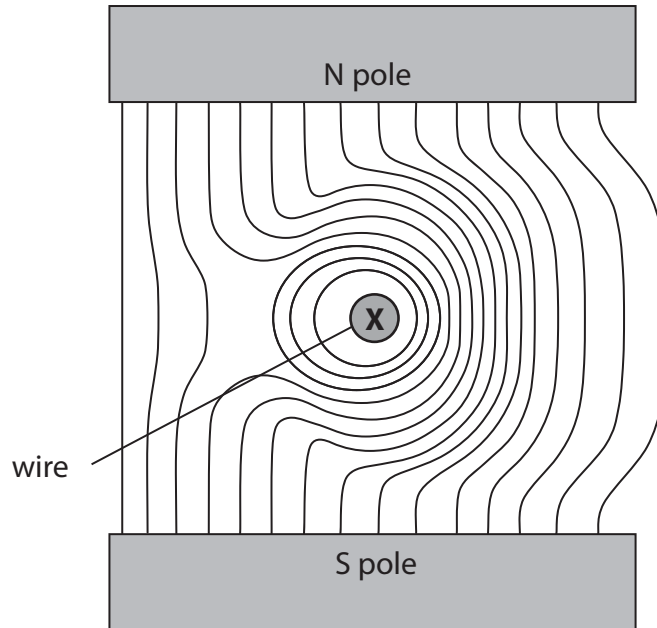


**Questions are for both separate science and combined science students
unless indicated in the question**

- 1 Magnetic field lines show the shape and direction of a magnetic field.
- (a) The diagram shows a cross-section through a wire placed between two magnetic poles.

The wire carries electric current into the page at **X**.

The shape of the magnetic field is shown.



- (i) Add arrows to two of the magnetic field lines to show the direction of the magnetic field.

(1)

- (ii) Draw an arrow on the diagram to show the direction of the force on the wire.

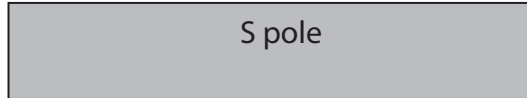
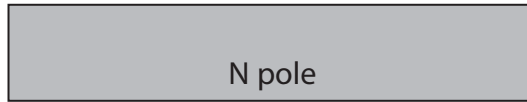
Label this arrow **F**.

(2)

(b) The wire is removed and the magnetic field between the poles changes.

Sketch the new magnetic field.

(2)



(c) Explain how you could use a plotting compass to investigate the magnetic field around a bar magnet.

You may draw a diagram to help your answer.

(3)

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(Total for Question 1 = 8 marks)

2 This photograph shows an electromagnetic device used to keep a door open.



The electromagnet attracts the metal plate to hold the door open.

The electromagnet is connected to a fire alarm circuit.

When the fire alarm sounds, the door is released and it closes.

(a) State why the metal plate is made of iron. **(separate only)**

(1)

(b) Describe the construction of an electromagnet.

You may draw a diagram to help your answer. **(separate only)**

(3)

(c) Describe the changes that allow the electromagnet to release the door when the fire alarm sounds. **(separate only)**

(2)

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(Total for Question 2 = 6 marks)

3 (a) A direct current passes around a flat, circular coil as shown.

On the diagram, sketch the magnetic field caused by the current in the coil. **(separate only)**
(3)



- (b) The coil is suspended vertically so that it is free to swing.
A second, identical coil is placed beside it.

When direct currents pass, as shown,
the two coils move together.



When the current in the
right-hand coil is reversed,
the two coils move apart.



Explain why the coils move in this way. **(separate only)**

(3)

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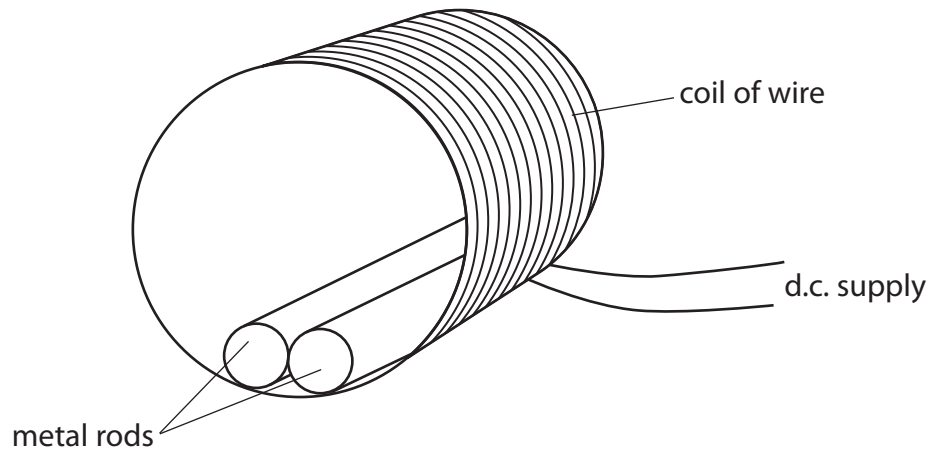
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(Total for Question 3 = 6 marks)

4 The diagram shows two identical metal rods placed inside a coil of wire.



(a) When a direct current is supplied to the coil, a magnetic field forms and the metal rods move apart.

Explain why the metal rods move apart. **(separate only)**

(2)

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(b) When the current is switched off, the metal rods return to their starting places.

Suggest what material the metal rods are made from.

Explain your answer. **(separate only)**

(3)

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(c) The direct current in the coil is replaced by an alternating current.

Explain what will happen to the magnetic field. **(separate only)**

(2)

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(Total for Question 4 = 7 marks)
