

## Magnetic Effect of Electric Current

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Any substance that attracts iron and iron like objects is defined as magnet. When a wire carries an electric current, it behaves as a magnet.

### Properties of Magnet

- Every magnet has north and south poles.
- Same poles repel each other and unlike poles attract each other.
- A freely suspended magnet will align itself in north south direction, north facing north of the magnet and south facing south of the magnet.

### Characteristics of Field Lines

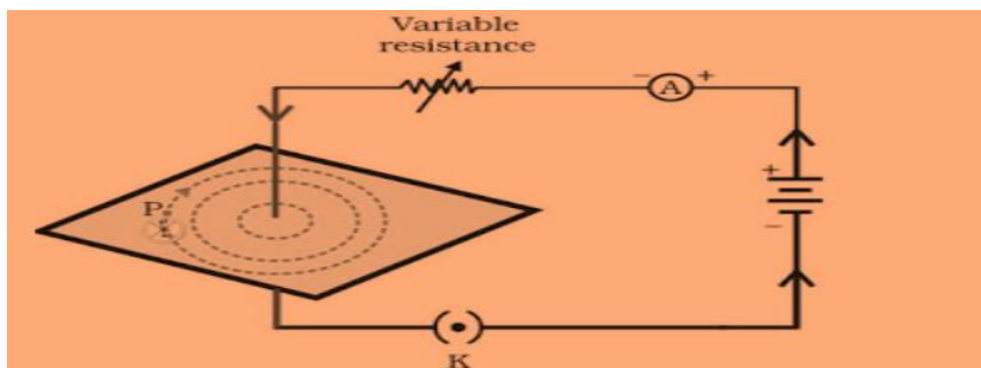
- Field lines arise from north pole and end into south pole of the magnet.
- They are closed curves.
- Field lines never intersect each other.
- Direction of magnetic field lines inside the magnet is from south to north.

### Magnetic Field of a Bar Magnet

Hold the thumb, forefinger and middle finger of right hand at right angles to each other. If the forefinger is in direction of magnetic field and the thumb points in the direction of motion of conductor, then the direction of induced current is indicated by middle finger

### Magnetic Field due to current through a Straight Conductor

They are represented in the form of concentric circles at every point on conductor.

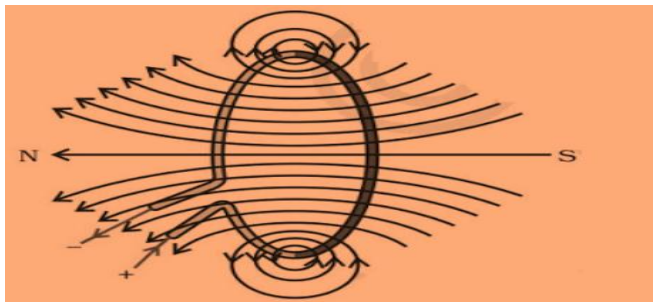


**Fig.1. Magnetic field through a straight conductor**

Direction of the field is given by compass or right-hand thumb rule. Circles are always closer near the conductor.

### Magnetic field due to current through a circular loop

It is represented by concentric circle at every point. Circle will become larger and larger as one move away.



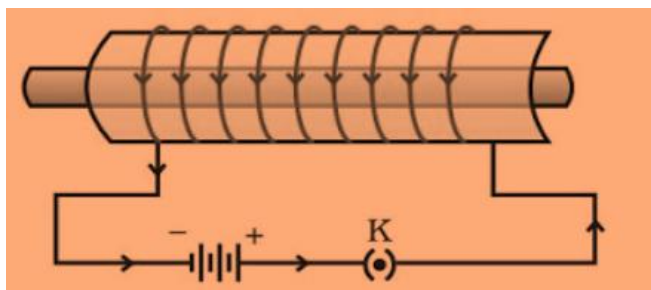
**Fig.2. Magnetic field**

### **Factors affecting magnetic field of a circular current carrying conductor-**

- Magnetic field is directly proportional to the current passing through the conductor.
- Magnetic field is inversely proportional to the distance from the conductor.
- Magnetic field is directly proportional to number of turns in coil.

