Magnets and Electromagnets - GCSE Science (Foundation) (1)

There are two types of magnet — permanent magnets and induced magnets.

Permanent magnets produce their own magnetic field.

Induced magnets are magnetic materials that turn into a magnet when they're put into a magnetic field.

permanent magnet

induced magnet

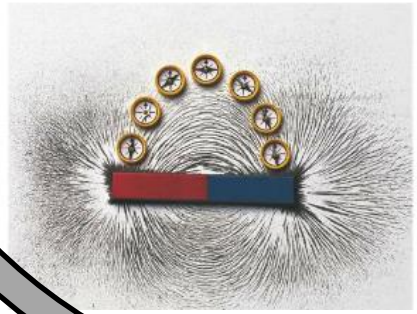
A magnetic field is a region where magnets, magnetic materials (like iron and steel), and also wires carrying currents, experience a force acting on them.

This is the magnetic field around a bar magnet. It's strongest at the north and south poles, where the field lines are closest together.

Compasses

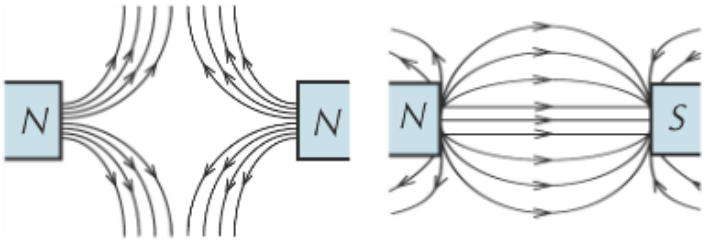
Inside a compass is a tiny bar magnet. The north pole of this magnet is attracted to the south pole of any other magnet it is near. So the compass points in the direction of the magnetic field it is in. You can move a compass around a magnet and trace its position on some paper to build up a picture of what the magnetic field looks like.

When they're not near a magnet, compasses always point north. This is because the Earth generates its own magnetic field, which shows that the inside (core) of the Earth must be magnetic.



Tip: Remember, the direction of the field lines is the direction of the force a north pole would feel in that location.

Like poles repel each other and opposite poles attract each other.



Magnetic materials are iron, nickel, cobalt and steel (because it contains iron).

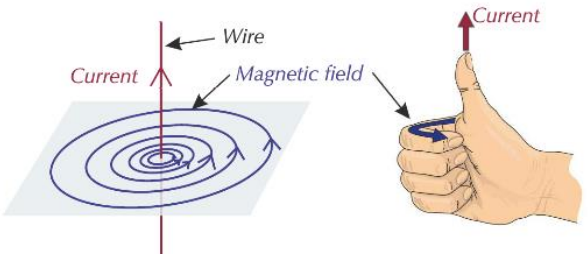
Magnets and Electromagnets - GCSE Science (Foundation) (2)

When a current flows through a wire, a magnetic field is created around the wire.

The field is made up of concentric circles perpendicular to the wire, with the wire in the centre.

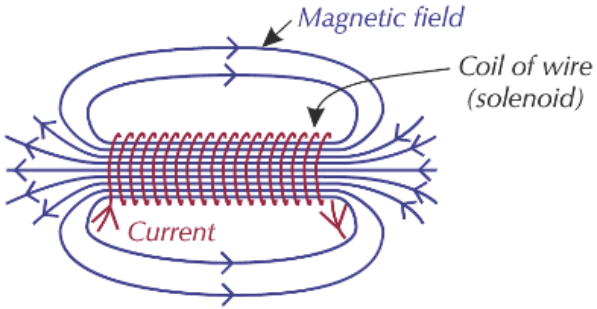
The right-hand thumb rule

Using your right hand, point your thumb in the direction of the current, and curl your fingers. The direction of your fingers is the direction of the field.



Solenoid (a coil of wire)

You can increase the strength of the magnetic field of a solenoid even more by putting a block of iron in the centre of the coil. The iron core becomes an induced magnet whenever current is flowing. The magnetic field of the core and the coil combine, making a stronger magnet overall.



Magnetism and Basic Electromagnetism

1) What is a magnetic field?
2) Give three magnetic materials.
3) In what direction do magnetic field lines point?
4) Describe how you could use a compass to show the direction of a bar magnet's magnetic field lines.
5) Describe the behaviour of a compass that is far away from a magnet.
6) True or false? The force between a magnet and a magnetic material is always repulsive.
7) What happens to an induced magnet when it is moved far away from a permanent magnet?
8) Describe the magnetic field around a current-carrying wire.
9) Why does adding more turns to a solenoid increase the strength of its magnetic field?
10) Describe an electromagnet and give one example of where it could be used.

Magnets can be used to attract and pick up things made from magnetic materials like iron and steel. Electromagnets are used in some cranes, e.g. in scrap yards and steel works.

If an ordinary magnet was used, the crane would be able to pick up the scrap metal etc., but then wouldn't let it go, which isn't very helpful.

Using an electromagnet means the magnet can be switched on when you want to pick stuff up, then switched off when you want to drop it, which is far more useful.