Simple Phenomena of Magnetism

Question Paper

Course	CIE IGCSE Physics
Section	4. Electricity & Magnetism
Topic	Simple Phenomena of Magnetism
Difficulty	Hard

Time Allowed 50

Score /38

Percentage /100

Question 1a

A student is experimenting with magnets and electric charges.

The student places a bar magnet on a piece of paper, as shown in Fig. 9.1.

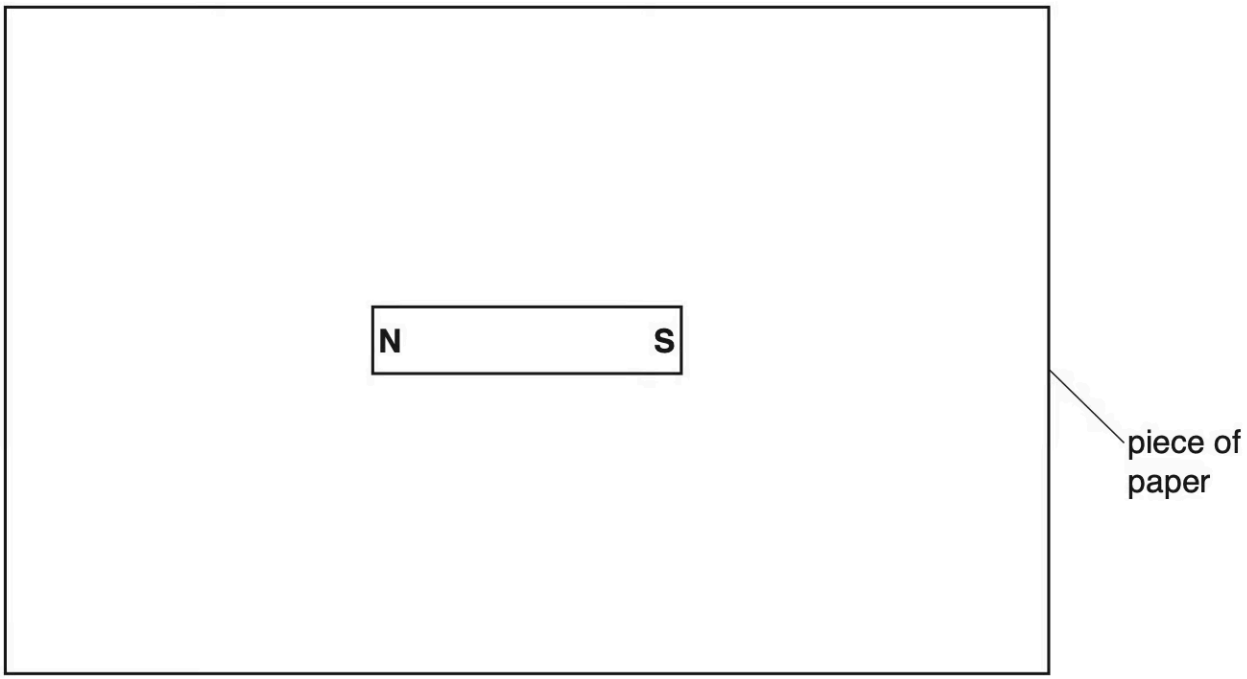


Fig. 9.1

Show the pattern of magnetic field lines around the bar magnet.

Draw **two** lines above the magnet and **two** lines below the magnet. Start and finish each line at a pole. Include **one** arrow to show the direction of the magnetic field.

[3 marks]

Question 1b

The student rubs a plastic rod with a dry cloth. The plastic rod becomes positively charged.

Explain why the friction between the plastic and the cloth causes the plastic to become positively charged.

[2 marks]

Question 1c

The student investigates the forces between two pairs of objects.

Fig. 9.2 and Fig. 9.3 show the pairs of objects.

State whether there is a force of attraction, a force of repulsion, or no force between the pairs of objects. Draw a **ring** around **one** phrase for each pair of objects.

1. two positively charged spheres

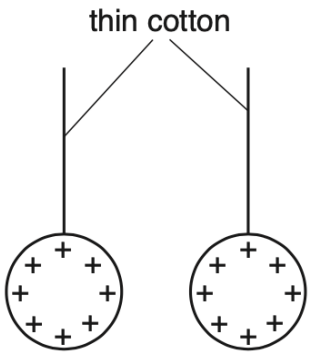


Fig. 9.2

force of attraction **force of repulsion** **no force**

2. a bar magnet and a bar of copper metal

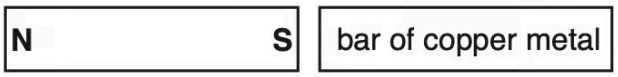


Fig. 9.3

force of attraction **force of repulsion** **no force**

[2 marks]

Question 2a

Fig. 9.1 shows the magnetic field pattern around a bar magnet.

