AQA - Magnetism and electromagnetism – GCSE Physics

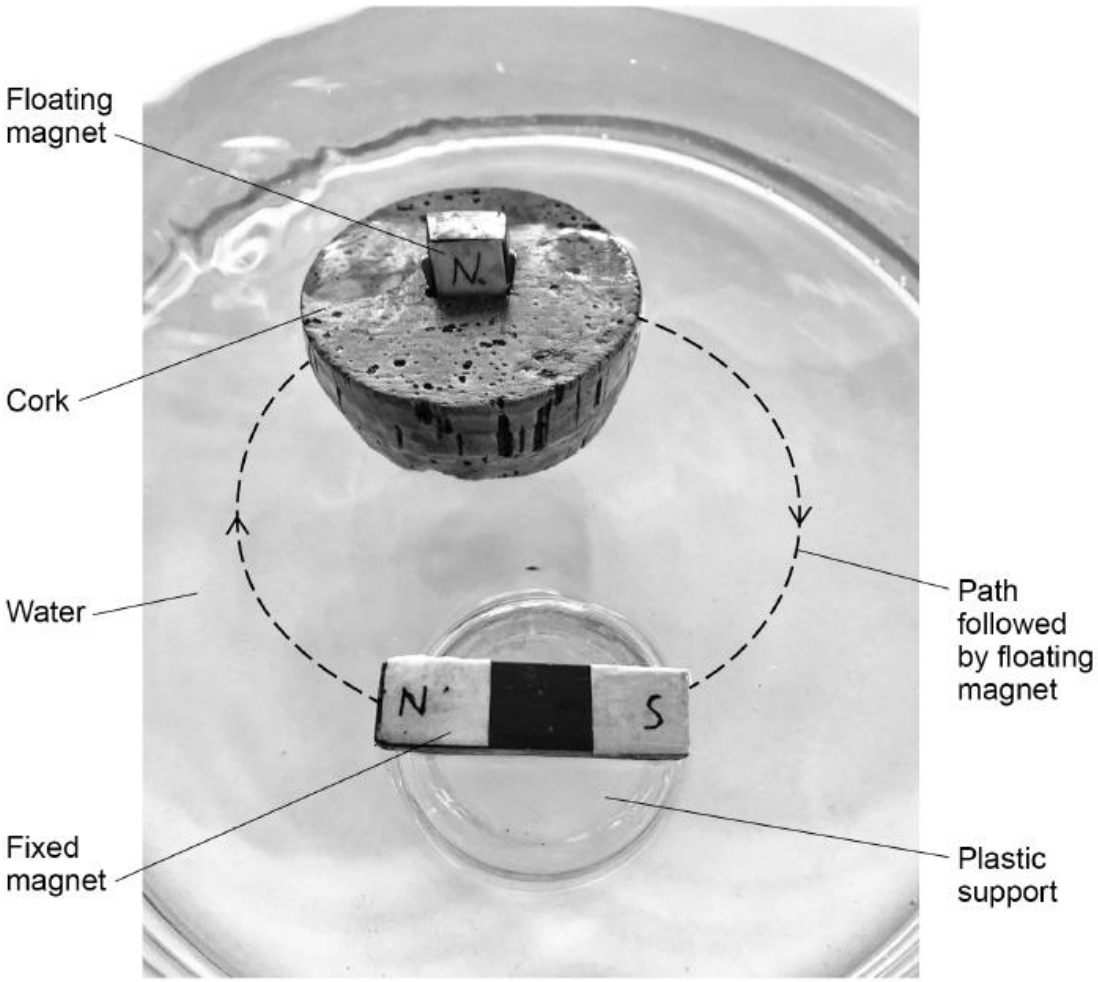
1. June/2020/Paper_2F/No.5

0 5 A student placed a magnet on top of a plastic support in a bowl of water. This magnet was fixed in position and above the surface of the water.

The student put a second magnet into a piece of cork so that the magnet floated on the water. Only the north pole of the floating magnet was above the surface of the water.

Figure 6 shows the arrangement of the magnets.

Figure 6



0 5 . 1 The floating magnet was placed near to the north pole of the fixed magnet. The floating magnet then moved along the path shown in **Figure 6**.

