MAGNETIC EFFECTS

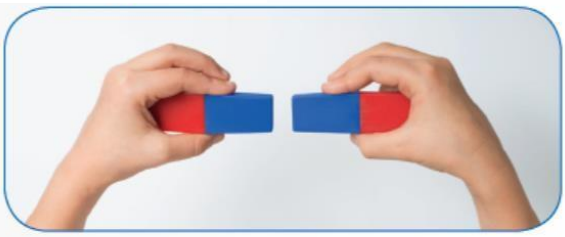
Magnet

A substance that attracts iron or iron like substances.

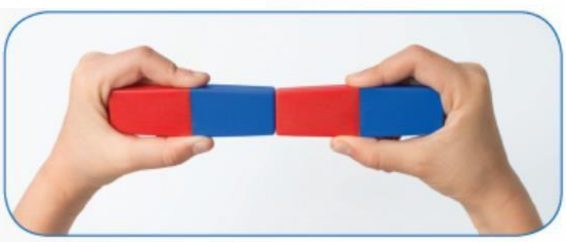
Properties of Magnet

- Every magnet has two poles i.e. North and South.
- Like poles repel each other.
- Unlike poles attract each other.
- A freely suspended bar magnet aligns itself in nearly north-south direction, with its north poles towards north direction.

Repel



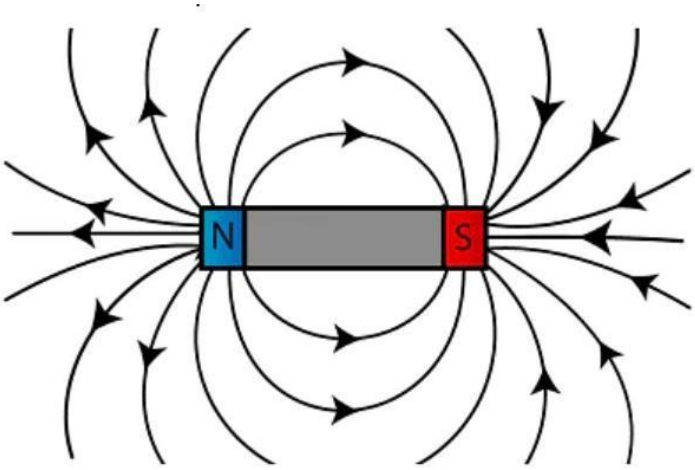
Attract



Magnetic Field

The area around a magnetic in which its magnetic force can be experienced.

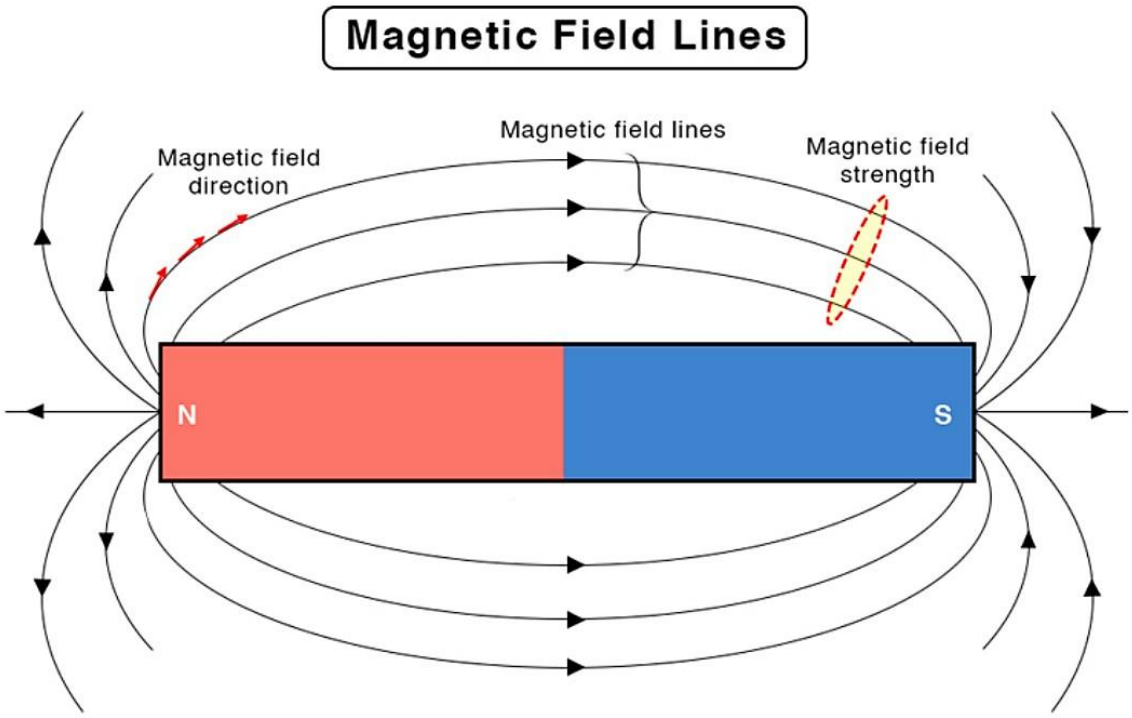
- Its SI unit is Tesla (T).
- Magnetic field has both magnitude and direction.
- Magnetic field can be described with help of a magnetic compass.
- The needle of a magnetic compass is a freely suspended bar magnet.



