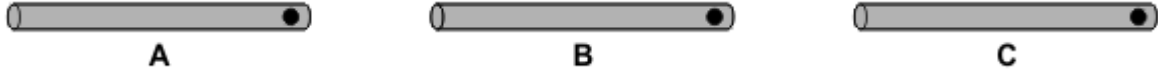


1

Hannah has three rods (A, B and C) made from different metals. One rod is a **magnet**; one is made of **copper**; and one is made of **iron**. She does not know which rod is which.



Each rod has a dot at one end.

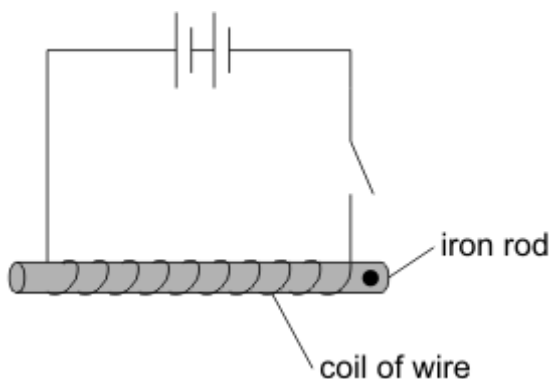
- (a) Hannah uses **only** a bar magnet to identify each rod. She puts each pole of the bar magnet next to the dotted end of each rod.

Complete Hannah's observations in the table below. Write if each rod is **copper**, **iron** or a **magnet**.

| test | observations | type of rod |
|--------------|-----------------|-------------|
| <p>rod A</p> | attract | Rod A is |
| <p>rod A</p> | attract | |
| <p>rod B</p> | nothing happens | Rod B is |
| <p>rod B</p> | | |
| <p>rod C</p> | attract | Rod C is |
| <p>rod C</p> | | |

3 marks

(b) Hannah uses the iron rod to make an electromagnet.



When the switch is closed the iron rod becomes an electromagnet.
Give **two** ways Hannah could make the electromagnet stronger.

1.

