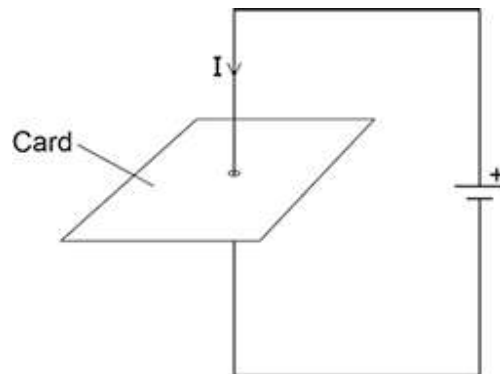


1

Figure 1 shows a straight wire passing through a piece of card.

A current (I) is passing down through the wire.

Figure 1



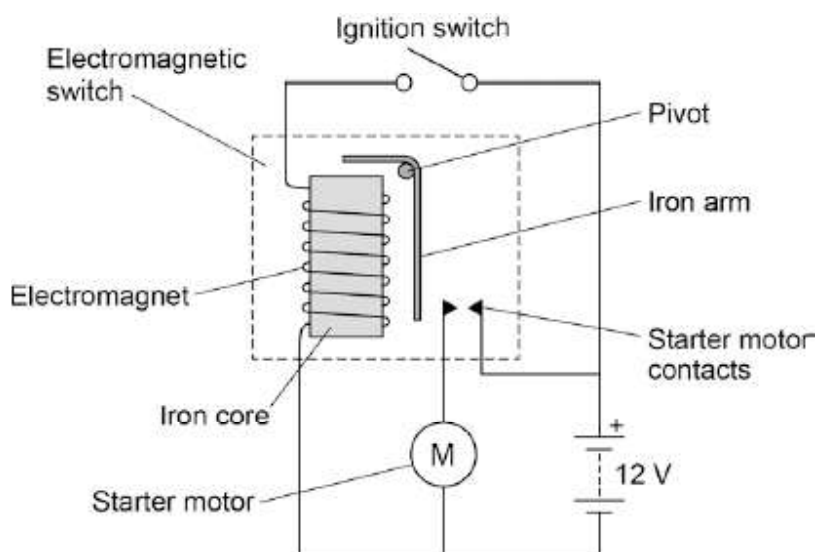
(a) Describe how you could show that a magnetic field has been produced around the wire.

(2)

- (b) **Figure 2** shows the ignition circuit used to switch the starter motor in a car on.

The circuit includes an electromagnetic switch.

Figure 2



Explain how the ignition circuit works.

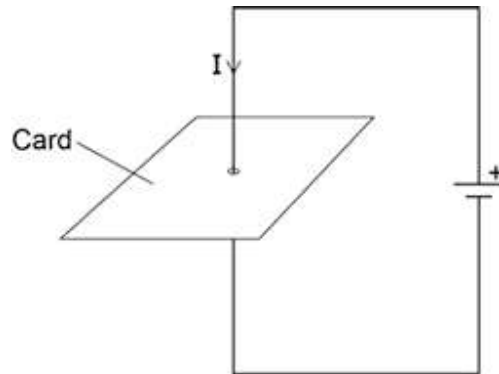
(4)
(Total 6 marks)

2

Figure 1 shows a straight wire passing through a piece of card.

A current (I) is passing down through the wire.

Figure 1



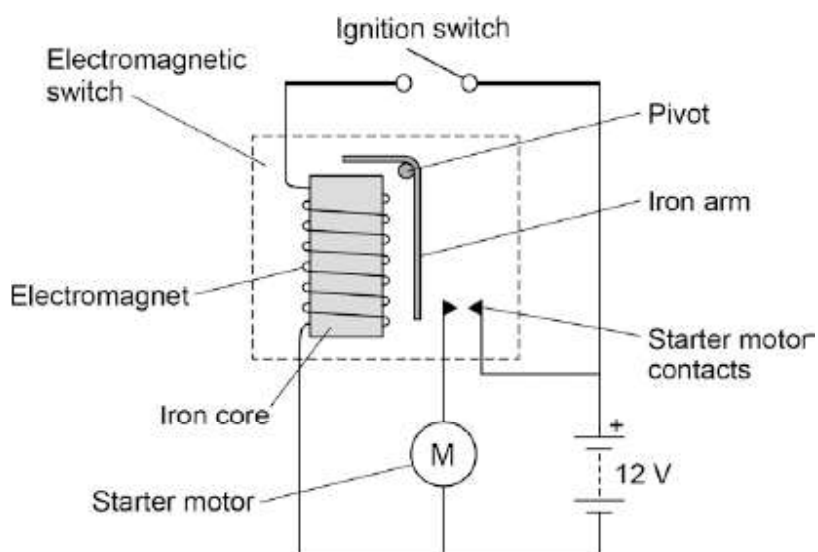
(a) Describe how you could show that a magnetic field has been produced around the wire.