Characteristics of Field Lines

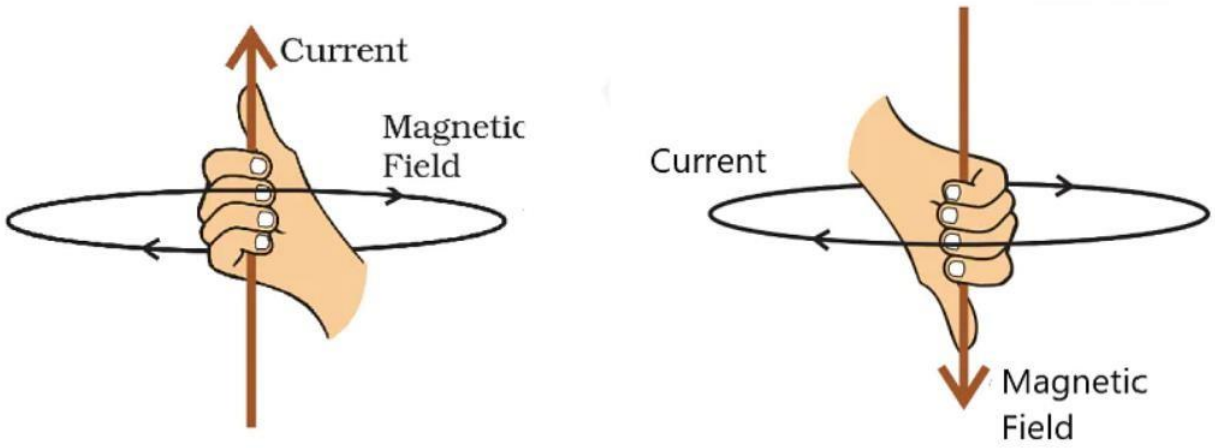
- Field lines arise from North pole and end into South pole of the magnet.
- Field lines are closed curves.
- Field lines are closer in stronger magnetic field.

- Field lines never intersect each other as for two lines to intersect, there must be two north directions at a point, which is not possible.
- Direction of field lines inside a magnet is from South to North.
- The relative strength of magnetic field shown by degree of closeness of field lines.