Explain why.

[2 marks]

0 5 . 2 The student replaced the floating magnet with a piece of iron.

What happened to the piece of iron?

[1 mark]

0 5 . 3 Describe how to use a compass to plot the magnetic field pattern around a bar magnet.

Use **Figure 7** to help you.

[4 marks]

Figure 7

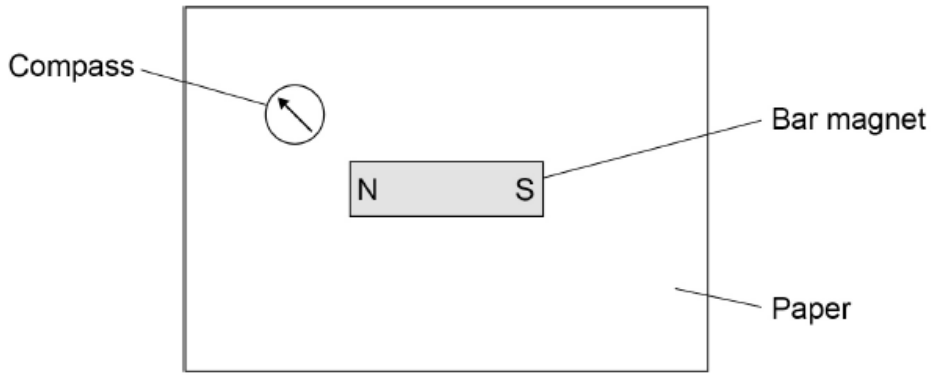
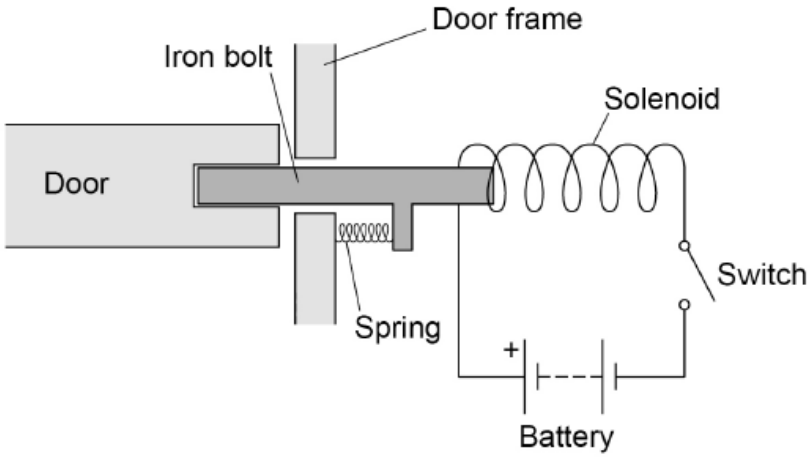


Figure 8 shows a diagram of an electromagnetic lock used to secure a door.

Figure 8



0 5 . 4 **Figure 9** shows an incomplete sequence of how the door unlocks.

Figure 9

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

[2 marks]

A The iron bolt moves.

B A magnetic field is created around the solenoid.

C There is a current in the circuit.

0 5 . 5 The electromagnetic lock contains a spring.

When the door is unlocked the extension of the spring is 0.040 m.

spring constant = 200 N/m

Calculate the elastic potential energy of the spring when the door is unlocked.

Use the equation:

$$\text{elastic potential energy} = 0.5 \times \text{spring constant} \times (\text{extension})^2$$

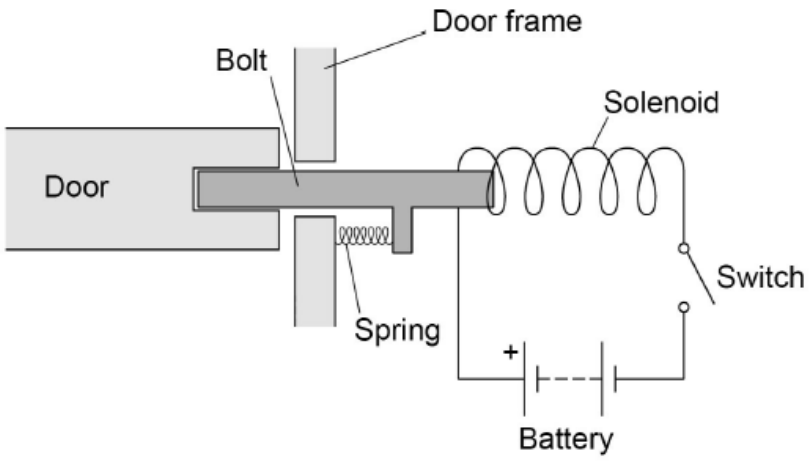
[2 marks]