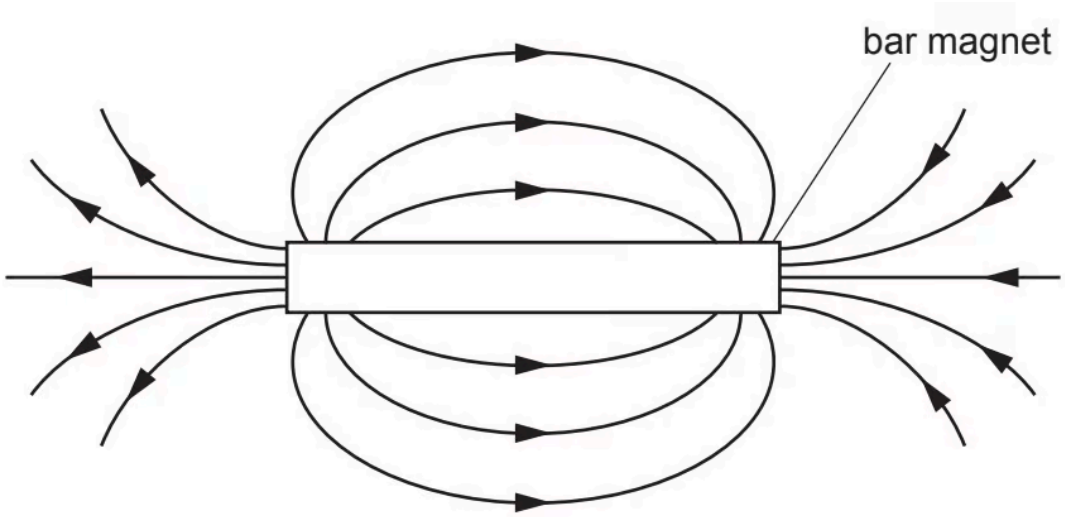


Fig. 9.1

(i) On Fig. 9.1, write the letters N and S to indicate the north and south poles of the magnet.

[1]

(ii) Fig. 9.2 shows a soft-iron bar placed close to a permanent magnet.

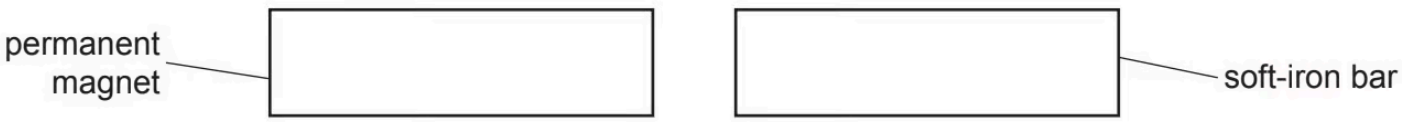


Fig. 9.2

State and explain what happens to the soft-iron bar. You may draw on Fig. 9.2.

[3]

[4 marks]

Question 2b

Three balls P, Q and R are electrically charged. The balls are suspended by threads of insulating material. Fig. 9.3 shows the arrangement.

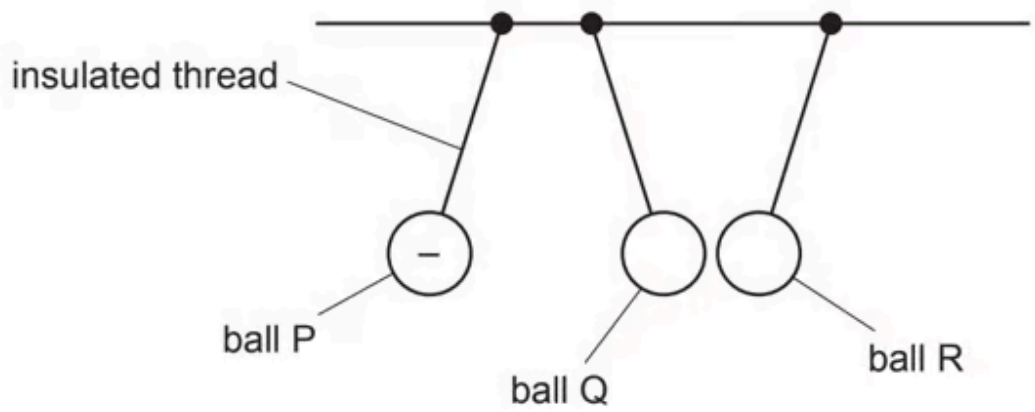


Fig. 9.3

Ball P is negatively charged.