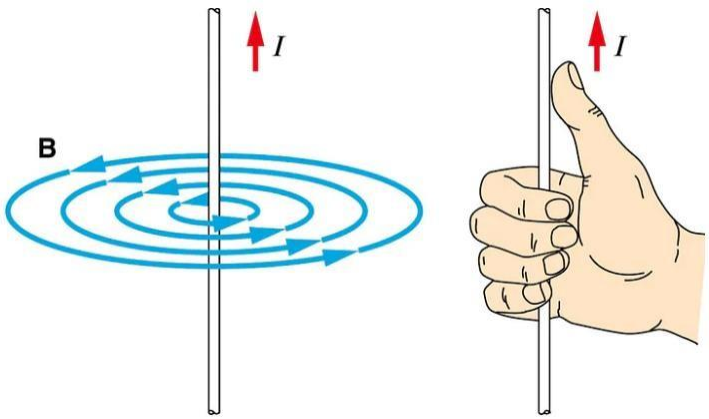
Right Hand Thumb Rule

Imagine you are holding a current carrying straight conductor in your right hand such that the thumb is pointing towards the direction of current. Then the fingers wrapped around the conductor give the direction of magnetic field.



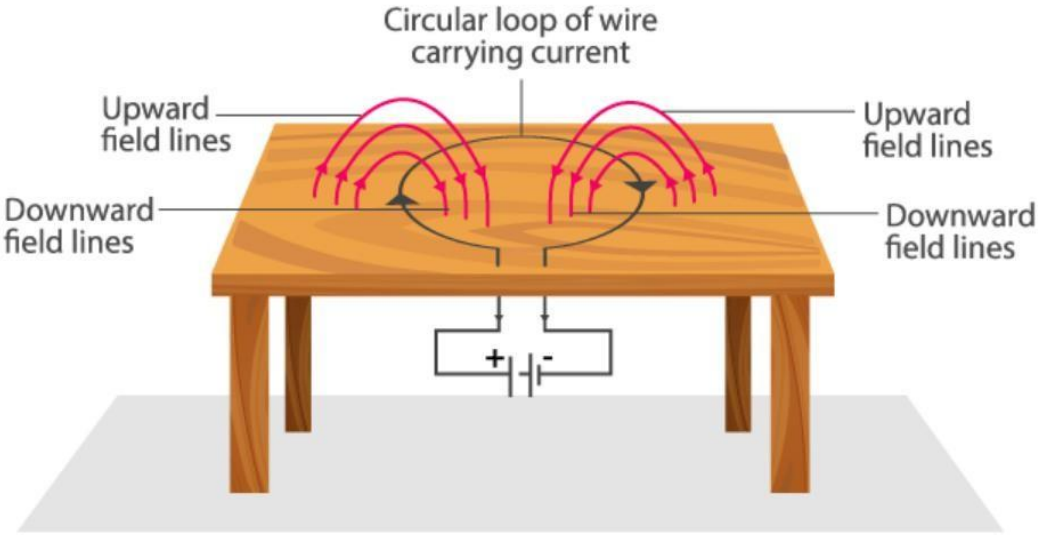
Magnetic Field due to Current Through a Straight Conductor

- It can be represented by concentric circles at every point on conductor.
- Direction can be given by right hand thumb rule or compass.
- Circles are closer near the conductor.
- Magnetic field $\propto$ Strength of Current
- Magnetic field $\propto \frac{1}{\text{Distance from conductor}}$



Magnetic Field due to a Current through a Circular Loop

- It can be represented by concentric circle at every point.
- Circles become larger and larger as we move away.
- Every point on wire carrying current would give rise to magnetic field appearing as straight line at center of the loop.
- The direction of magnetic field inside the loop is same.



