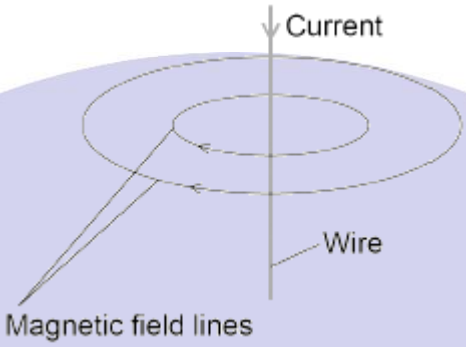
Q1.

Figure 1 shows the magnetic field pattern produced when there is a current in a wire.

Figure 1



(a) What do the arrows on the magnetic field lines represent?

_____

_____

(1)

(b) How could the strength of the magnetic field be increased?

Tick (✓) **one** box.

Change the direction of the current in the wire ☐

Increase the current in the wire ☐

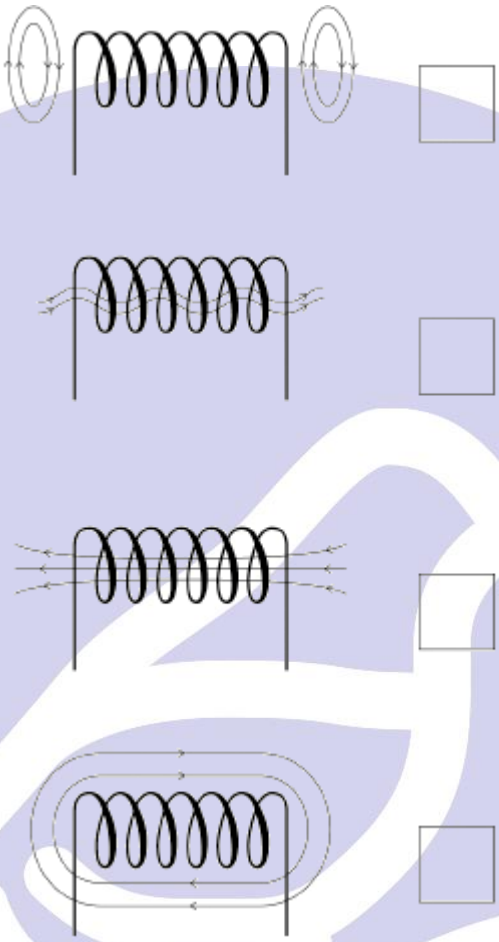
Increase the temperature of the wire ☐

(1)

(c) The wire is coiled to make a solenoid.

Which diagram in **Figure 2** shows the magnetic field pattern produced when there is a current in the solenoid?

