairing electrical items at home, it is advisable to wear rubber slippers