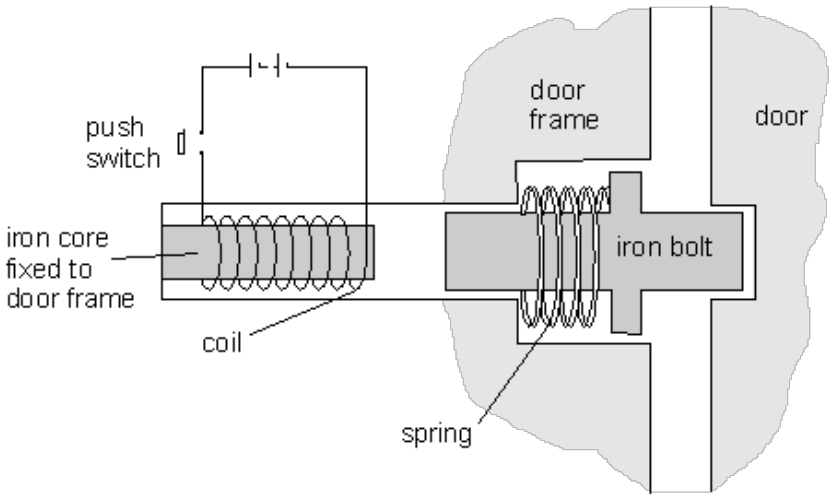
7.9.6 Magnetic Poles

85 minutes

117 marks

Q1. 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.

.....

.....

.....

.....

.....

3 marks

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

.....

.....

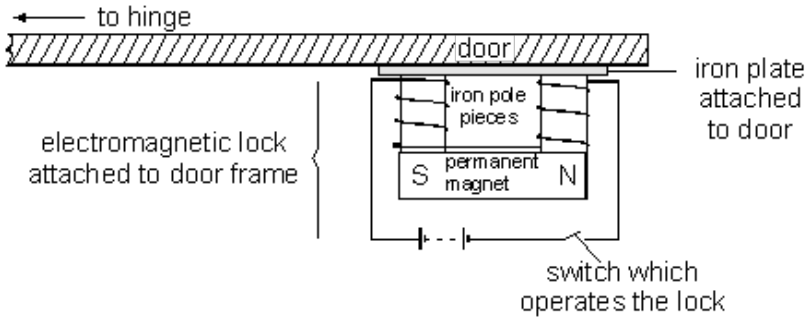
.....

2 marks

Maximum 5 marks

##

The diagram shows a magnetic lock for a door. It consists of both a strong permanent magnet and an electromagnet. It is fitted into the door frame. An iron plate is attached to the door.



(a) In the diagram the switch is open. Explain why the door cannot be opened.

.....

.....

1 mark

(b) When the switch is closed the door may be opened. Explain why the door may now be opened.

.....

.....

1 mark

(c) A burglar tries to get in by cutting the wires to the battery. Explain why the door still cannot be opened.

.....

.....

1 mark

(d) When the wires are repaired, the battery is accidentally connected the other way round.

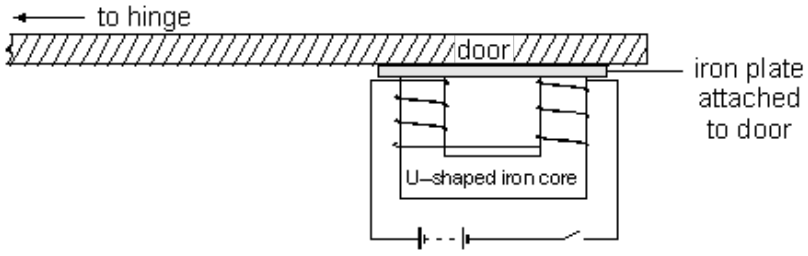
Explain why the door cannot now be opened.

.....

.....

1 mark

(e) Another magnetic lock is shown below. It does **not** have a permanent magnet in it.



Explain how this kind of lock works and why it is not as secure as the one shown at the beginning of the question.

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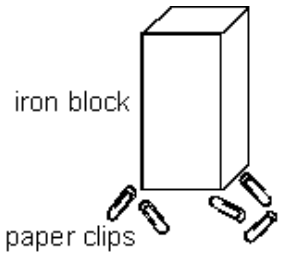
.....