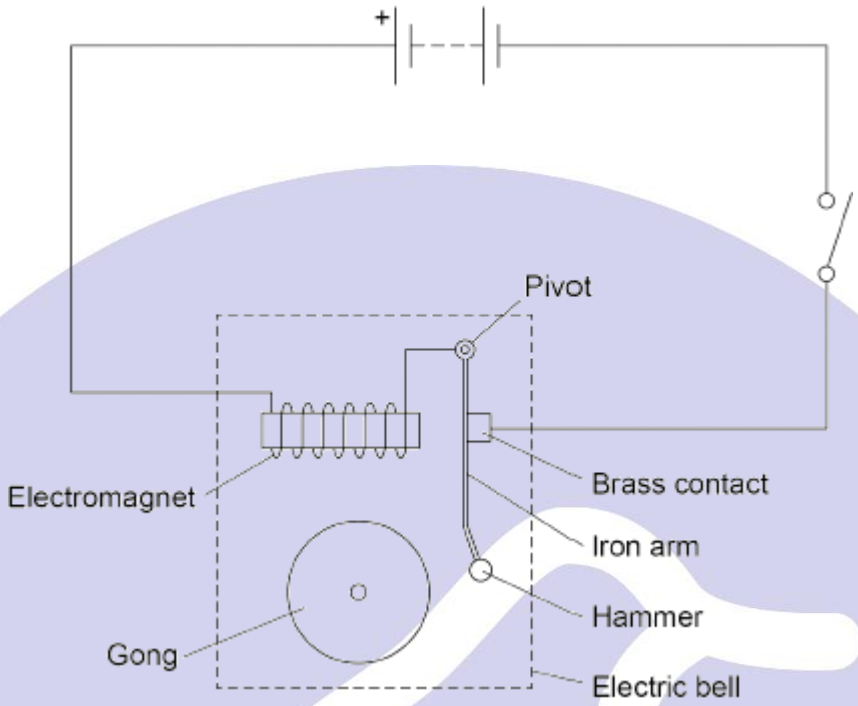
Figure 2



(1)

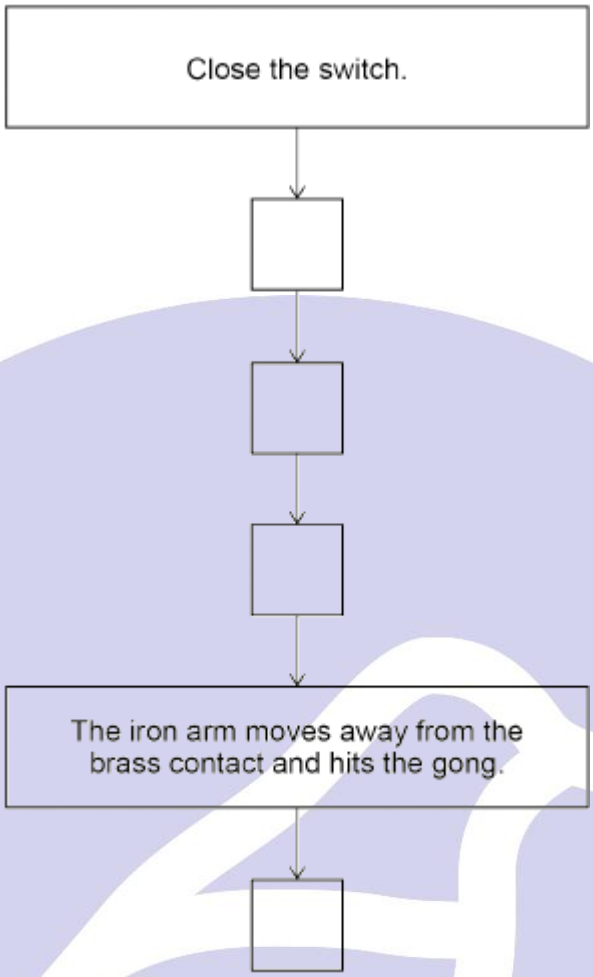
Figure 3 shows the parts of an electric bell.

Figure 3



(d) **Figure 4** shows an incomplete sequence of how the bell works.

Figure 4



Write **one** letter in each box to show the correct sequence.

Use each letter once.

A A magnetic field is created around the electromagnet.

B A resultant force acts on the iron arm causing it to move towards the electromagnet.

C The iron arm returns to its original position.

D There is a current in the circuit.

(2)

(e) Which of the following would increase the resultant force on the iron arm?

Tick (✓) **one** box.

Decrease the distance between the electromagnet and the iron arm	☐
Decrease the number of cells in the circuit	☐
Decrease the number of turns on the electromagnet	☐

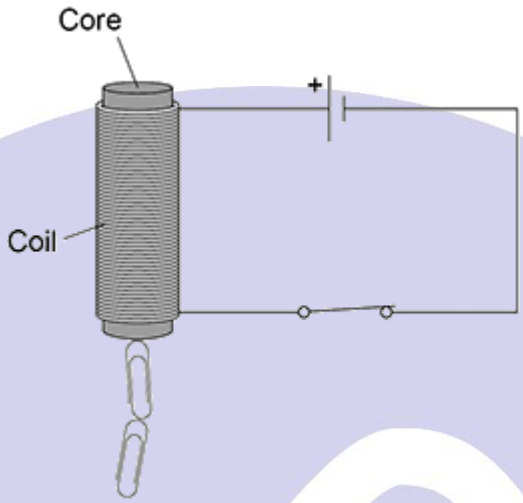
(1)

(Total 6 marks)

Q2.