Factors affecting magnetic field of a circular current carrying conductor

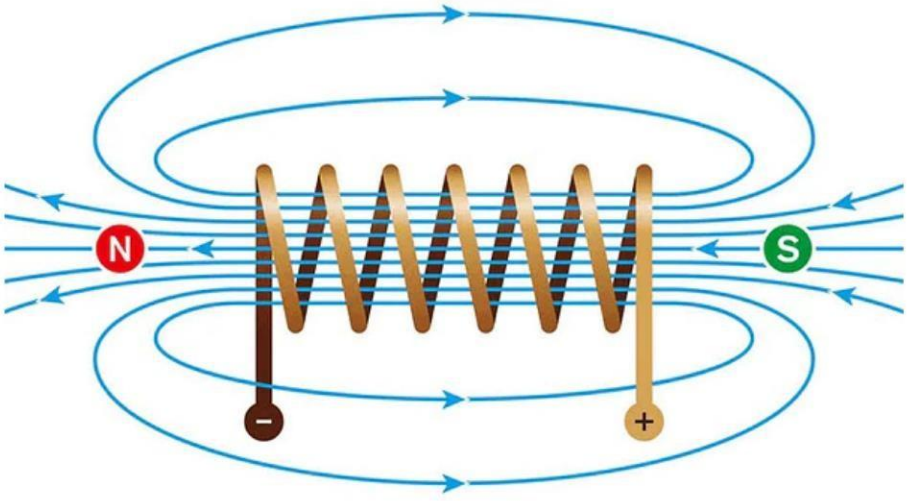
- Magnetic field ∝ Current passing through the conductor
- Magnetic field $\propto \frac{1}{\text{Distance from conductor}}$
- Magnetic field ∝ Number of turns in the coil

Magnetic field is additive in nature means magnetic field of one loop adds up to magnetic field of another loop. This is because the current I each circular turn has same direction

Solenoid

A coil of many circular turns of insulated copper wire wrapped closely in a cylindrical form.

- Magnetic field of a solenoid is similar to that of a bar magnet.
- Magnetic field is uniform inside the solenoid and represented by parallel field lines.
- Direction of magnetic field
    i) Outside the solenoid: North to South
    ii) Inside the solenoid: South to North
- Solenoid can be used to magnetize a magnetic material like soft iron.