(i) State the charge on ball Q and the charge on ball R.

[2]

(ii) Explain your answer for part (i) for the charge on ball Q.

[2]

[4 marks]

Question 3a

A long straight wire passes through a piece of card. There is a current in the wire, as shown in Fig. 11.1.

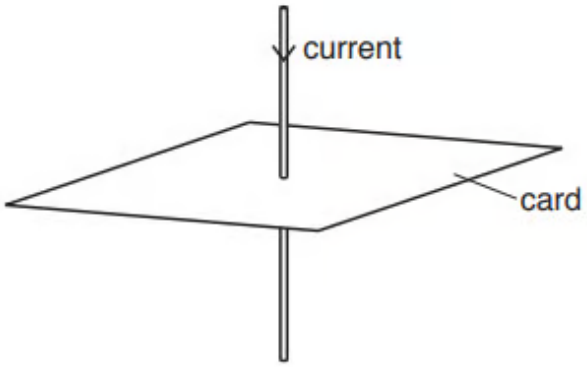


Fig. 11.1

Fig. 11.2 shows the view of the card from above. The current is into the page.

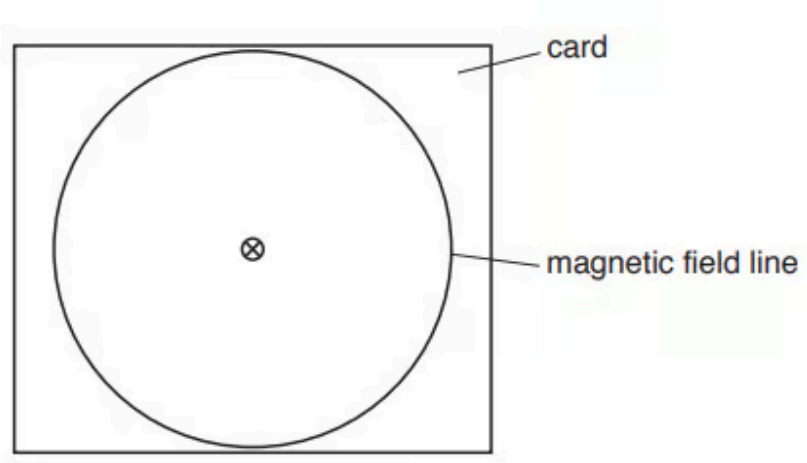


Fig. 11.2

The current in the wire produces a magnetic field around the wire. One magnetic field line is drawn.

On Fig. 11.2, draw two more magnetic field lines around the wire. Show the direction of the magnetic field by drawing an

arrow on each field line.

[2 marks]

Question 3b

Fig. 11.3 shows the circuit for an electric bell.

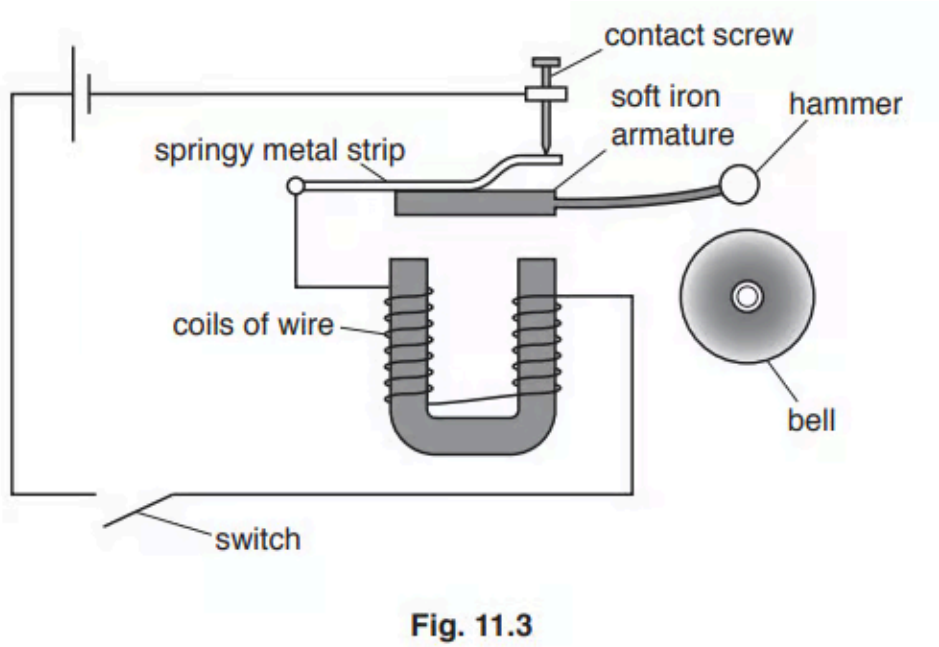


Fig. 11.3

Explain how the circuit causes the hammer to hit the bell repeatedly when the switch is closed.