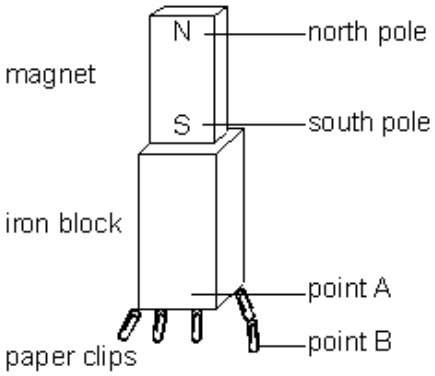
2 marks
Maximum 6 marks

##

An iron block is near some steel paper clips. The paper clips do not stick to the iron block.



A pupil puts a magnet on top of the iron block. The paper clips stick to the iron block and to each other.



(a) What are the magnetic poles at points **A** and **B** in the diagram?
Put **one** tick in each row in the table.

	north pole	south pole	no magnetic pole
point **A**			
point **B**			

2 marks

(b) (i) The sentences below are about the force which the magnet exerts on the iron block.

Tick the box by the **one** correct sentence.

The magnet attracts the iron block. ☐

The magnet repels the iron block. ☐

There is no magnetic force on the iron block. ☐

1 mark

(ii) The sentences below are about the force which the magnetised iron block exerts on the magnet.

Tick the box by the **one** correct sentence.

The iron block attracts the magnet. ☐

The iron block repels the magnet. ☐

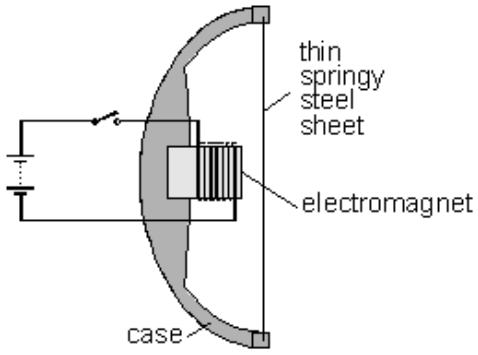
There is no magnetic force on the magnet. ☐

1 mark

Maximum 4 marks

##

A pupil fixes a small electromagnet close to a thin springy steel sheet. The device acts like a small speaker. She connects a battery and switch to the electromagnet as shown.



(a) (i) When the pupil closes the switch, what will happen to the steel sheet?

.....

1 mark

(ii) The pupil opens the switch again. What will happen to the steel sheet now?

.....

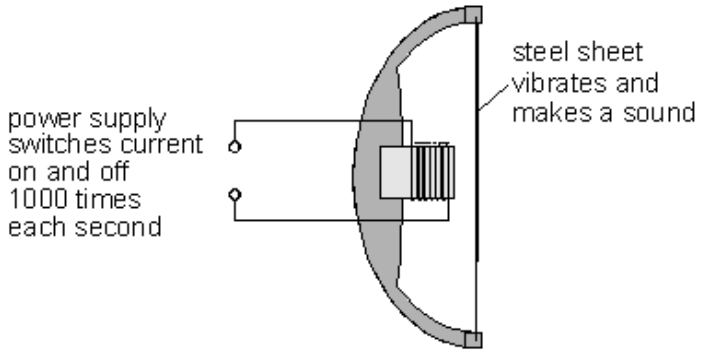
1 mark

(iii) If the pupil had connected the battery the other way round, what difference would this have made to your answer to part (i)?

.....

1 mark

(b) The pupil removes the battery and switch. She connects the electromagnet to a power supply which switches the current on and off 1000 times each second. The steel sheet vibrates and makes a sound.



(i) She then adjusts the power supply so that the current is switched on and off 3000 times each second.

What difference does this make to the pitch of the sound?

Give a reason for your answer.

.....

.....

.....

2 marks

(ii) The pupil now adjusts the power supply so that the current is larger. Explain why this makes the sound louder.

