CHAPTER – 12 MAGNETIC EFFECTS OF ELECTRIC CURRENT

Magnet

Magnet is any 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 a nearly north-south direction, with its north pole towards the north direction.

Magnetic Field

The area around a magnetic in which its magnetic force can be experienced. It is vector quantity.

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

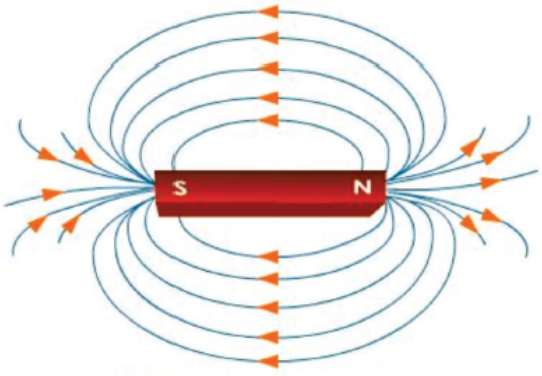
Characteristics of Field Lines

(i) Field lines arise from the North Pole and end into the South Pole of the magnet.

(ii) Field lines are closed curves.

(iii) Field lines never intersect each other

(v) The direction of field lines inside a magnet is from South to North.

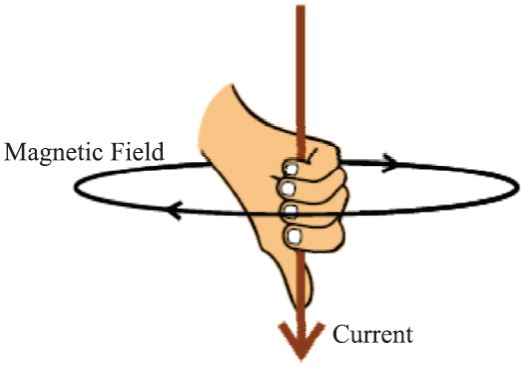


Magnetic field due to a current through a straight conductor

The magnetic field lines around a current carrying straight conductor are concentric circles whose centers lie on the wire.

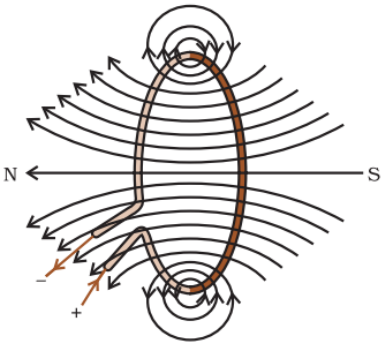
Maxwell's Right-Hand Thumb Rule

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



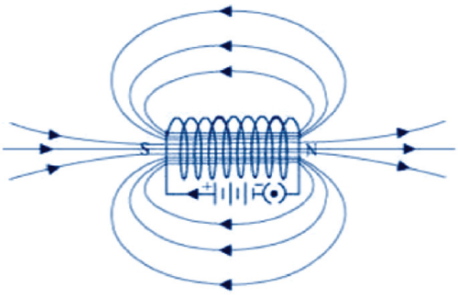
Magnetic field due to a current through a circular loop

At every point on a current carrying circular loop, the magnetic field is in the form of concentric circles around it. As we move away from it, the circles would become larger and larger. When we reach the center of loop, the field appears to be a straight line.



Solenoid

A solenoid is defined as a coil consisting of a large number of circular turns of insulated copper wire. These turns are wrapped closely to form a cylinder.



The field lines around a current carrying solenoid are similar to that produced by a bar magnet. This means that a current carrying solenoid behaves as if it has north pole and south pole. The field lines inside the solenoid are parallel to each other.

Thus, the strength of magnetic field is the same, i.e., uniform at all points inside a solenoid.

Electromagnet

The strong magnetic field produced inside a solenoid can be used to magnetise a piece of magnetic material like soft iron when placed inside the coil. The magnet so formed is called electromagnet.