Use your ideas about circuits and electromagnets.

[5 marks]

Question 3c

Apart from an electric door bell, suggest another use for electromagnets.

[1 mark]

Question 4a

A student is using plotting compasses to investigate the magnetic field lines of bar magnets.

The student places two bar magnets in the arrangement shown in Fig. 1.1.

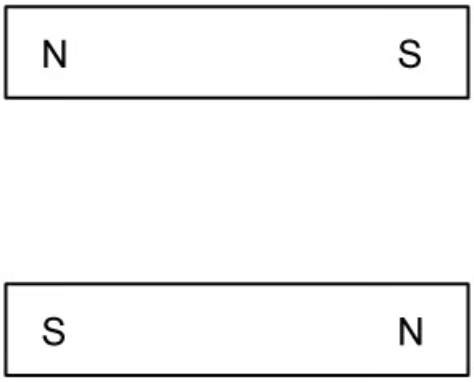


Fig. 1.1

Draw the magnetic field lines that the student will discover between the magnets.

[3 marks]

Question 4b

The student changed the orientation of the bottom magnet by rotating it 180°. Fig. 1.2 shows the predictive sketch drawn by the student before they added the plotting compasses.

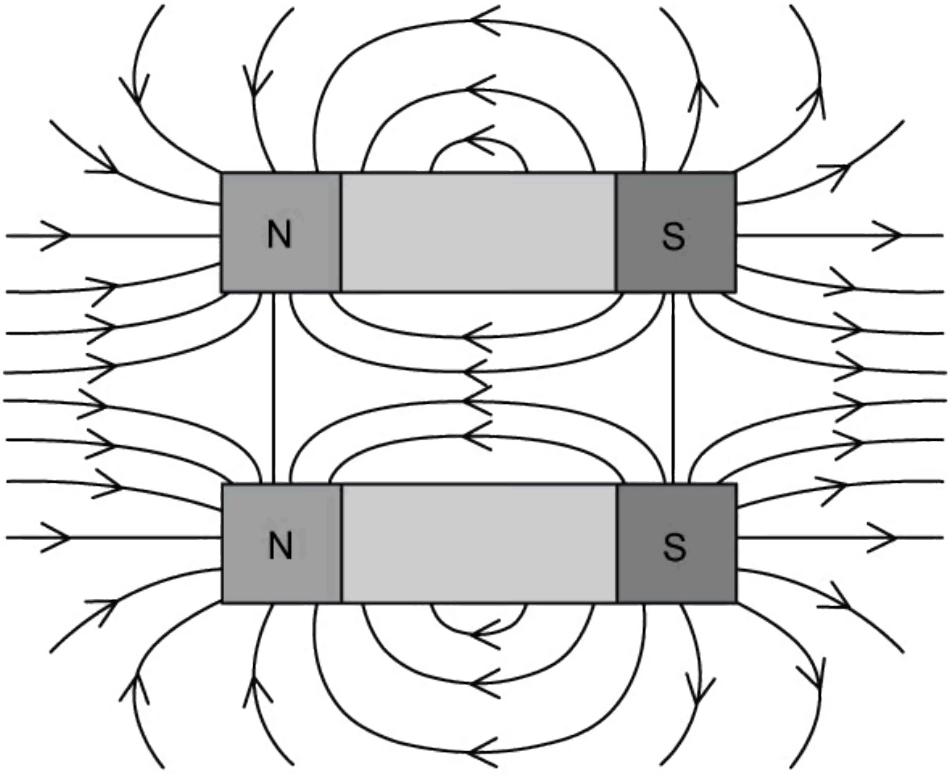


Fig. 1.2

State two differences between the sketch in Fig 1.2 and the pattern the student will actually see when they add the plotting compasses.

[2 marks]

Question 4c

The student attempts to look at the field lines by adding iron filings around the magnet.

Whilst collecting the iron filings, they spill some on the magnet.

Fig. 1.3 shows a side view of the magnet and the filings.