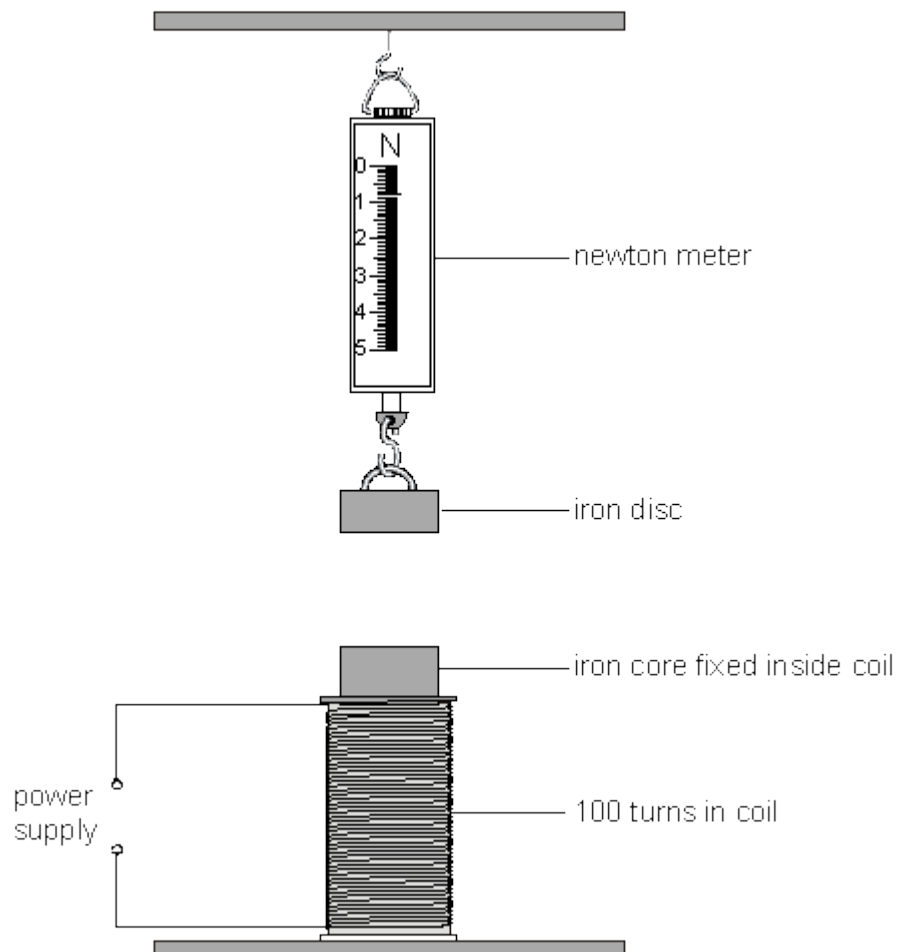
1 mark

2.

1 mark
maximum 5 marks

2

Mary used the apparatus below to test the strength of an electromagnet.
She used the reading on the newton meter to measure the force of the magnet on the iron disc.



(a) Explain why the reading on the newton meter increases when a current passes through the coil.

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.....
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.....