Figure 2 includes an electromagnet.

Figure 2



(a) Which metal is used to make the core of the electromagnet?

Tick (✓) **one** box.

Aluminium ☐

Copper ☐

Iron ☐

Magnesium ☐

(1)

(b) Complete the sentence.

Choose the answer from the box.

coil	**metal core**	**paper clip**

The switch is closed. There is a current in the _____.

(1)

(c) The number of turns on the coil is increased. The current remains the same.

How does this affect the strength of the magnetic field around the electromagnet?

Tick (✓) **one** box.

The magnetic field would be stronger. ☐

The magnetic field would stay the same. ☐

The magnetic field would be weaker. ☐

(1)

(d) The metal core was removed. The current remains the same.

How does this affect the strength of the magnetic field around the electromagnet?

Tick (✓) **one** box.

The magnetic field would be stronger. ☐

The magnetic field would stay the same. ☐

The magnetic field would be weaker. ☐

(1)

(Total 4 marks)

Q3.

The circle in **Figure 1** represents a straight wire carrying a current. The cross shows that the current is into the plane of the paper.

Figure 1

(a) Complete **Figure 1** to show the magnetic field pattern around the wire.

(2)

(Total 2 marks)

Q4.

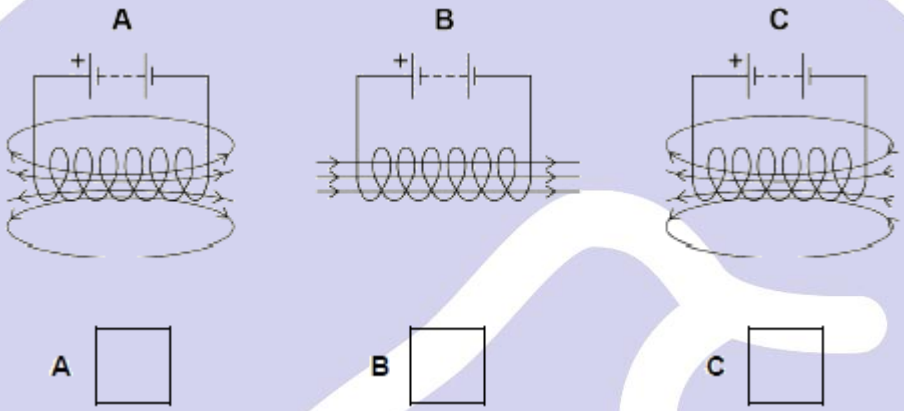
A coil of wire is connected to a battery.

The current in the coil produces a magnetic field.

(a) Which diagram in **Figure 4** shows the magnetic field produced by the current in the coil?

Tick (✓) **one** box.

Figure 4



A ☐ B ☐ C ☐

(1)

(b) A solid rod is placed inside the coil.

Which type of rod would make the magnetic field of the coil stronger?

Tick (✓) **one** box.

Glass rod ☐

Plastic rod ☐

Steel rod ☐

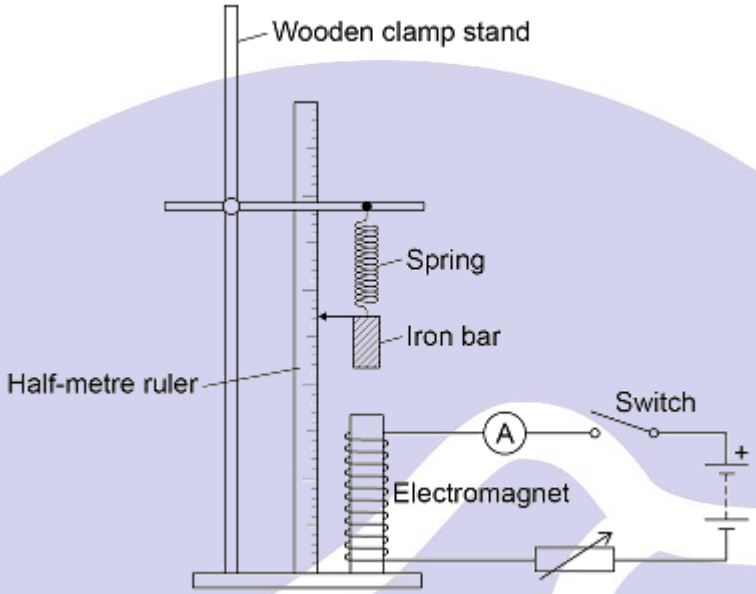
Wooden rod ☐

(1)

