PRACTICAL

Name:

9.1 Magnetic fields of permanent magnets

Aim: To investigate the magnetic fields around permanent magnets.

Warning: Do not touch the iron filings directly. If you do touch them accidentally, wash your hands thoroughly.

Equipment:

- 2 bar magnets
- Horseshoe magnet
- Keeper
- Soft iron ring
- Transparent plastic sheet, from overhead projector or similar (if a plastic sheet is not available, a plain piece of paper is a good substitute)
- Iron filings
- Plotting compass

Theory

All magnets have a north and a south pole. *Like* poles repel each other. *Unlike* poles attract. A magnetic field is a region of space where a charged particle, or a magnetic material, experiences a force. The magnetic field lines go from the north pole of a magnet to the south pole.

When iron filings are put into a magnetic field they experience a force that pulls them into position around the magnet. So iron filings can be used to plot the shape of the magnetic field. Similarly, a plotting compass will feel a force and can be used to indicate the direction of the magnetic field.

Method

1 Place the plastic sheet (or paper) over a bar magnet and sprinkle iron filings onto the sheet. Carefully tap the edge of the sheet. Note where the filings accumulate and draw the pattern using continuous lines.
Be careful not to get the iron filings on the magnet as they are difficult to remove afterwards!

2 Repeat the experiment using a horseshoe magnet.

3 Place the keeper on the horseshoe magnet.

a What does the field look like now?

b What is the purpose of the keeper?

4 Put the soft iron ring between the poles of the horseshoe magnet and repeat the experiment.

c What is the effect of the iron ring on the magnetic field pattern?

5 Place two bar magnets under the transparency so that *like* poles are pointing to each other. Sprinkle with iron filings and draw the pattern you see.

d The point in the middle is called a neutral point. Can you work out why?

6 Place two bar magnets end-to-end under the transparency so that they are touching, *unlike* poles together.

e What does the field look like now?

f What would it look like if you could cut a magnet in half?

7 Look at the plotting compass while it is far away from any magnet. In which direction does it point?

8 Bring the plotting compass close to one of the poles of the bar magnet.

g What happens?

9 Move the plotting compass around the bar magnet and draw the magnetic field around the magnet.