Elastic potential energy = _____ J

2. June/2020/Paper_2H/No.4(4.3_4.4)

Figure 6 shows a diagram of the lock. The door unlocks when the switch is closed.

Figure 6



0 4 . 3 Which material should the bolt be made from?

[1 mark]

Tick (✓) **one** box.

Aluminium ☐

Brass ☐

Copper ☐

Iron ☐

0 4 . 4 Explain why the door unlocks when the switch is closed.

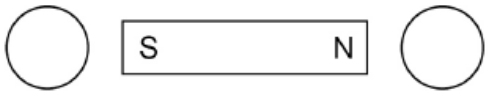
[3 marks]

3. June/2019/Paper_2F/No.3

0 3 . 1 **Figure 5** shows a bar magnet.

Each circle represents a compass.

Figure 5



Draw an arrow inside each circle to show the direction that each compass would point.

[1 mark]

0 3 . 2 **Figure 6** shows part of a coat.

The coat has two magnets hidden inside the material.

Figure 7 shows how the magnets are used to fasten the coat.

Figure 6

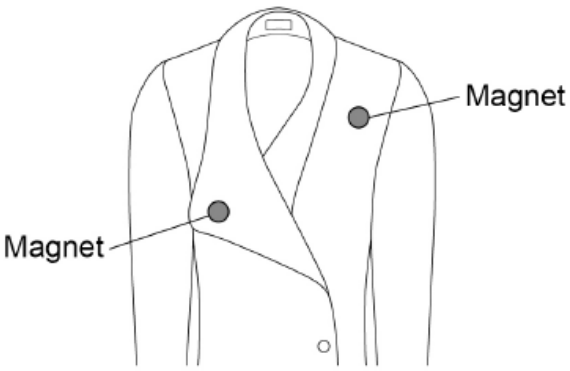
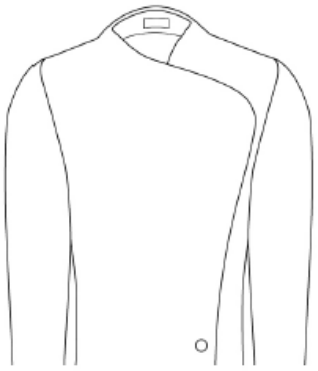


Figure 7



Explain why the magnets inside the coat must **not** have two south poles facing each other.

[2 marks]

A coil of wire is connected to a battery.

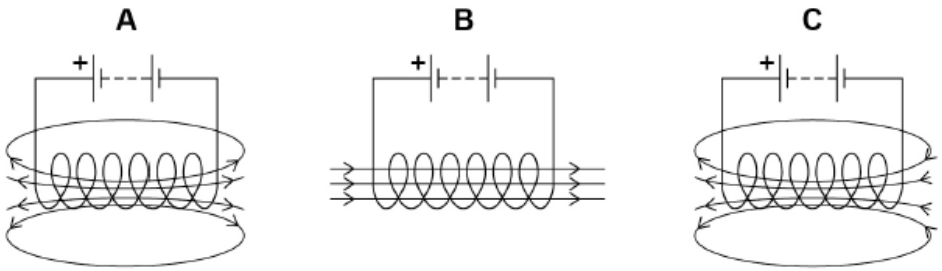
The current in the coil produces a magnetic field.

0 3 . 3 Which diagram in **Figure 8** shows the magnetic field produced by the current in the coil?

[1 mark]

Tick (✓) **one** box.

Figure 8



A ☐ B ☐ C ☐

0 3 . 4 A solid rod is placed inside the coil.

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

[1 mark]

Tick (✓) **one** box.