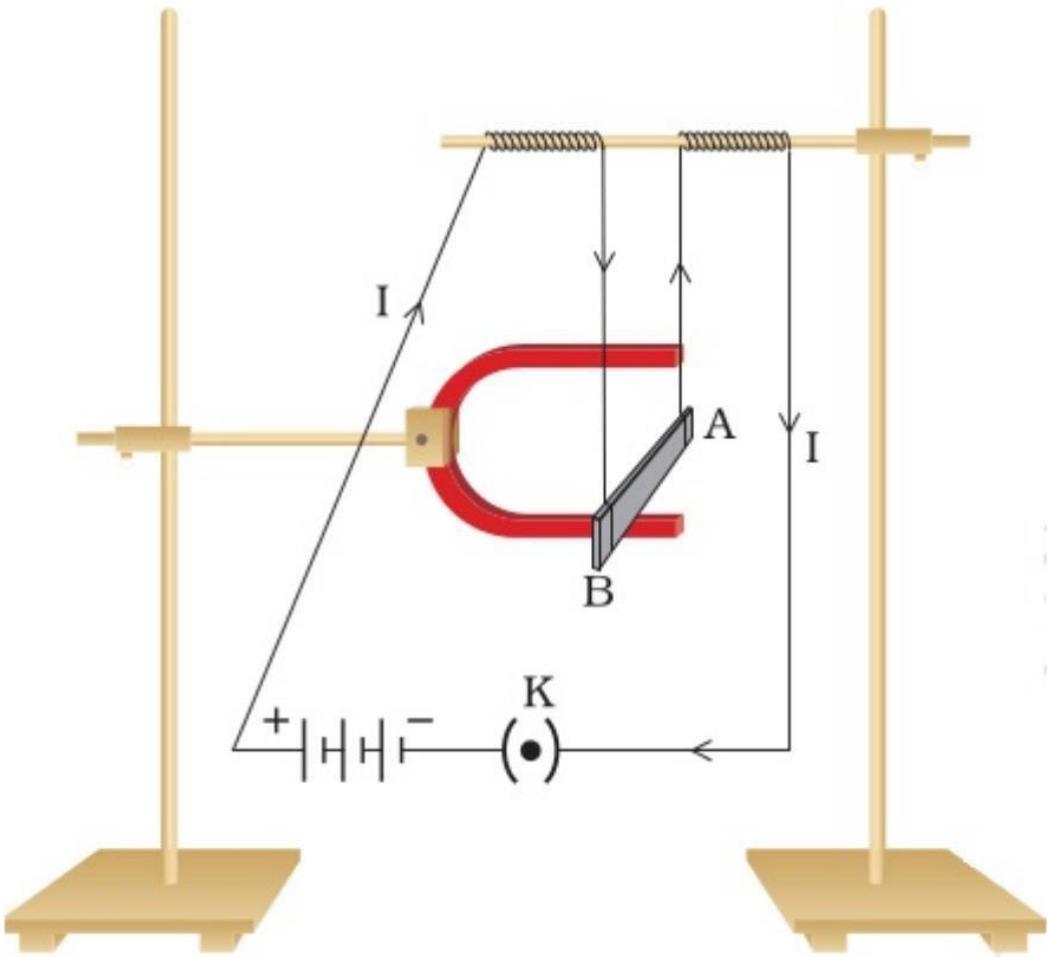


Types of Magnets

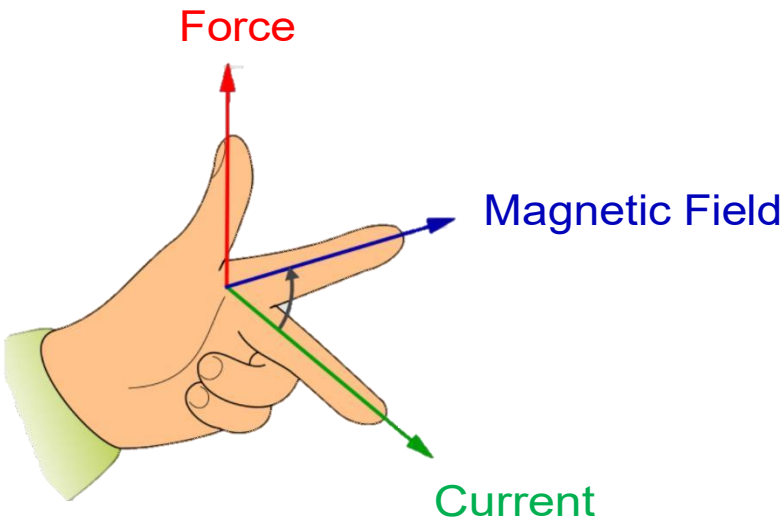
Electromagnet	Permanent Magnet
1) It is a temporary magnet, so it can be easily demagnetized. 2) Strength can be varied. 3) Generally strong magnet. 4) Poles can be reversed. (matlab North pole ko South or South pole ko North pole bna skte h/ Poles ko reverse kiya ja skta h)	1) Can't be easily demagnetized. 2) Strength is fixed. 3) Generally weak magnet. 4) Poles can't be reversed.

Force on a Current carrying Conductor in a Magnetic Field

- Andre Marie Ampere suggested that the magnet also exerts an equal and opposite force on a current carrying conductor.
- The displacement in the conductor is the maximum when the direction of current is at right angle to the direction of magnetic field.
- Direction of force is reversed on reversing the direction of current.



Fleming's Left Hand Rule



Types of Current

Alternating Current	Direct Current
1) The current which reverses its direction periodically.	1) The current which doesn't reverse its direction.
2) AC can be transmitted to long distance.	2) DC can't be transferred to long distances.
3) This can't be stored in batteries.	3) DC can be stored in Batteries.
4) The frequency of AC is never zero.	4) Frequency is always Zero.
5) AC keep changing their directions – backward and forward.	5) This only move in one direction – that is forward.
6) Our TV, Fridge works through Alternating Current	6) Sources of DC are Cell, Battery etc. Our TV remote works on Direct Current