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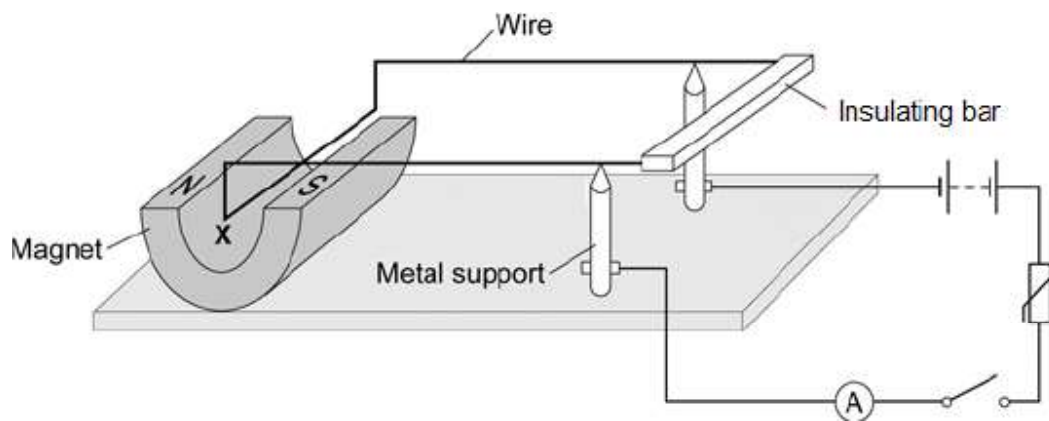
Explain how the ignition circuit works.

(4)
(Total 6 marks)

3

Figure 1 shows a piece of apparatus called a current balance.

Figure 1



When the switch is closed, the part of the wire labelled **X** experiences a force and moves downwards.

- (a) What is the name of the effect that causes the wire **X** to move downwards?

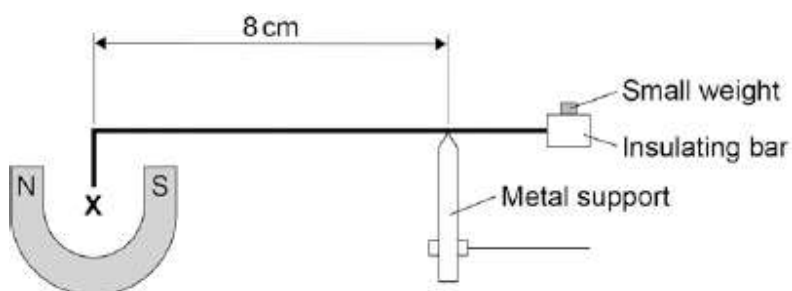
(1)

- (b) Suggest one change you could make to the apparatus in **Figure 1** that would increase the size of the force that wire **X** experiences.

(1)

- (c) **Figure 2** shows how a small weight placed on the insulating bar makes the wire **X** go back and balance in its original position.

Figure 2



The wire **X** is 5 cm long and carries a current of 1.5 A.

The small weight causes a clockwise moment of $4.8 \times 10^{-4} \text{ Nm}$.

Calculate the magnetic flux density where the wire **X** is positioned

Give the unit.

Magnetic flux density = _____ Unit _____

(6)

(Total 8 marks)

4

- (a) Electromagnets are often used at recycling centres to separate some types of metals from other materials.