A student investigated how the strength of an electromagnet varies with the current in the coil of the electromagnet.

Figure 5 shows the equipment the student used.

Figure 5



(c) Why does the spring get longer when the electromagnet is switched on?

_____

_____

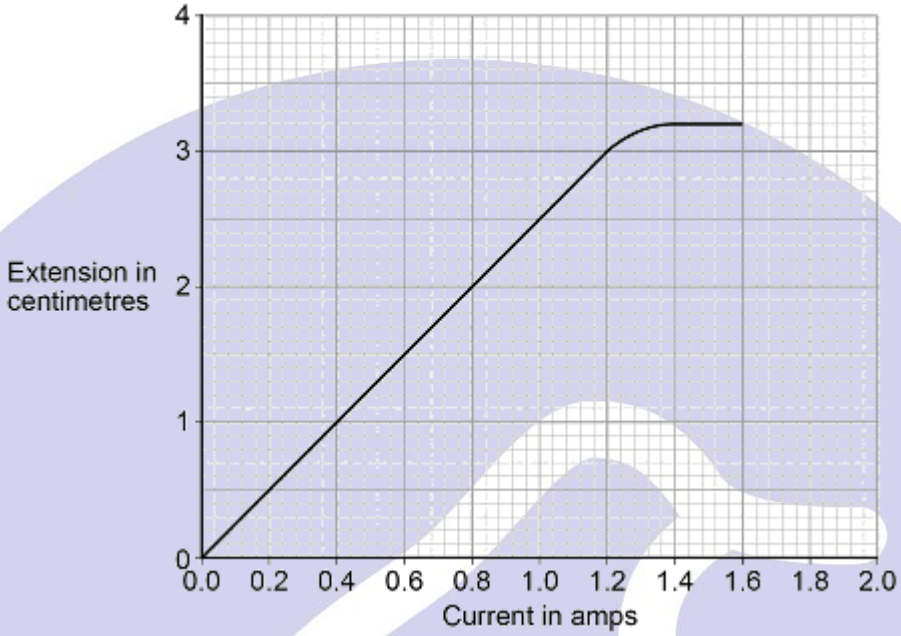
_____

(1)

The student measured how much further the spring extended with different values of current in the coil.

Figure 6 shows the results.

Figure 6



(d) Describe what happened to the strength of the electromagnet as the current in the coil increased from 1.2 A to 1.6 A

_____

_____

_____

_____

(2)

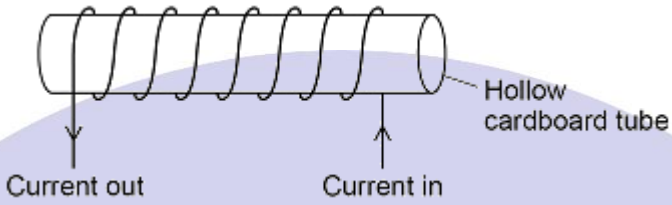
(Total 11 marks)

Q5.

(a) **Figure 1** shows a solenoid.

Draw the magnetic field of the solenoid on **Figure 1**.

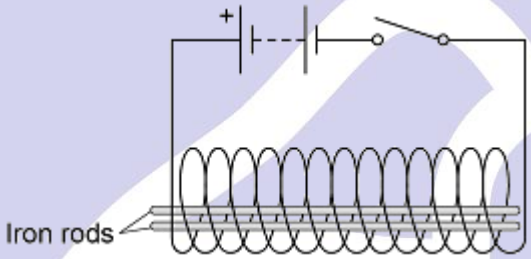
Figure 1



(2)

(b) **Figure 2** shows two iron rods placed inside a solenoid.