Glass rod ☐

Plastic rod ☐

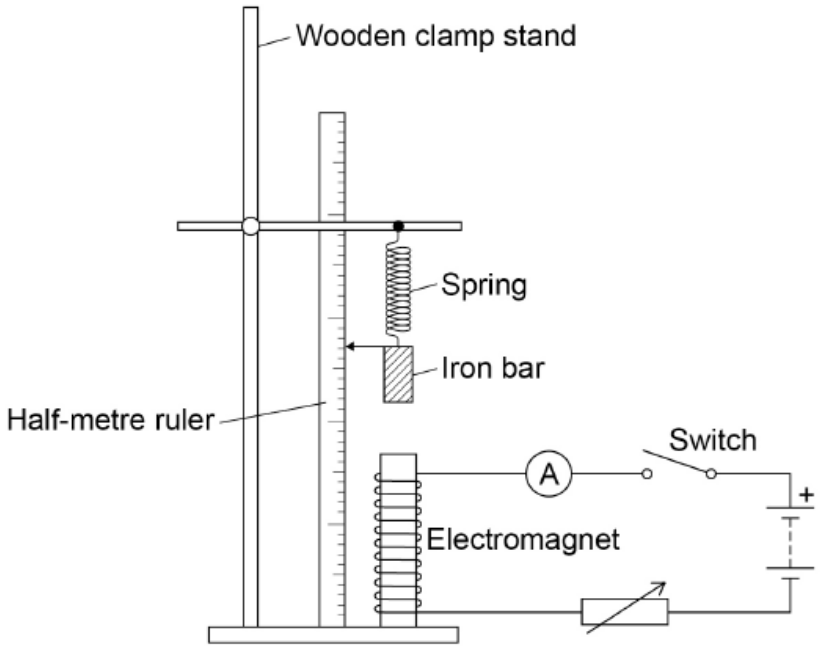
Steel rod ☐

Wooden rod ☐

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

Figure 9 shows the equipment the student used.

Figure 9



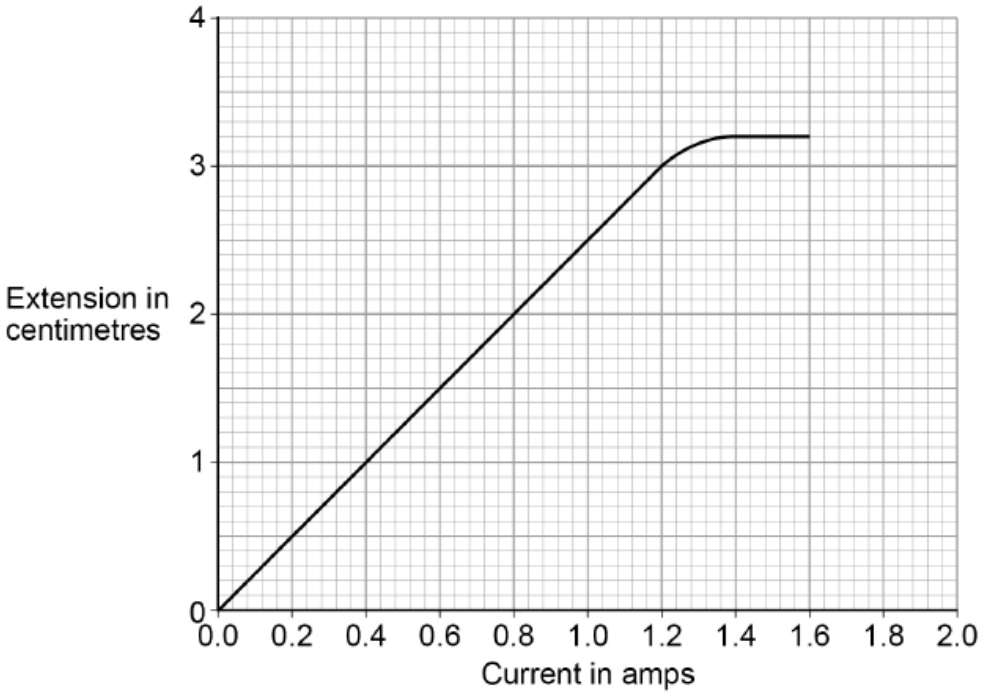
0 3 . 5 Why does the spring get longer when the electromagnet is switched on?