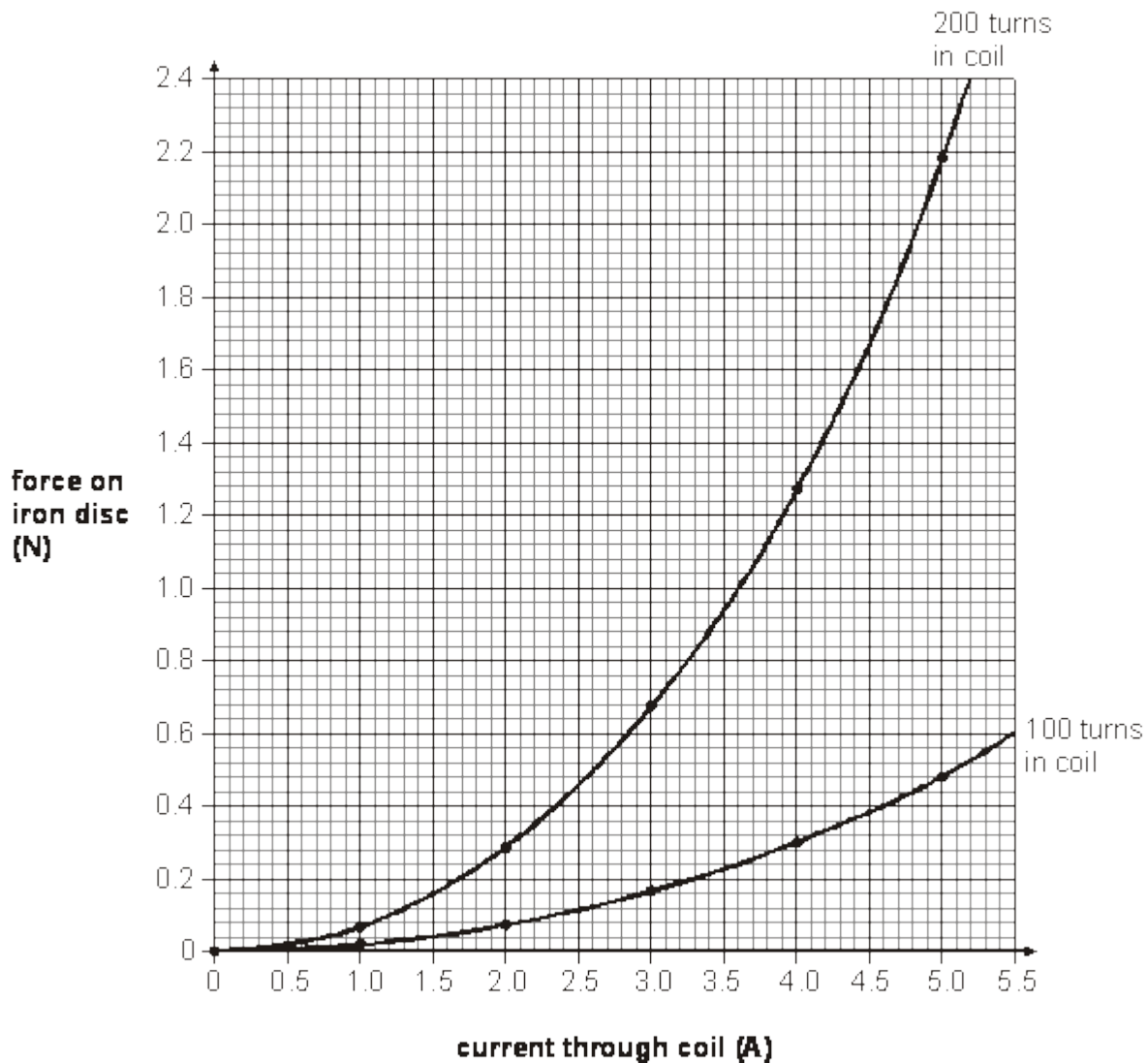
2 marks

(b) When a current passes through the coil, some of the electrical energy is changed to thermal energy.
What would happen to the coil if the current passing through it was too large?

.....

1 mark

- (c) Mary made two electromagnets, one with 100 turns of wire in the coil and one with 200 turns. She varied the current through the coil of each electromagnet. She measured the force of each electromagnet on the iron disc. The graph shows her results.



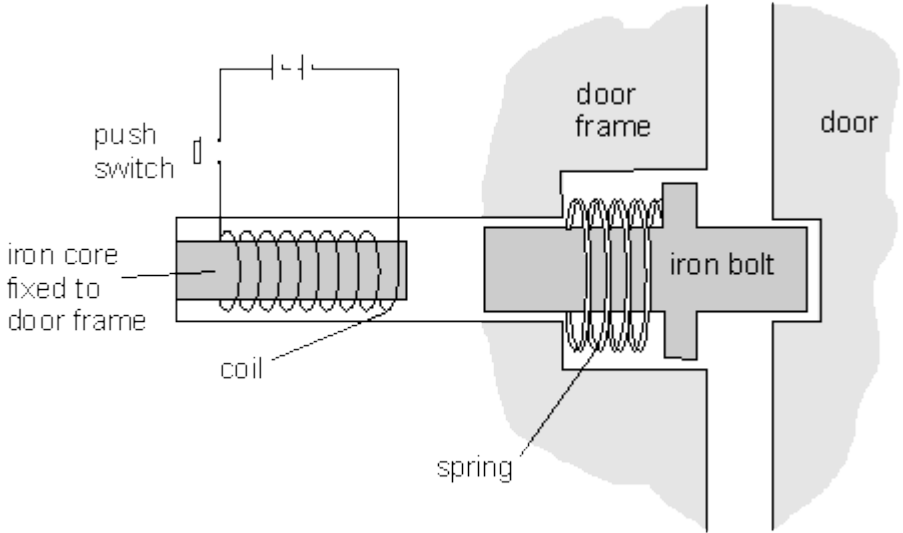
Write **two** conclusions that Mary could make from these results.

1.
-
2.
-

2 marks
maximum 5 marks

3

The diagram shows an electromagnet used in a door lock.



(a) The push switch is closed and the door unlocks. Explain in detail how this happens.

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.....

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.....

.....

3 marks

(b) The switch is released and the door locks. Explain in detail how this happens.

.....

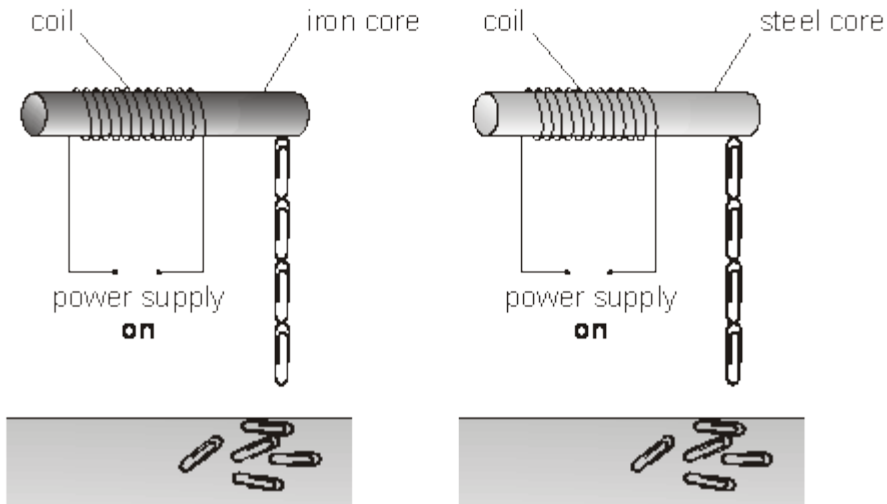
.....

