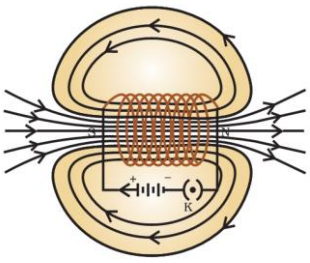
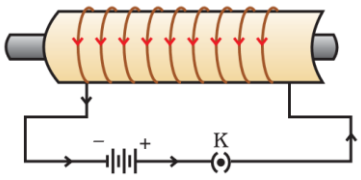
Magnetic Field due to a Current in a Solenoid

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



The pattern of the magnetic field lines around a current-carrying solenoid

- One end of the solenoid behaves as a magnetic north pole, while the other behaves as the south pole.
- The field lines inside the solenoid are in the form of parallel straight lines. This indicates that the **magnetic field is the same at all points inside the solenoid**. That is, the **field is uniform 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**. The magnet so formed is called an **electromagnet**.

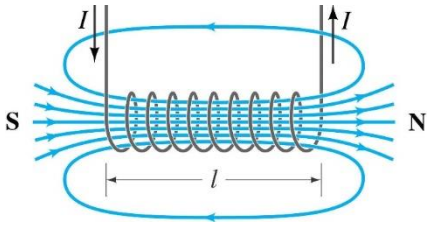


A current-carrying solenoid coil is used to magnetise steel rod inside it - an electromagnet.

Question: The magnetic field inside a long straight solenoid-carrying current

a) is zero.
b) decreases as we move towards its end.
c) increases as we move towards its end.
d) is the same at all points.

Explanation: In case of a current carrying coil, the magnetic field of each loop adds up to produce a net magnetic field. But in case of solenoid each loop is separated by a distance & the magnetic field at the centre of each loop is same.



Solenoid acts as a simple bar magnet

Ans: d) is the same at all points.

Application of Electromagnets

- When the electric current is switched off, the wire or coil generally loses its magnetism. Such wires or coils are called **electromagnets**.
- The electromagnets are used on the track for a **maglev train**.
- The electromagnets can be made extraordinarily strong & can **lift very heavy loads**.
- Electromagnets are used in **electric bell**.

The coil in the bell acts as an electromagnet when electricity is passed through it.

Hans Christian Oersted (1777-1851)

- Hans Christian Oersted, one of the leading scientists of the 19th century, played a crucial role in understanding **electromagnetism**.