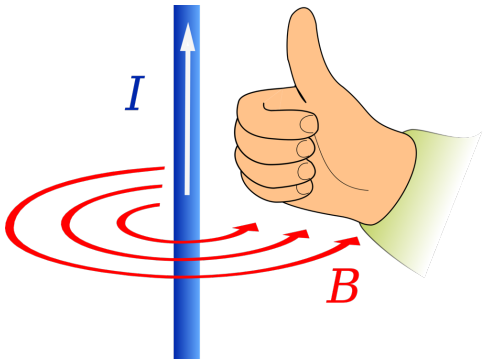
7.2.1 Electromagnetism

videos

Magnetic fields can be produced by the flow of charge (current) through a conductor. This link between electricity and magnetism is known as 'electromagnetism'.

When we pass an electric current through a conducting wire a magnetic field is produced in the space around the wire.

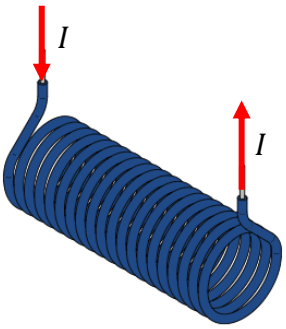
The magnetic field lines wrap around the wire in a circle. You can determine the direction they point by using the right-hand thumb rule. The thumb points in the direction that the current (I) flows, and the fingers wrap around in the direction of the lines of magnetic flux.

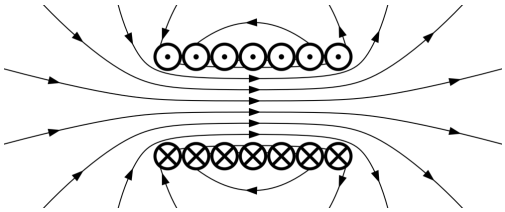


(1) What would happen to the magnetic field if the current direction was reversed? (Hint: Use the right-hand thumb rule.)

(2) What would happen to the magnetic field if the current was increased?

If we wrap the wire into a coil (called a solenoid) we can produce a magnetic field similar to that of a bar magnet.





In the diagram, above, the dots show current flowing upwards (out of the page) and the crosses show current flowing downwards.

(3) On the diagram, mark on the north pole and south pole of the solenoid. (Hint: The S pole is where field lines go in. A compass always points towards a S pole.)

(4) How would you describe the magnetic field down the middle of the solenoid? (Hint: the spacing of field lines indicates the strength of the magnetic field.)

We can increase the strength of the magnetic field produced by a solenoid in a number of ways:

- increase the current
- increase the number of coils (called 'turns')
- place a soft magnetic material down the middle (called a 'soft magnetic core')

A solenoid with a soft magnetic material in the core is often referred to as an 'electromagnet'.

Electromagnets are widely used in devices, such as loud speakers, circuit breakers and doorbells.

(5) What is the key advantage of an electromagnet compared to a permanent magnet?