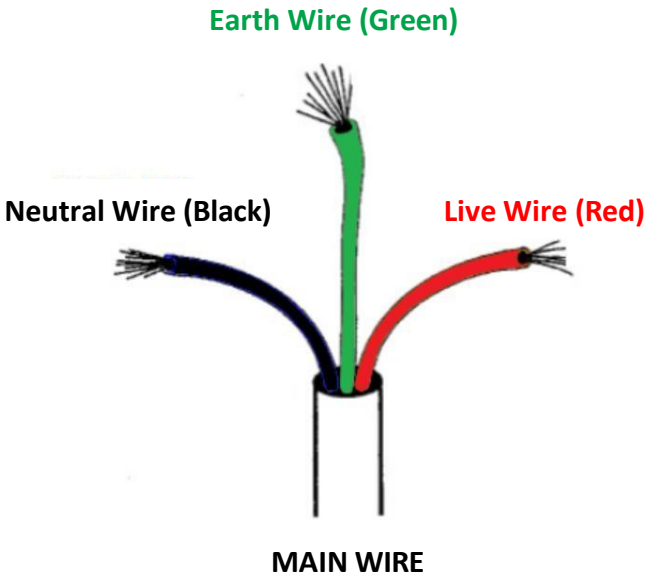
Domestic Electric Circuits

- There are three kinds of wires used:

  (i) Live Wire (positive) with red insulation cover.

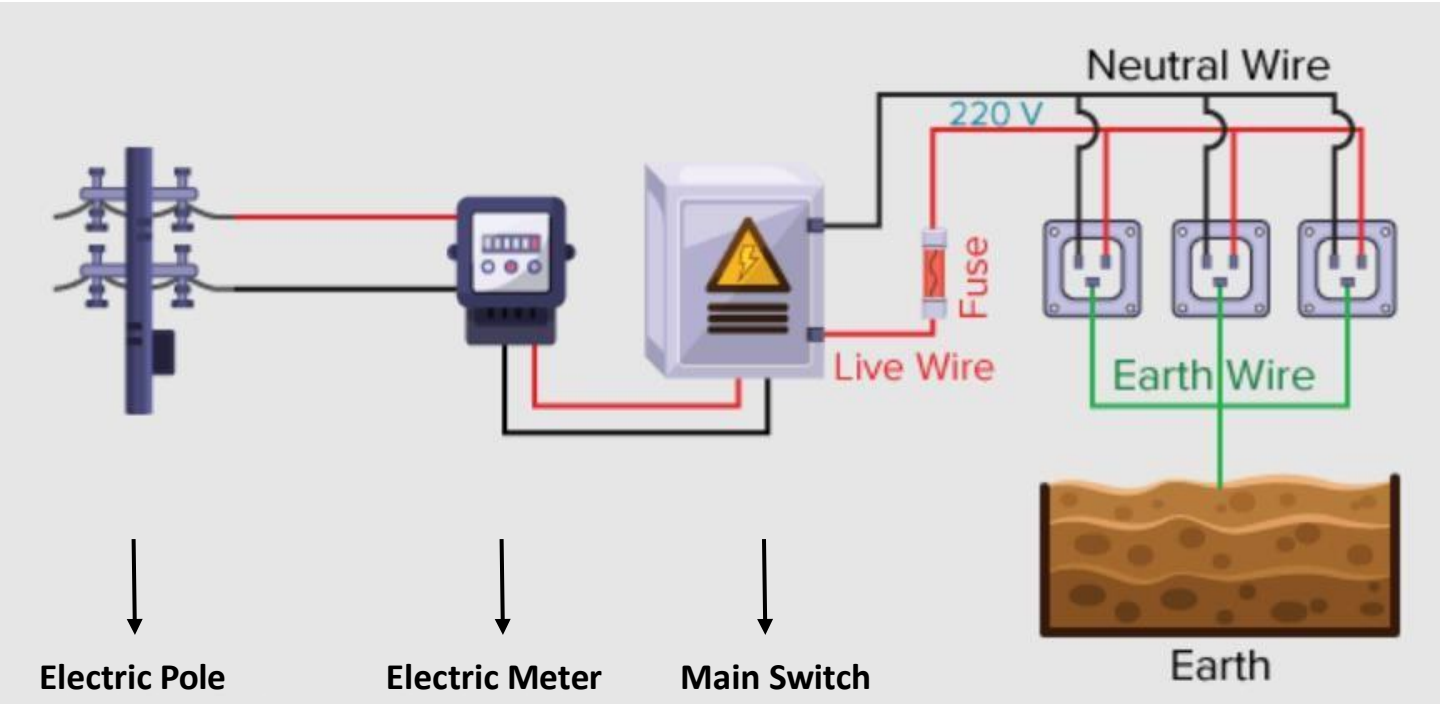
  (ii) Neutral wire (negative) with black insulation cover.