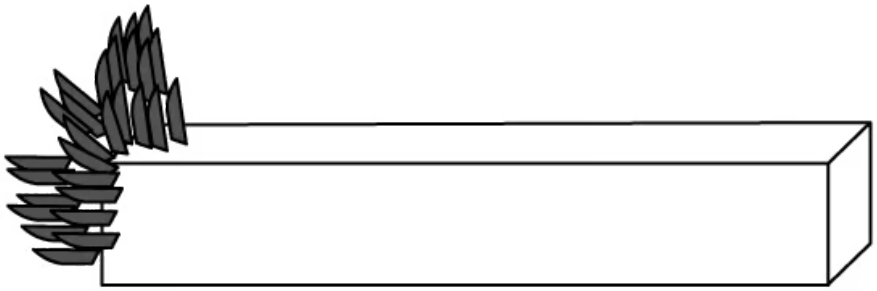


Fig. 1.3

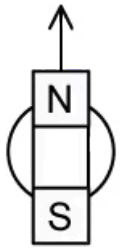
Explain why the iron filings are in this position.

[3 marks]

Question 5a

Scientists can explain magnetic materials and non-magnetic materials using domain theory.

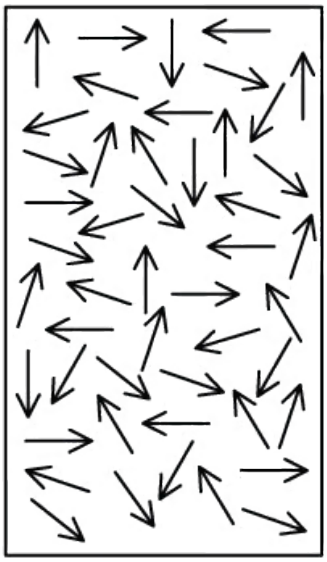
All atoms contain electrons, and electrons act as tiny magnets with a north and a south pole, as shown in Fig. 1.1.



Electron acting as a tiny magnet

Fig. 1.1

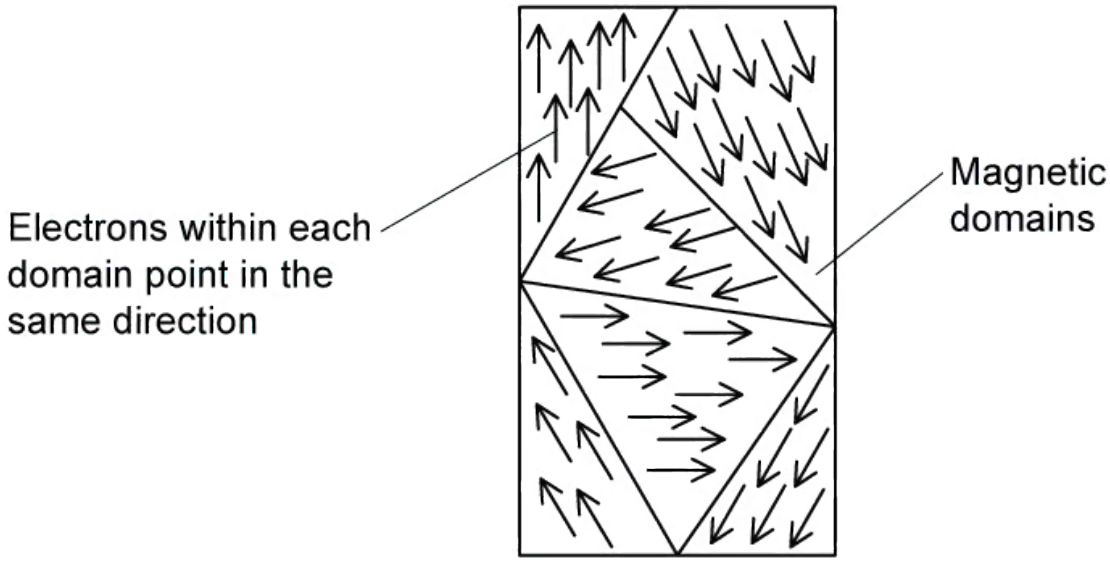
Metals are collections of many millions of atoms. For non-magnetic materials the electrons are randomly aligned as shown in Fig. 1.2.



Electrons acting as tiny magnets inside a non-magnetic material

Fig. 1.2

For magnetic materials, the electrons are arranged in groups called domains. Within each domain, the electrons are aligned so that they all point in the same direction, and each domain acts as a magnet itself. Fig. 1.3 shows this arrangement.



Electrons acting as tiny magnets within a magnetic material

Fig. 1.3

Use domain theory to explain

(i) Why most metals are not magnetic.

[3]

(ii) Why some metals can be magnetised.

[3]

[6 marks]

Question 5b

Using arrows in a rectangle to represent electrons in a metal as in part **(a)**, draw a sketch of a magnetised material.

[1 mark]