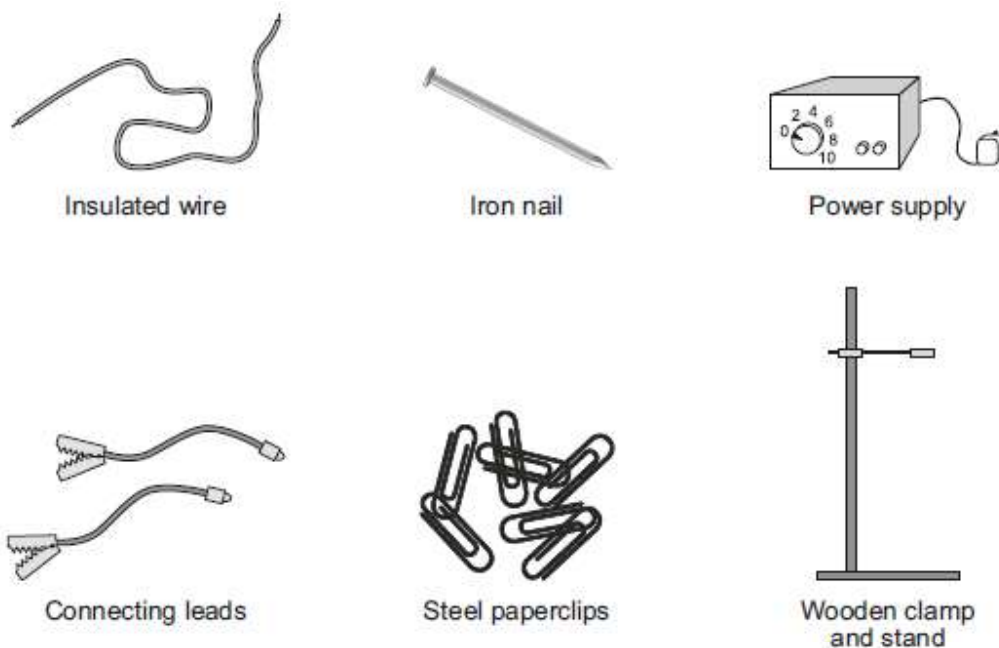
Give **one** reason why an electromagnet would be used rather than a permanent magnet.

(1)

- (b) In this question you will gain marks for using good English, organising information clearly and using scientific words correctly.

Some students want to build an electromagnet.

The students have the equipment shown below.



Describe how the students could build an electromagnet. Include in your answer how the students should vary and test the strength of their electromagnet.

(6)

(Total 7 marks)

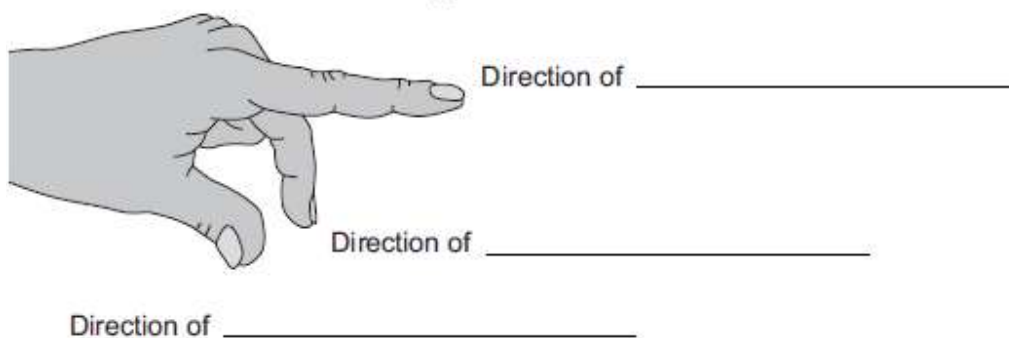
5

The left-hand rule can be used to identify the direction of the force acting on a current-carrying conductor in a magnetic field.

- (a) Use words from the box to label **Figure 1**.

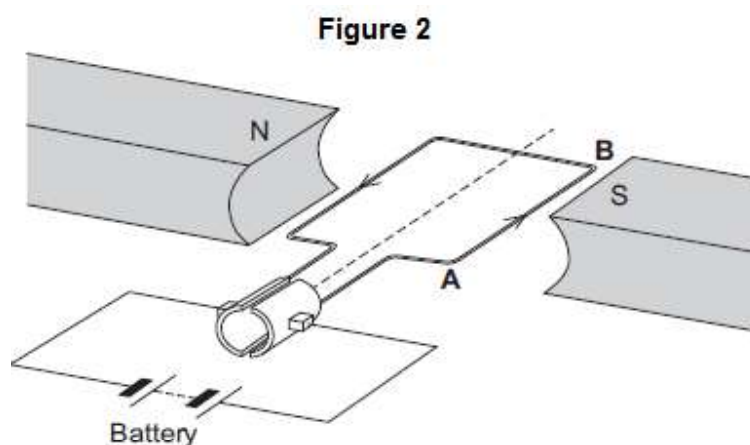
current	field	force	potential difference
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Figure 1



(3)

- (b) **Figure 2** shows an electric motor.



- (i) Draw an arrow on **Figure 2** to show the direction of the force acting on the wire **AB**.

(1)

- (ii) Suggest **two** changes that would increase the force acting on the wire **AB**.