.....

2 marks
Maximum 5 marks

4

David made two electromagnets as shown below. He used paper-clips to test the strength of each electromagnet. He switched on the power supply in both circuits.



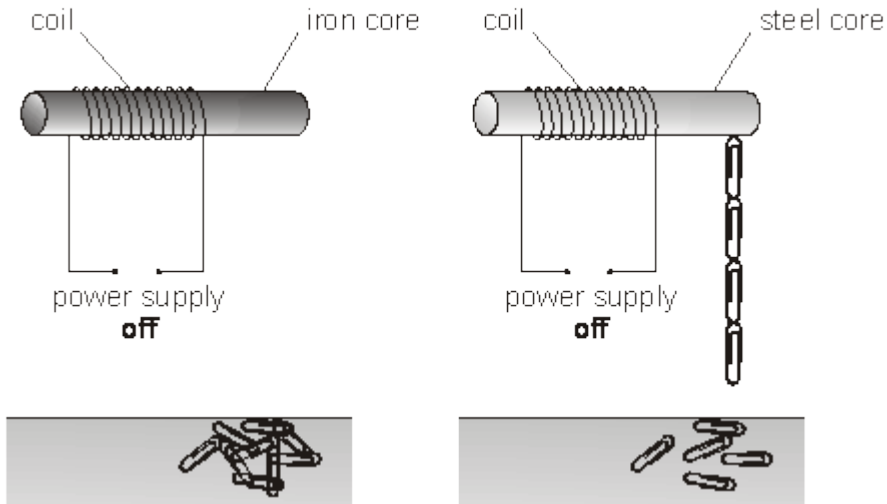
(a) How can you tell that the strength of both electromagnets is the same?

.....

.....

1 mark

(b) David switched off the power supply in both circuits. The paper-clips fell off the iron core, but **not** off the steel core.



Why is iron used, rather than steel, for the core of an electromagnet? Use the diagrams above to help you.

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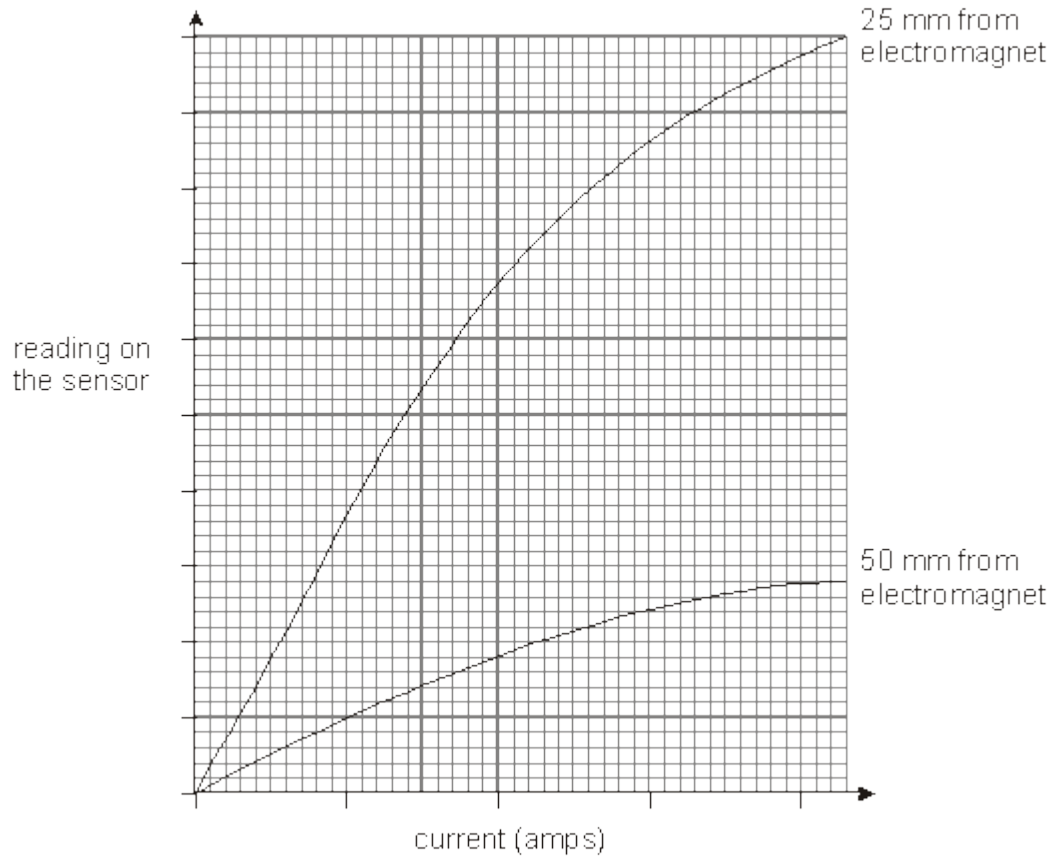
1 mark