Figure 2



Explain why the iron rods move apart when the switch is closed.

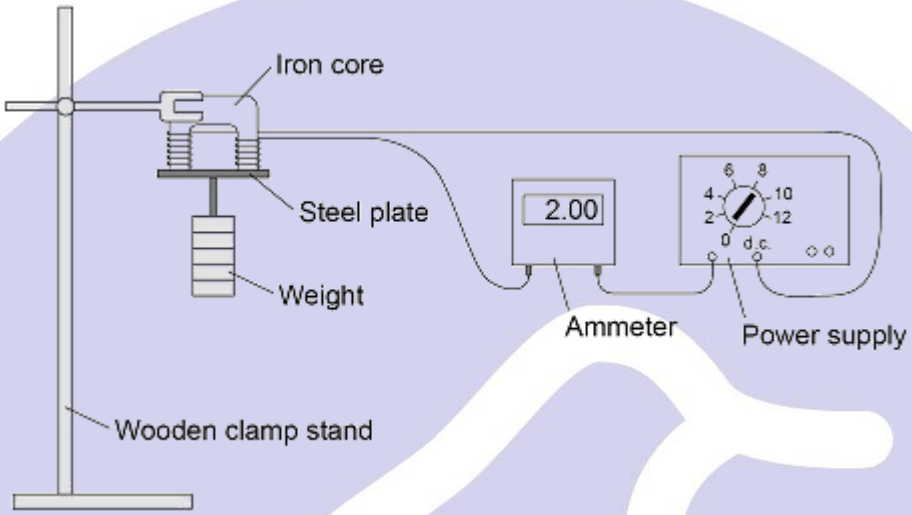
(2)

A student investigated the strength of an electromagnet.

The student investigated how the strength depended on:
- the current in the wire
- the number of turns of wire around the iron core.

Figure 3 shows the equipment used.

Figure 3



The student measured the strength of the electromagnet as the maximum weight the electromagnet could hold.

(c) The following table shows the results.

Current in amps	Number of turns of wire	Maximum weight in newtons
1.0	30	6.5
1.5	20	6.4
2.0	10	3.7