1. _____

2. _____

(2)

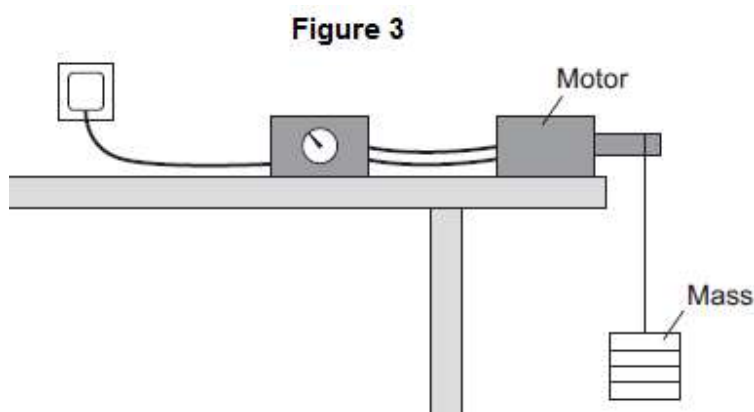
- (iii) Suggest **two** changes that would reverse the direction of the force acting on the wire **AB**.

1. _____

2. _____

(2)

- (c) A student used an electric motor to lift a mass. This is shown in **Figure 3**.



The student varied the electrical input power to the motor. For each different electrical input power, he recorded the time taken to lift the mass and calculated the output power of the motor.

The results are shown in the table.

Test	Electrical input power in watts	Work done lifting the mass in joules	Time taken to lift the mass in seconds	Output power in watts
A	20	24	2.4	10
B	40	24	1.2	20
C	60	24	0.8	30
D	80	24	0.2	120

The result for **Test D** is anomalous.

- (i) Calculate the efficiency of the motor in **Test D**.

Efficiency = _____

(2)

- (ii) Comment on your answer to part (c)(i).

(1)

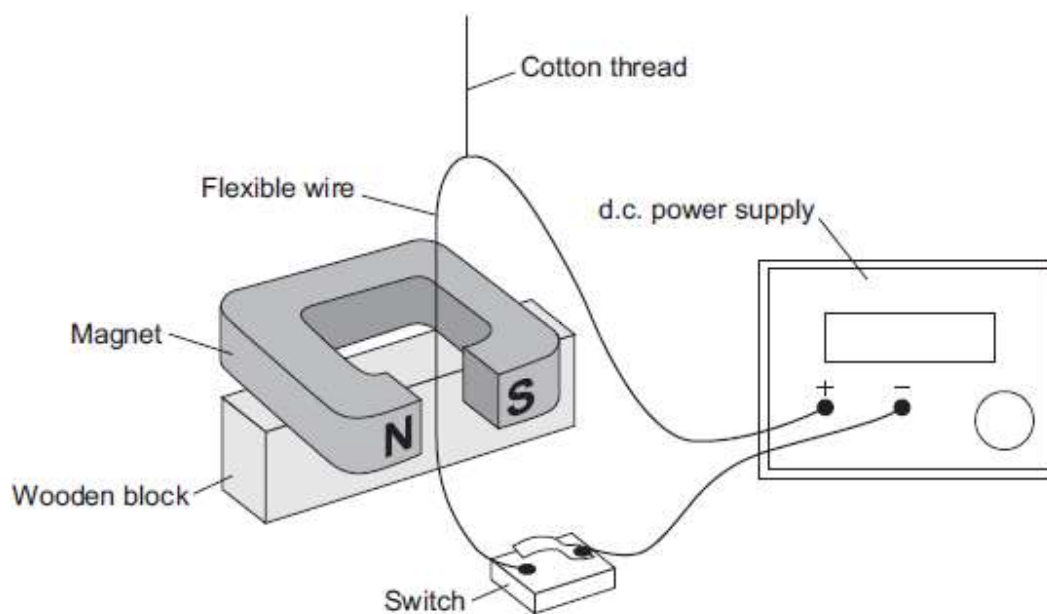
(iii) Suggest a reason for this anomalous result.

(1)

(Total 12 marks)

6

The diagram shows a demonstration carried out by a teacher.



When the switch is closed, there is a current of 2 A through the wire. The wire experiences a force and moves.

(a) Use the correct word from the box to complete the sentence.

generator	motor	transformer
-----------	-------	-------------

The demonstration shows the _____ effect.

(1)

(b) State **two** changes that the teacher could make to the demonstration, each of which would increase the force on the wire. The teacher does not touch the wire.

1. _____

2. _____

(2)

- (c) State **one** change that the teacher could make to the demonstration to change the direction of the force on the wire.

(1)

- (d) With the switch closed, the teacher changes the position of the wire so that the force on the wire is zero.

What is the position of the wire?

Tick (✓) **one** box.

The wire is at 90° to the direction of the magnetic field.

☐

The wire is at 45° to the direction of the magnetic field.

☐

The wire is parallel to the direction of the magnetic field.

☐

(1)

(Total 5 marks)