[1 mark]

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

Figure 10 shows the results.

Figure 10



0 3 . 6 The current in the coil is increased from 0.6 A to 1.2 A

Determine the increase in the extension of the spring.

[1 mark]

Increase in the extension = _____ cm

0 3 . 7 Calculate the increase in the force on the spring when the current in the coil increased from 0.6 A to 1.2 A

Spring constant = 0.18 N/cm

Use the equation:

force = spring constant × extension

[2 marks]

Increase in the force = _____ N

0 3 . 8 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 marks]

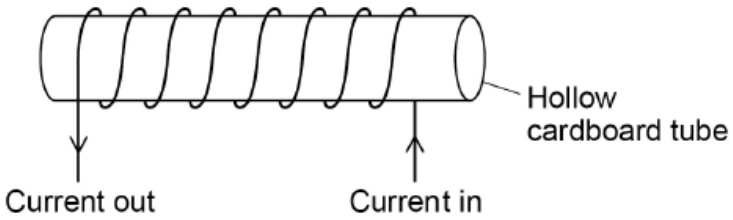
4. June/2019/Paper_2H/No.4

0 4 . 1 **Figure 5** shows a solenoid.

Draw the magnetic field of the solenoid on **Figure 5**.

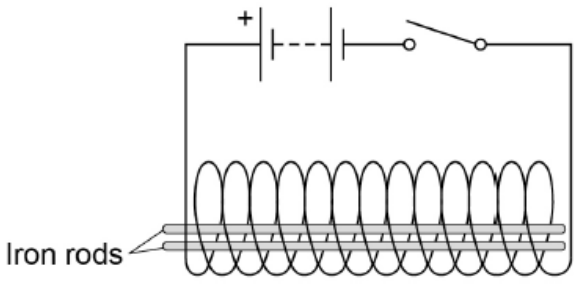
[2 marks]

Figure 5



0 4 . 2 **Figure 6** shows two iron rods placed inside a solenoid.

Figure 6



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

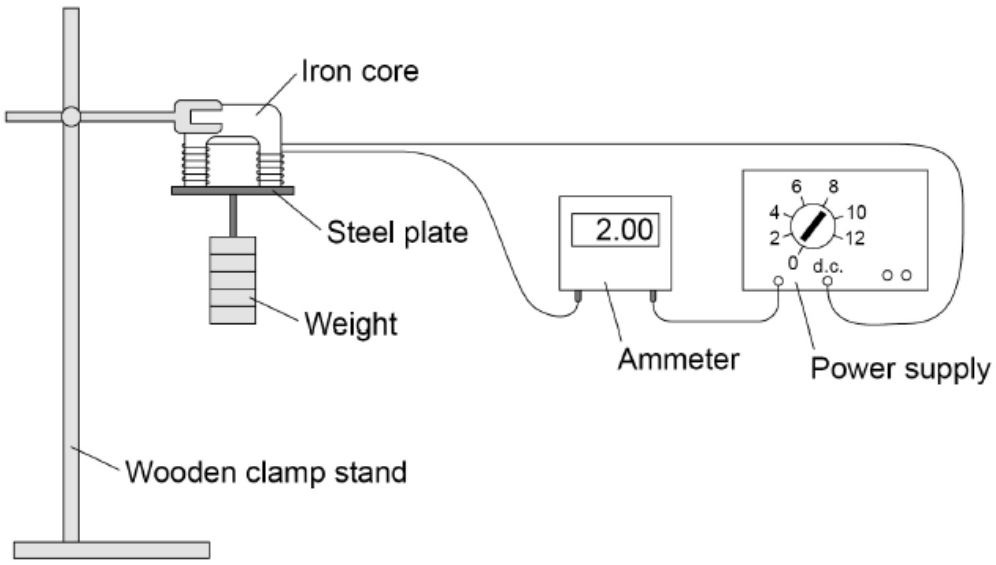
[2 marks]

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 7 shows the equipment used.

Figure 7



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

0 4 . 3 **Table 1** shows the results.