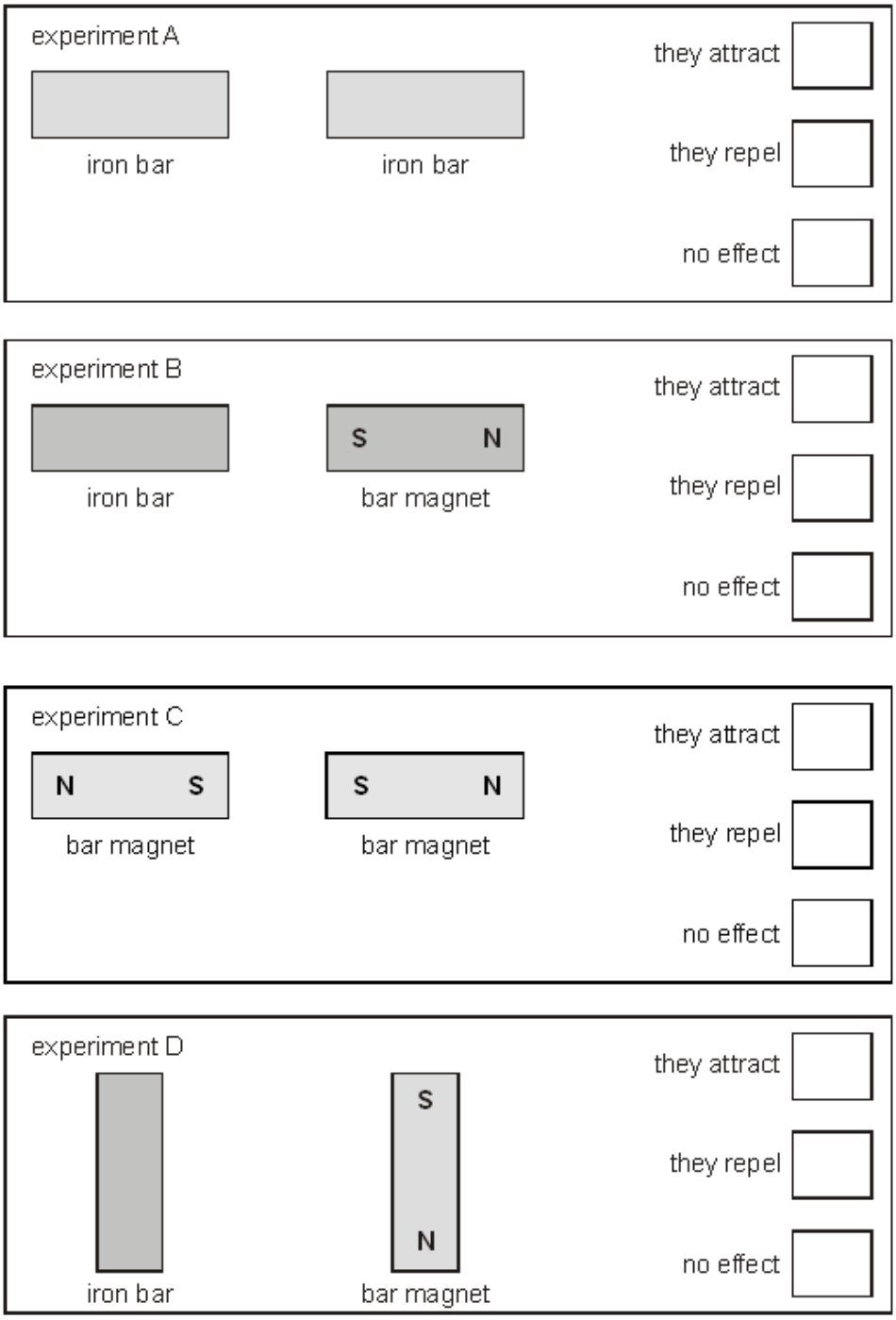
.....

.....

1 mark

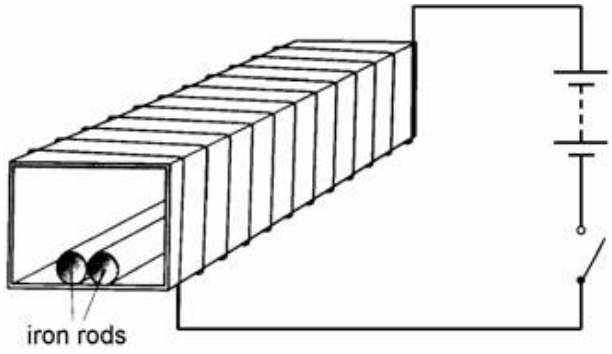
Maximum 6 marks

Q5. A pupil does four experiments with bar magnets and small, unmagnetised iron bars. She places them as shown below. For each experiment, tick **one** box to show the effect of the magnetic force between the two objects.



