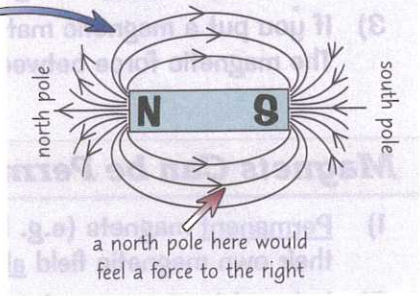
Magnets and Magnetic Fields

I think magnetism is an attractive subject, but don't get repelled by the exam — revise.

Magnets Produce Magnetic Fields

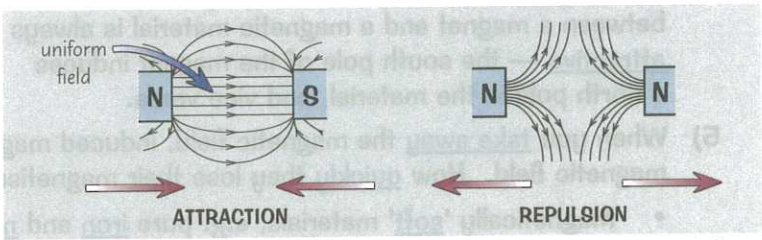
1) All magnets have two poles — north and south.
2) All magnets produce a magnetic field — a region where other magnets or magnetic materials (see next page) experience a force.
3) You can show a magnetic field by drawing magnetic field lines.
4) The lines always go from north to south and they show which way a force would act on a north pole at that point in the field.
5) The closer together the lines are, the stronger the magnetic field.
6) The further away from a magnet you get, the weaker the field is.
7) The magnetic field is strongest at the poles of a magnet. This means that the magnetic forces are also strongest at the poles.

To see the shape of a magnetic field, place a piece of card over a magnet and sprinkle iron filings onto it. The filings line up with the field lines — but they won't show you the direction of the field.



Magnetic Fields Cause Forces between Magnets

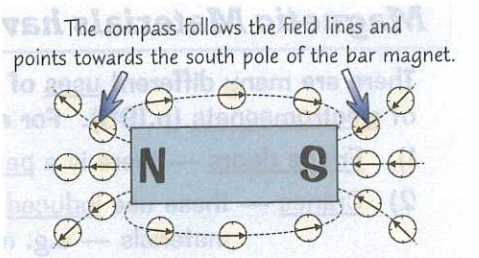
1) Between two magnets the magnetic force can be attractive or repulsive. Two poles that are the same (these are called like poles) will repel each other. Two unlike poles will attract each other.
2) Placing the north and south poles of two bar magnets near each other creates a uniform field between the two poles. The magnetic field is the same strength everywhere between the poles.
3) If you're asked to draw a uniform magnetic field, you need to draw at least three field lines, parallel to each other and all the same distance apart.



Don't forget the arrows on your field lines.

Plotting Compasses Show the Directions of Magnetic Fields

1) Inside a compass is a tiny bar magnet called a needle. A compass needle always lines up with the magnetic field it's in.
2) You can use a compass to build up a picture of what the field around a magnet looks like:
   - Put the magnet on a piece of paper and draw round it.
   - Place the compass on the paper near the magnet. The needle will point in the direction of the field line at this position.
   - Mark the direction of the compass needle by drawing two dots — one at each end of the needle.
   - Then move the compass so that the tail end of the needle is where the tip of the needle was in the previous position and put a dot by the tip of the needle. Repeat this and then join up the marks you've made — you'll end up with a drawing of one field line around the magnet.
   - Repeat this method at different points around the magnet to get several field lines. Make sure you draw arrows from north to south on your field lines.
3) When they're not near a magnet, compasses always point towards the Earth's North Pole. This is because the Earth generates its own magnetic field (and the North Pole is actually a magnetic south pole). This shows the inside (core) of the Earth must be magnetic.



Magnets are like farmers — surrounded by fields...

Magnetism is one of those things that takes a while to make much sense. Learn these basics — you'll need them.

Q1 Draw the magnetic field lines for a bar magnet. Label the areas where the field is strongest. [3 marks]

Q2 Describe how to plot the magnetic field lines of a bar magnet using a compass. [4 marks]

Magnets and Magnetic Fields

Warm-Up

For each statement, circle whether it is true (T) or false (F).

A magnetic field is a region where other magnets experience a force.	T / F
Field lines show the direction a force would act on a south pole at that point in the field.	T / F
The further away from a magnet you get, the weaker the field is.	T / F

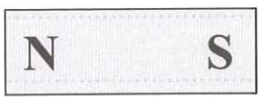
1 All magnets produce magnetic fields. Grade 4-6

a) Which of the following statements is correct for magnets?

- ☐ **A** Like poles attract each other.
- ☐ **B** Magnetic fields are weakest at the poles of a magnet.
- ☐ **C** Unlike poles attract each other.
- ☐ **D** Magnetic field lines go from the south pole to the north pole. *[1]*

b) **Figure 1** shows a bar magnet. Draw the magnetic field lines onto the diagram in **Figure 1**.

Figure 1



[3]

Two bar magnets are placed near to each other, as shown in **Figure 2**.

Figure 2

c) i) A uniform magnetic field is created between them. Explain what is meant by a uniform field.

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[1]

ii) Draw the uniform field between the two poles shown in **Figure 2**.

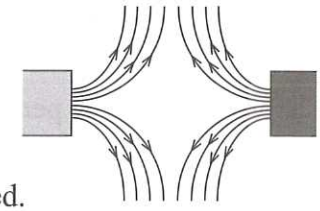
[2]

[Total 7 marks]

2 A student places two magnetic objects near to each other on a flat, frictionless surface. **Figure 3** shows their magnetic fields. The student then releases the objects at the same time.

Grade 6-7

Figure 3



State and explain the behaviour of the two objects once they are released.

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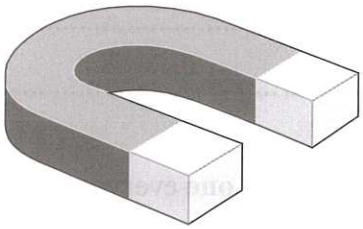
[Total 3 marks]

3 A student wants to investigate the magnetic field of a horseshoe magnet, shown in **Figure 4**.

Grade 6-7

Figure 4



a) Describe how a compass could be used to determine the magnetic field pattern of the magnet.

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[4]

b) State and explain what would happen to the compass if you were to move it far away from any magnets.

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[2]

[Total 6 marks]

Exam Practice Tip

Iron filings can also be used to see the shape of a magnetic field — but remember, they won't show you its direction.