  (iii) Earth wire with green insulation cover.



The Potential difference between Live and Neutral wire in India is 220 Voltage.

Pole → Main supply → Fuse → Electricity meter → MCB → To separate circuits



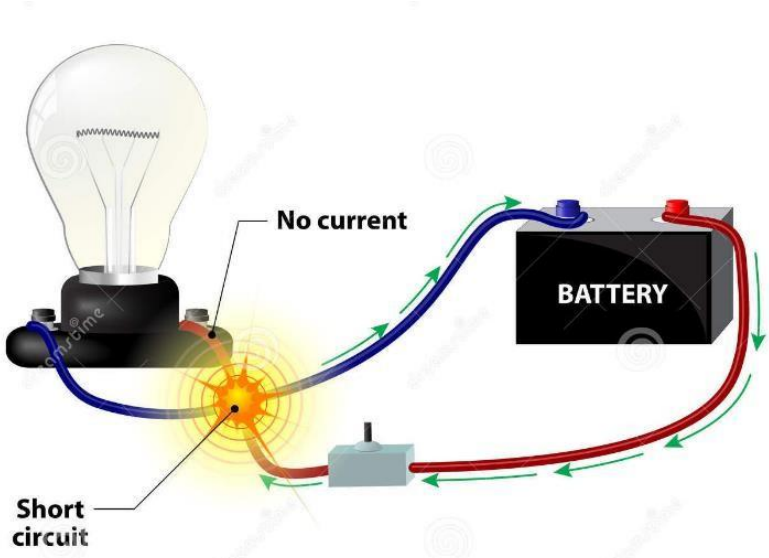
Earth Wire:

Protects us from electric shock in case of leakage of current especially in metallic body appliances. It provides a low resistance path for current in case of leakage of current.

Short Circuit:

When live wire comes in direct contact with neutral wire accidentally.

- Resistance of circuit becomes low.
- Can result in overloading.



Overloading

When current drawn is more than current carrying capacity of a conductor, it results in overloading.

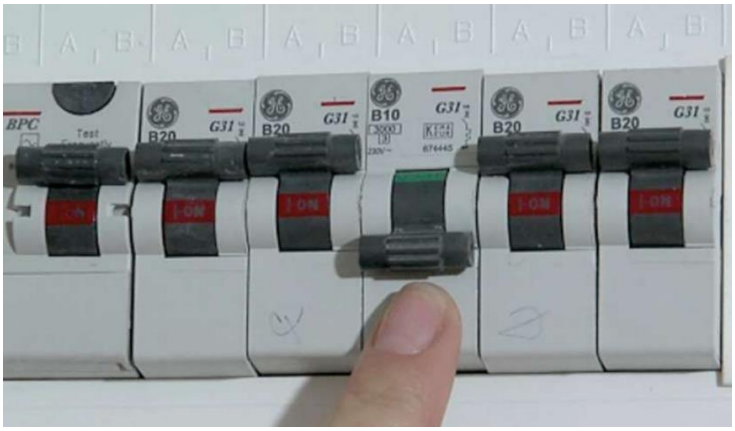
Causes of Overloading:

- Accidental hike in voltage supply.

- Use of more than one appliance in a single socket.

Safety devices:

- Electric fuse
- Earth wire
- MCB (Miniature Circuit Breaker)



MCB (Miniature Circuit Breaker)

Fuse

NOTE

Topics like Electric Motor, Electro Magnetic Induction, Flemings Right Hand Rule and Electric Generator are cut from the syllabus.