4 marks

Q6. The diagram shows a rectangular coil and circuit. It has two iron rods in it. The rods are parallel and touching. They are free to move.



(a) When the switch is closed, the two rods move apart.

(i) Explain why this happens.

.....

.....

.....

.....

2 marks

(ii) The switch is then opened to break the circuit. What, if anything, happens to the two iron rods?

.....

.....

1 mark

(b) One of the two iron rods is taken out and replaced with a brass rod.
The rods are parallel and touching.
What, if anything, will happen to the rods when the switch is closed?
Explain your answer.

.....

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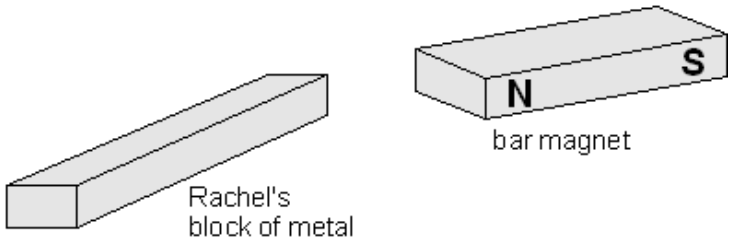
.....

2 marks
Maximum 5 marks

Q7. Rachel has a small block of metal. She wants to know if it is a magnet.



She holds the North pole of the bar magnet near one end of the block of metal. They attract. Then she holds the South pole of the bar magnet near the same end of the block of metal. Again they attract.

(a) Explain how this shows that Rachel's block of metal is **not** a permanent magnet.

.....

.....

1 mark

(b) What metal could Rachel's block be made from?

……

1 mark

(c) Rachel puts the block of metal in a thin plastic bag.
What effect, if any, will the bar magnet now have on the block?

.....

.....

1 mark

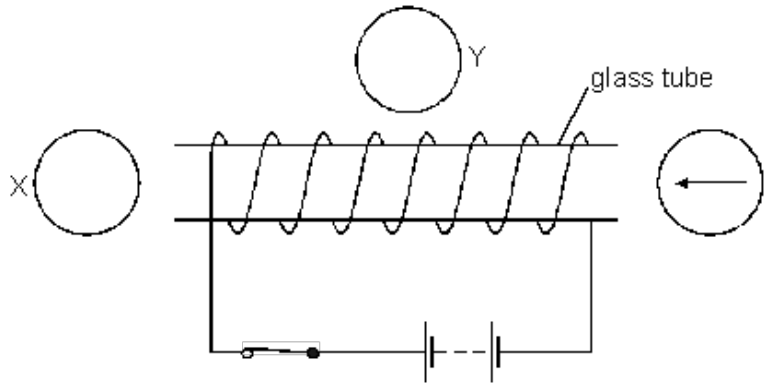
(d) Rachel puts the bar magnet into a pile of coins. Some of the coins are attracted to the magnet but some are not.
Suggest a reason for this.

.....

.....

1 mark
Maximum 4 marks

Q8. A pupil wound a coil of copper wire around a glass tube and connected the wire to a battery. She placed a compass at each end of the tube and one compass beside the tube as shown.



(a) (i) Complete the diagram by drawing arrows in compasses X and Y to show the direction of the magnetic field.

2 marks

(ii) Draw an arrow in the middle of the glass tube to show the direction of the magnetic field in the glass tube.

1 mark

(iii) When the switch is opened, in which direction will the three compass needles point?

.....

1 mark

(b) Give **one** way to reverse the magnetic field around the glass tube

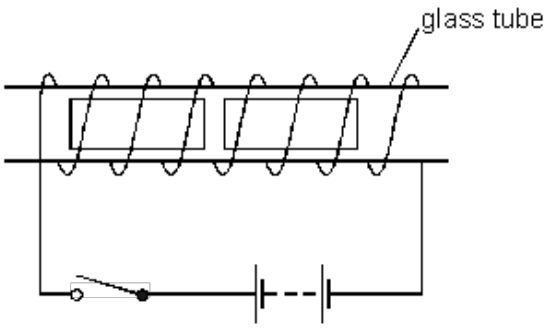
.....