### **Solenoid**

Solenoid is defined as coil of many circular turns of insulated copper wire wrapped closely in a cylindrical form. Magnetic field of solenoid is similar to bar magnet.



**Fig.3. Current carrying solenoid**

### **Electromagnet**

It is temporary magnet that can be easily demagnetized. In this type of magnet, polarity can be reversed and strength can be varied. They are very strong magnet.

### **Permanent Magnet**

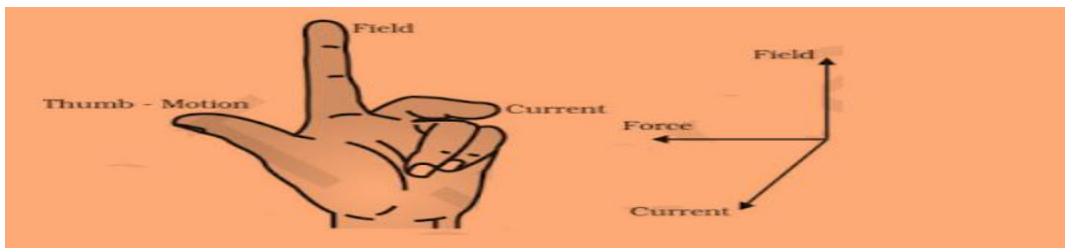
These types of magnet cannot be easily demagnetized. They are weak magnets in which polarity cannot be reversed.

### **Force on a current carrying conductor in a magnetic field**

The displacement in the conductor is the maximum when the direction of current is at right angle to the direction of magnetic field.

### **Flemings Left Hand Rule**

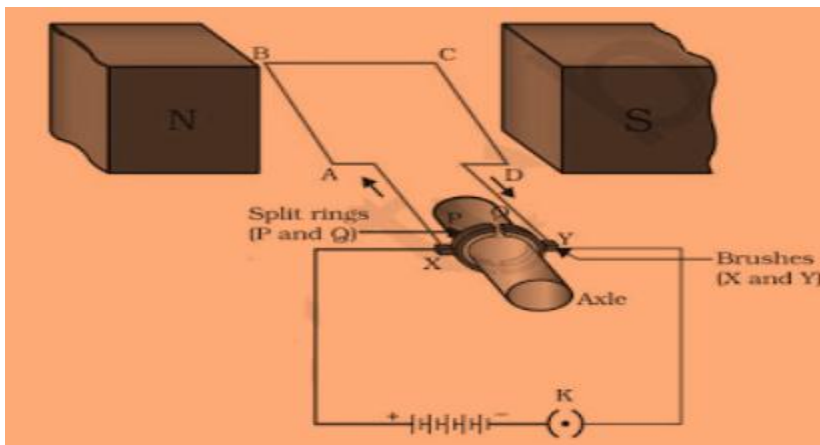
Stretch the thumb, forefinger and middle finger of the left hand such that they are mutually perpendicular. If the forefingers is in the direction of the magnetic field, middle finger in the direction of current then thumb will point in the direction of motion or force.



**Fig.4. Fleming left hand rule**

## Electric Motor

A rotating device that converts electrical energy to mechanical energy.