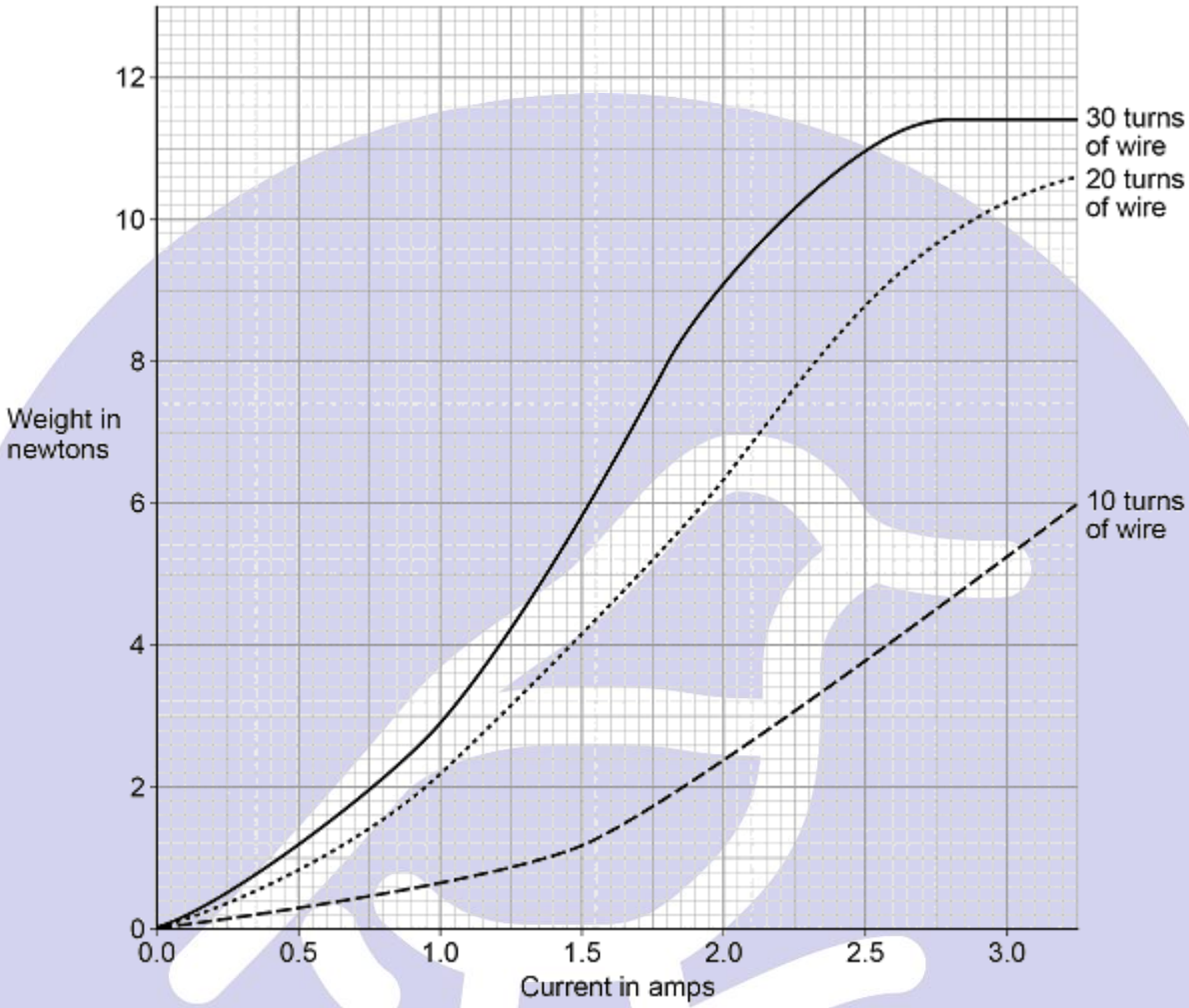
Explain why the method used by the student is **not** valid for this investigation.

(2)

A second student repeated the investigation using the same equipment.

Figure 4 shows the second student's results.

Figure 4



(d) How does increasing the current in the wire affect the strength of the electromagnet, when the electromagnet has 30 turns of wire?

_____

_____

_____

_____

(1)

(e) How does increasing the number of turns of wire from 10 to 20 affect the strength of the electromagnet, compared to increasing the number of turns of wire from 20 to 30?

_____

_____

_____

_____

(1)

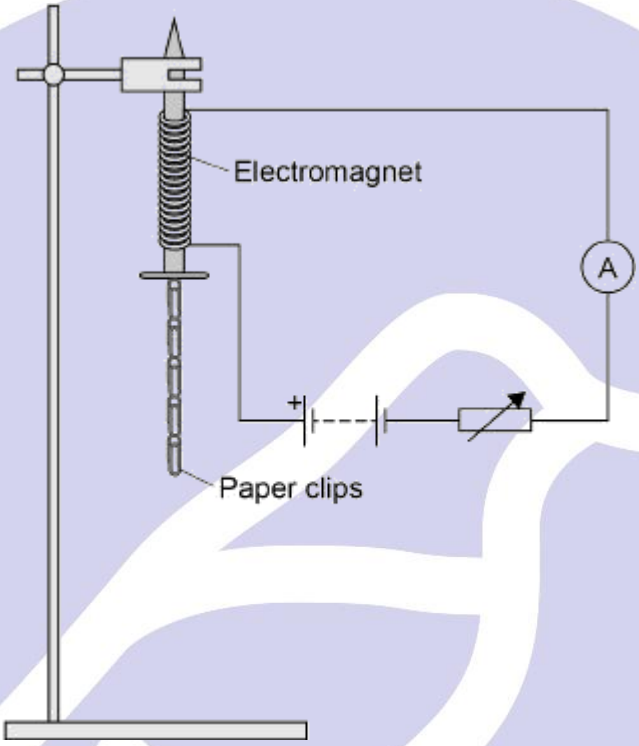
(Total 8 marks)

Q6.