Table 1

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

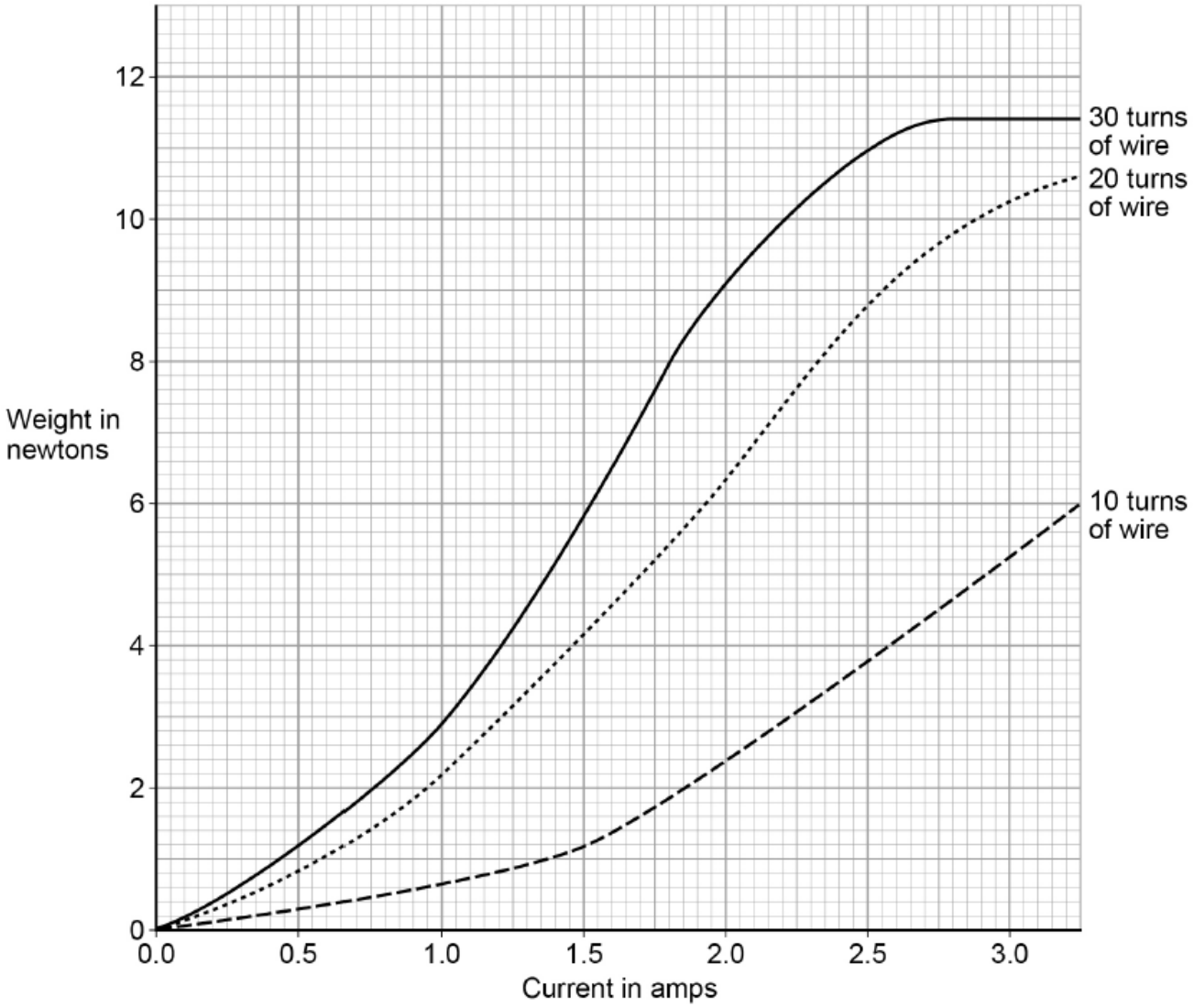
Explain why the method used by the student is **not** valid for this investigation.

[2 marks]

A second student repeated the investigation using the same equipment.

Figure 8 shows the second student's results.

Figure 8



0 4 . 4 How does increasing the current in the wire affect the strength of the electromagnet, when the electromagnet has 30 turns of wire?

[1 mark]

0 4 . 5 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 mark]