**Fig. 5. Electric motor**

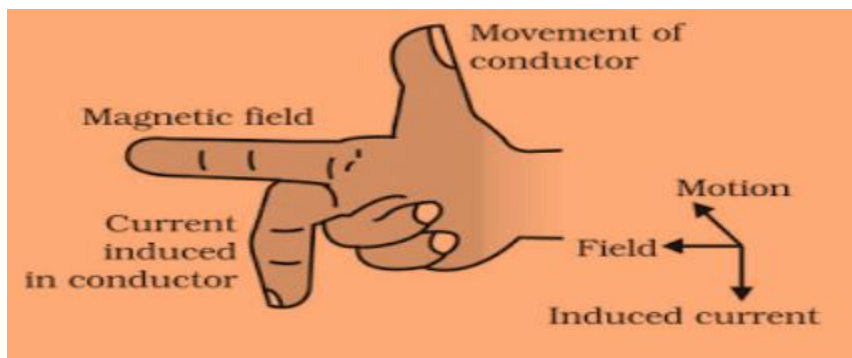
It consists of rectangular coil ABCD made up of insulated copper wire. The coil is placed perpendicular to magnetic field. There are two conducting brushes X and Y. Current in coil ABCD enters through a source battery through conducting brush X and flows back to the battery through brush Y. The split ring acts as commutator. It reverses the direction of flow of current in a commutator.

They are used in electromagnets, as soft iron core on which coil is wound. Armature enhances the power of the motor.

## Electromagnetic Induction

When we place a conductor in a changing magnetic field, some current is induced in it. This current is known as **Induced Current** and the phenomenon is known as **Electromagnetic Induction**.

## **Fleming Right Hand Rule**

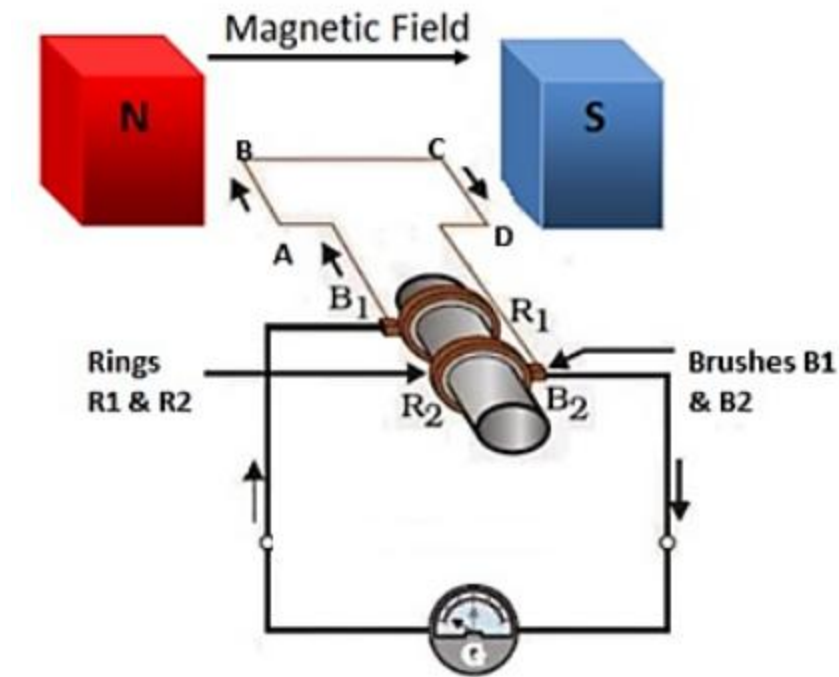


**Fig.6. Fleming right hand rule**

Hold the forefinger, middle finger and thumb of right hand at right angles to each other. Forefinger points towards the direction of magnetic field, thumb points in the direction of motion of conductor and middle finger shows direction of induced current.

## Electric Generator

Electric Energy is a device used to convert mechanical energy into alternating form of electrical energy. It consists of insulated copper wire, magnetic poles, split rings, axle, brushes and galvanometer.



**Fig.7. Electric generator**

The axle is rotated so that it moves clockwise direction that is AB moves up and CD moves down. After half rotation, CD starts to move up and AB moves down. After every half rotation current changes its direction, this is called AC current.

## Domestic Electric Circuits

Three kinds of wires are used in domestic electric circuits.

- Live wire red in colour
- Neutral wire with black insulation cover
- Earth wire with green insulation cover.

The potential difference between live and neutral wire in India is 220V.

## Electric Fuse

- It is a safety device to limit the current in an electric circuit.
- It prevents the electric appliances from damage.
- It is made up of material which has high resistivity and low melting point.

# Thank You

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