.....

1 mark

(c) Two pieces of iron are placed inside the glass tube.

(i) When the switch is closed, the magnetic field is the same as in the diagram opposite. The pieces of iron become magnetised.
Label the **four** poles on the pieces of iron.



1 mark'

(ii) When the switch was closed, the pieces of iron moved.
Explain why they moved.

.....

.....

1 mark
Maximum 7 marks

Q9. The words 'contains added iron' were printed on Colin's box of cereal.

(a) Colin decided to test the cereal to see if it contained tiny pieces of powdered iron metal.

First he crushed 500 g of cereal into a fine powder and mixed it with water.

He put a clean, white, plastic-coated magnet in the mixture.
Then he stirred it.

If the cereal contains tiny pieces of iron metal, what should Colin expect to see?

.....

.....

1 mark

(b) Colin finds that the cereal **does** contain pieces of powdered iron.
Give **two** differences between iron metal and compounds containing iron.

1. .....

.....

2. .....

.....

2 marks

(c) Colin eats some cereal. The tiny pieces of iron metal in the cereal react with the hydrochloric acid in his stomach.

Complete the word equation to show the reaction of iron with hydrochloric acid.

iron + **hydrochloric acid** → ..... + ...

2 marks

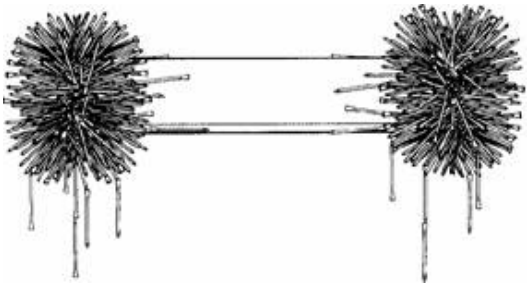
(d) The body needs iron to make red blood cells. The red blood cells transport oxygen to all the cells of the body. People who do not have enough red blood cells may feel that they do **not** have much energy. Explain why.

.....

.....

2 marks
Maximum 7 marks

Q10. Paulo drops a bar magnet into a box of nails. When he picks the magnet up, some nails are sticking to the ends.



(a) What material are the nails made from?

.....

1 mark

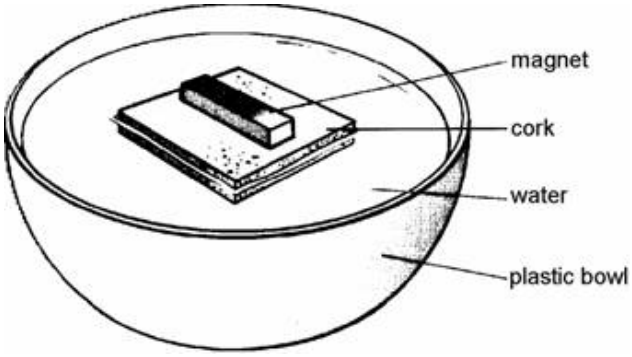
(b) The nails stick to the ends of the bar magnet but not to the middle.
Why do the nails stick to the **ends** of the magnet?

.....

.....

1 mark

(c) Paulo puts a magnet on a piece of cork. He floats the cork on water in a plastic bowl, and spins it round slowly.



When the cork stops spinning, in which direction will the magnet point?

.....

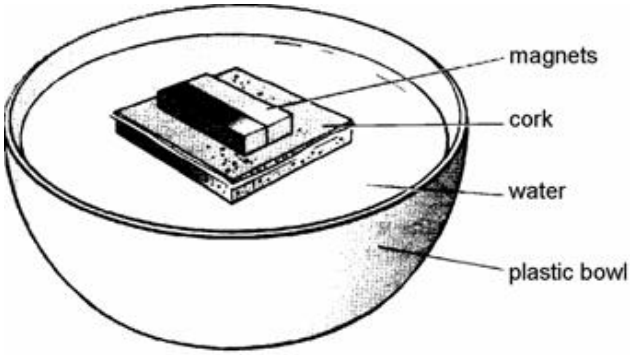
1 mark

(d) Paulo takes a second, identical bar magnet. The two magnets stick together as shown. One of the poles has been labelled on the drawing.