A student investigated how the number of turns of wire on an electromagnet affects the strength of the electromagnet.

Figure 2 shows the equipment used by the student. Throughout the investigation the student kept the current through the wire constant.

Figure 2



(a) The student measured the strength of the electromagnet by counting the number of paper clips the electromagnet could hold.

Explain why it was important that the paper clips were all the same size.

_____

_____

_____

_____

(2)

The table below shows the student's results.

Number of turns of wire on the electromagnet	Number of paper clips held
10	3
20	6
30	9
40	12

(b) Describe the pattern shown in the table.

_____

_____

_____

_____

(2)

(c) The student then used 50 turns of wire on the electromagnet.

The electromagnet picked up 18 paper clips. This was more paper clips than the student had expected.

Which **one** is the most likely cause of this result?

Tick **one** box.

The paper clips used with 50 turns were larger than the others. ☐

There were less than 50 turns of wire on the electromagnet. ☐

Some of the paper clips were already magnetised. ☐

(1)

(d) The student repeated the measurement for 50 turns of wire three more times.

This gave her the following set of results.

18 16 14 15

Explain what the student should now do with the **four** results for 50 turns of wire.

(3)

(e) The student wrote the hypothesis:

'Increasing the current through the wire will make the electromagnet stronger.'

Describe how the student should change the investigation to test this hypothesis.

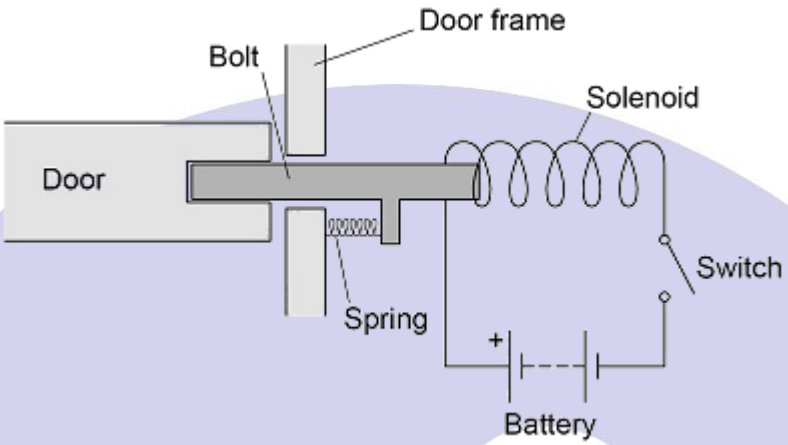
(3)

(Total 11 marks)

Q7.

A door is fitted with a security lens and a lock.

The diagram below shows a diagram of the lock. The door unlocks when the switch is closed.



(a) Which material should the bolt be made from?

Tick (✓) **one** box.

- Aluminium ☐
- Brass ☐
- Copper ☐
- Iron ☐

(1)

(b) Explain why the door unlocks when the switch is closed.

_____

_____

_____

_____

_____

_____

(3)

(c) Give **two** ways the resultant force on the bolt could be increased.

1 _____

_____

2 _____

_____

(2)

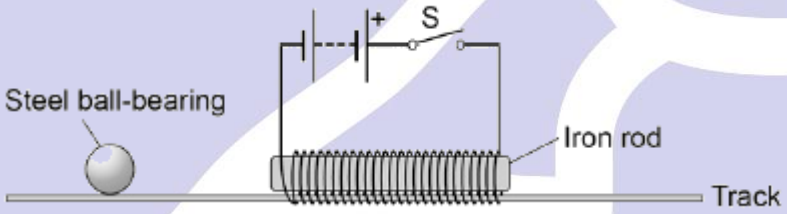
(Total 14 marks)

Q8.

A student has set up the apparatus shown in **Figure 2**.

The iron rod is fixed to the track and cannot move.

