Sharjah Indian School – Boys Wing

Class X - Physics

Magnetic Effects of electric current

Properties of magnets

1. Attractive property:- Magnets can attract magnetic materials such as iron, cobalt and nickel.
2. Directive property:- A freely suspended magnet points along the North-South direction.
3. The magnetic power of a bar magnet is concentrated at the ends called poles.
4. Like poles repel and unlike poles attract.
5. Monopoles do not exist.

Magnetic field:- It is a region around a magnet within which another magnet experiences an attractive or repulsive force.

Magnetic field lines: They are used to represent a magnetic field. A field line is the path along which a free north pole would tend to move.

Properties of magnetic field lines

- They originate from the north pole of a magnet and end at the south pole, outside the magnet. Inside they continue to move from south to north.
- They form closed loops.
- The relative strength of the magnetic field is shown by the degree of closeness of the field lines.
- Two magnetic field lines will never intersect each other.

Qn. Two magnetic field lines do not intersect each other. Why?

The direction of the magnetic field at a point is given by the direction of the north of a compass needle kept at that point. If two field lines intersect, at the point of intersection, a compass needle would show two different directions which is not possible.

Magnetic field due to a current-carrying straight conductor.

A current-carrying straight conductor has magnetic field around it. The strength of the magnetic field around a current-carrying straight conductor (B) is:

(i) Directly proportional to the current flowing through it ($B \alpha i$)

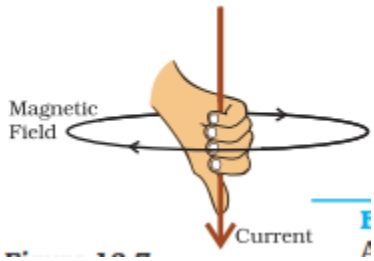
(ii) Inversely proportional to the distance from the conductor ($B \alpha 1/r$)

The direction of the magnetic field can be found by Right Hand Thumb Rule. The magnetic field lines due to a current-carrying straight conductor form concentric circles around the conductor.

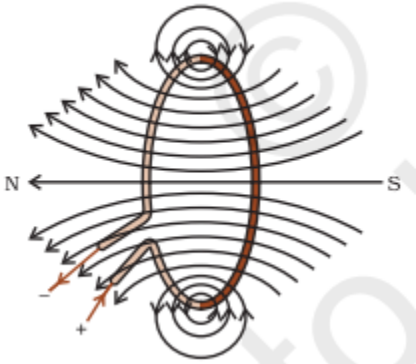
Right Hand Thumb Rule

Imagine you are holding a current-carrying straight conductor in your right hand such that the thumb point towards the direction of current. Then the fingers, encircling the conductor represent the directions of magnetic field lines around it.

Magnetic field lines due to a current-carrying Straight conductor



Magnetic field due to a current-carrying circular loop.

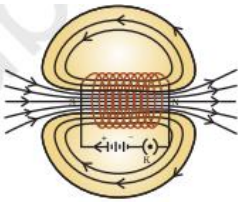


Solenoid:

A coil of many circular turns of insulated copper wire wrapped closed in the shape of a cylinder is called a solenoid.

Magnetic field due to a current-carrying solenoid.

The magnetic field due to a current-carrying solenoid is similar to that of a bar magnet. Inside the current-carrying solenoid, the magnetic field lines are parallel straight lines. This indicates that the magnetic field is uniform at all points inside the solenoid.



A 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.
This arrangement is called an electromagnet.