(i) Label the other three poles.

1 mark

(ii) Paulo puts the two magnets on the piece of cork. He floats the cork on the water in the plastic bowl, and again spins it round slowly.



In which direction will the magnets point at the end of the experiment?
Tick the correct box.

In a north-south direction. ☐

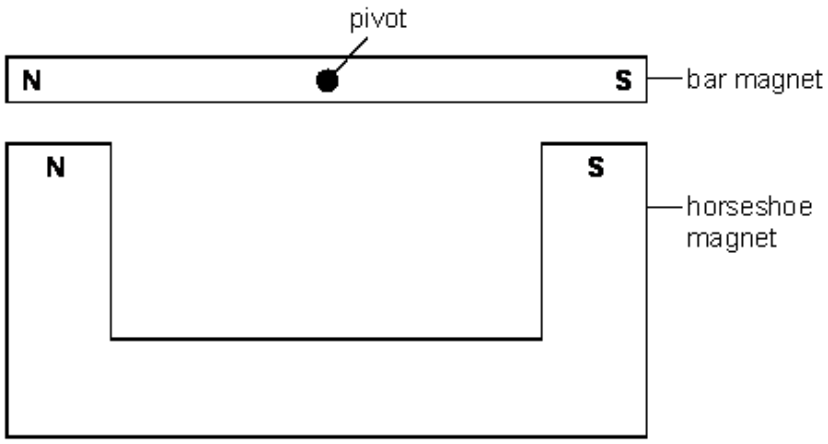
In an east-west direction. ☐

Could be in any direction. ☐

The cork does not stop spinning. ☐

1 mark
Maximum 5 marks

Q11. Anita has arranged a horseshoe magnet with a long bar magnet pivoted above it.



(a) Whenever Anita tips the bar magnet, it always moves back to the position shown in the diagram. Explain why this happens.

……

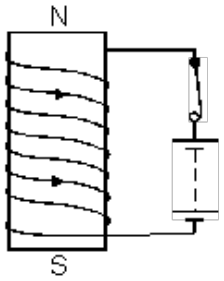
……

……

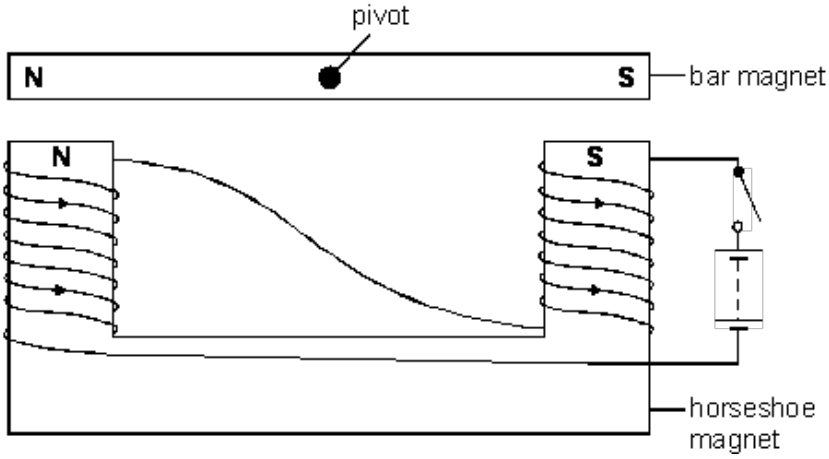
……

2 marks

(b) When a current is passed through a coil, it produces magnetic poles as shown in the diagram below.



Anita winds a coil around each end of the horseshoe magnet as shown below.



(i) Describe what will happen to the bar magnet when she closes the switch. Explain your answer.

……

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……

……

3 marks

(ii) Anita reverses the battery. Suggest what happens to the bar magnet.