(c) David used a sensor to measure the strength of an electromagnet.

He placed the sensor 25 mm from the electromagnet and increased the current in the coil.

He repeated the experiment with the sensor 50 mm from the electromagnet.

The graph below shows his results.



(i) How did the distance of the sensor from the electromagnet affect the reading on the sensor?

.....
.....

1 mark

(ii) How did the size of the current in the coil affect the strength of the electromagnet?

.....
.....

1 mark

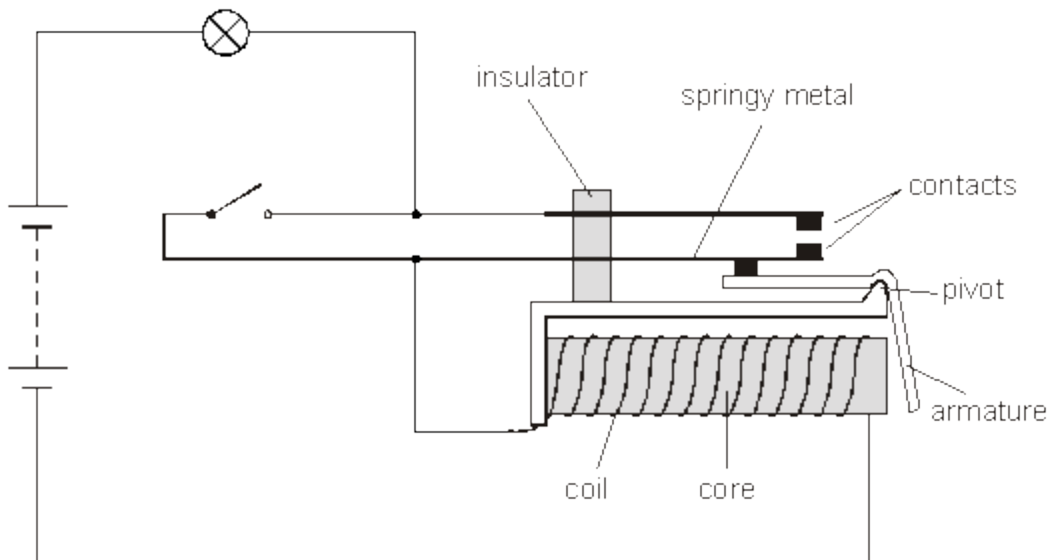
(iii) What else could David do to an electromagnet to change its strength?

.....
.....

1 mark
maximum 5 marks

5

The diagram shows an electromagnetic relay. The relay is connected in a circuit with a battery, a lamp and a switch.



(a) (i) Give the name of a suitable material to use for the core of the electromagnet.

.....

1 mark

(ii) Give the name of a suitable material to use for the armature.

.....

1 mark

(b) (i) Explain why the contacts come together when the switch is closed.

.....
.....
.....
.....
.....

3 marks

(ii) When the switch is now opened, the bulb stays on. Explain why.

.....
.....

1 mark
Maximum 6 marks