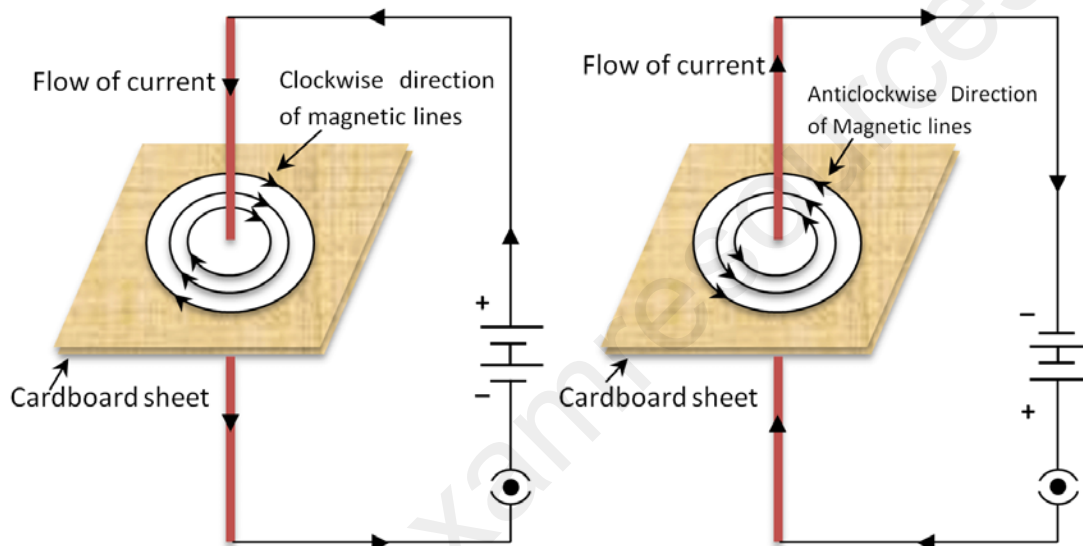


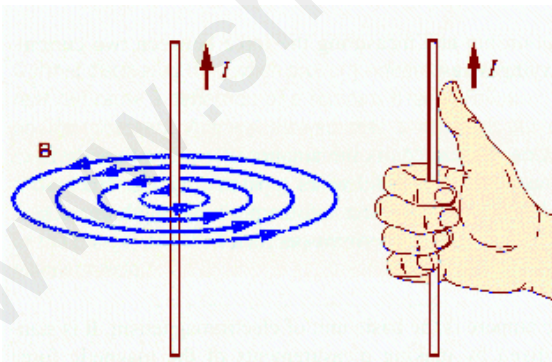
# Magnetic effect of a current

## Pattern of a magnetic field due to currents in straight wires:

When an electric current passes along a wire, a magnetic field is set up around the wire. the following is the pattern of the magnetic field lines around a straight current carrying wire.



## Ampere's right-hand grip rule (also called right-hand screw rule, coffee-mug rule or the corkscrew-rule)



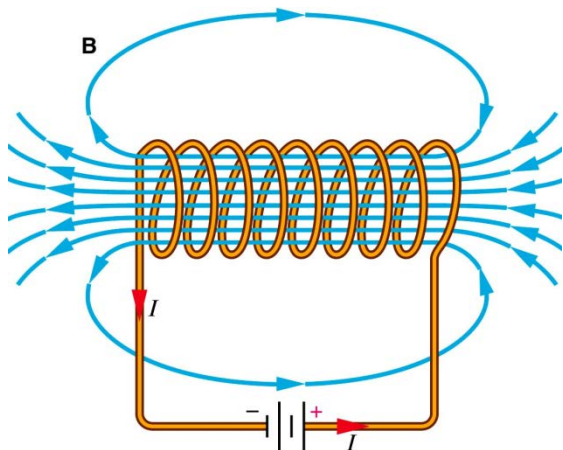
Point the thumb of your right hand in the direction of the conventional current and curl your fingers up as shown. The magnetic field lines are circles around the wire pointing in the same direction as your fingers.

The direction of the magnetic field lines can be reversed by reversing the direction of the conventional current.

### Pattern of magnetic fields in a current carrying solenoid:

**Solenoid:** A coil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder is called a solenoid.

- Current in solenoid produces a stronger magnetic field inside the solenoid than outside.

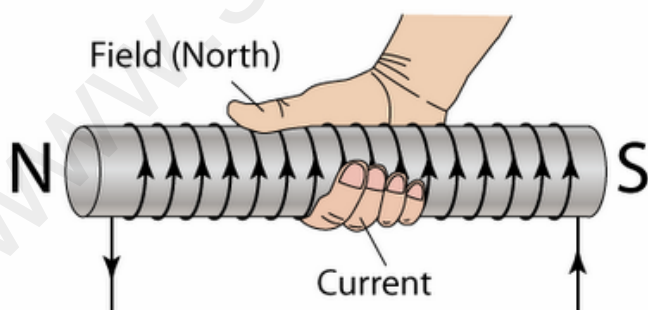


- The field lines are concentrated at the ends of the solenoid.
- The field lines are uniform inside the solenoid. Hence the magnetic field has the same strength and direction inside the solenoid.
- The field lines spread out beyond the ends of the solenoid.
- Field lines outside the solenoid are similar to that of a bar magnet, and it

behaves in a similar way - as if it had a north pole at one end and south pole at the other end. The side where magnetic field lines emerge is the North pole and vice-versa.

- Strength of the field diminishes with distance from the solenoid.
- Strength of the magnetic field can be increased by:
  1. increasing the magnitude of the current in the coil
  2. increasing the number of coils in the solenoid; and
  3. using a soft iron core within the solenoid.

### Finding the direction of the induced magnetic field:



Right-hand rule can be used to find the direction of the magnetic field.

In this case, point the wrapped fingers (along the coil) in the direction of the conventional current. Then, the thumb will point to the direction of magnetic field within the solenoid.

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**Application of the magnetic effect of current:**

- The magnetic field inside the solenoid is used in applications ranging from cathode ray TV tubes, magnetic resonance(MR) brain scanner.
  - The magnetic field outside the solenoid is used to make electromagnets in the scrap-yard, to make small electromagnets to be used in relays.
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**APPLICATION BASED QUESTIONS:**

- 34 A wire perpendicular to the page carries an electric current in a direction out of the page. There are four compasses near the wire.

Which compass shows the direction of the magnetic field caused by the current?