Figure 2



(c) The student gives the steel ball bearing a gentle push in the direction of the iron rod.

At the same time the student closes the switch **S**.

Explain the effect on the motion of the ball bearing when the switch **S** is closed.

_____

_____

_____

_____

_____

_____

_____

_____

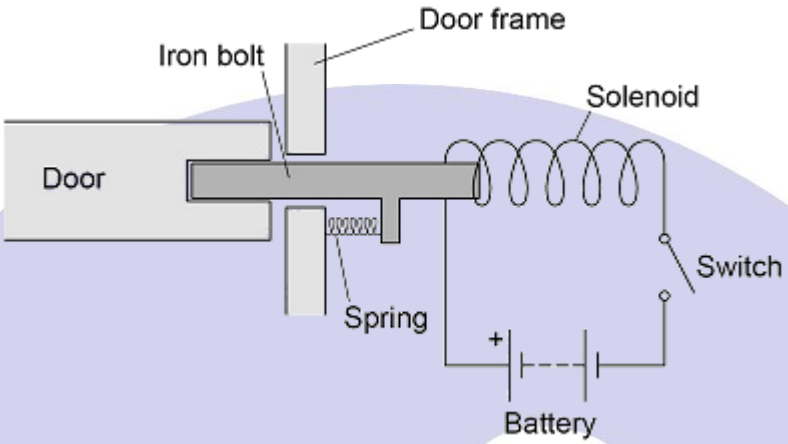
(4)

(Total 9 marks)

Q9.

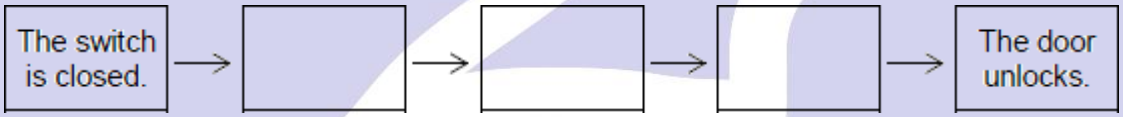
Figure 2 shows a diagram of an electromagnetic lock used to secure a door.

Figure 2



(d) **Figure 3** shows an incomplete sequence of how the door unlocks.

Figure 3



Write **one** letter in each box to show the correct sequence.

A The iron bolt moves.

B A magnetic field is created around the solenoid.

C There is a current in the circuit.

(2)

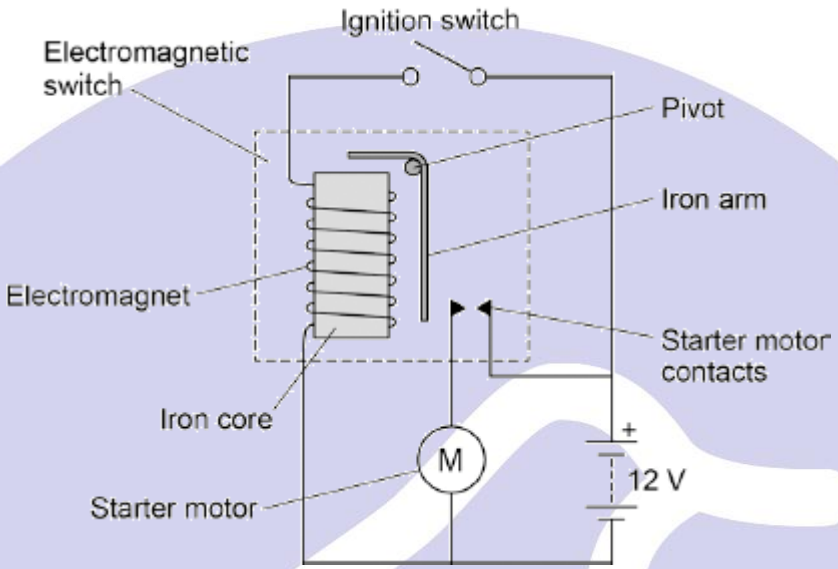
(Total 2 marks)

Q10.

(a) **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 4 marks)