……

……

1 mark

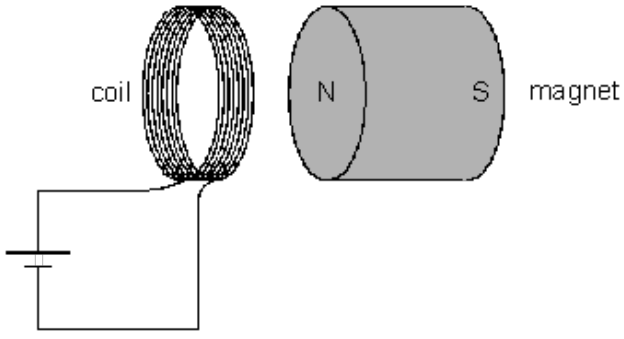
(iii) Anita replaces the battery with a power supply which changes the direction of the current every second. Suggest what happens to the bar magnet.

……

……

1 mark
Maximum 7 marks

Q12. (a) A pupil makes a small coil of copper wire and passes an electric current through it. The pupil places a small magnet near the coil.



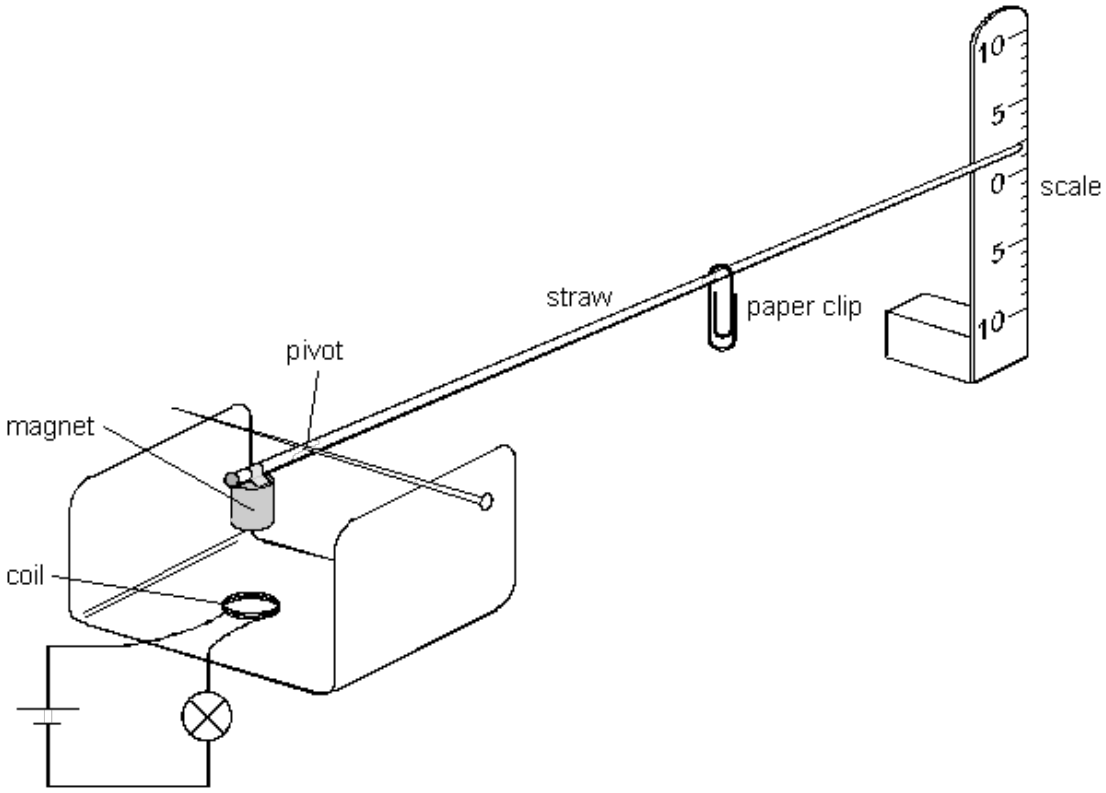
The magnet is attracted towards the coil. The pupil turns the magnet around so that the South pole is nearest the coil.
What effect, if any, will this have?

……

……

1 mark

(b) The pupil uses the coil and the magnet to make a simple ammeter to measure the current through a bulb.



not to scale

(i) The paper clip is used to balance the weight of the magnet.
Why is the paper clip further away from the pivot than the magnet is?

……

……

1 mark

(ii) Explain how a current in the coil makes the straw pointer move.

……

……

……

2 marks

(iii) The pupil places a piece of soft iron in the middle of the coil.
Describe and explain how this will affect the reading on the scale when the same current flows through the coil.

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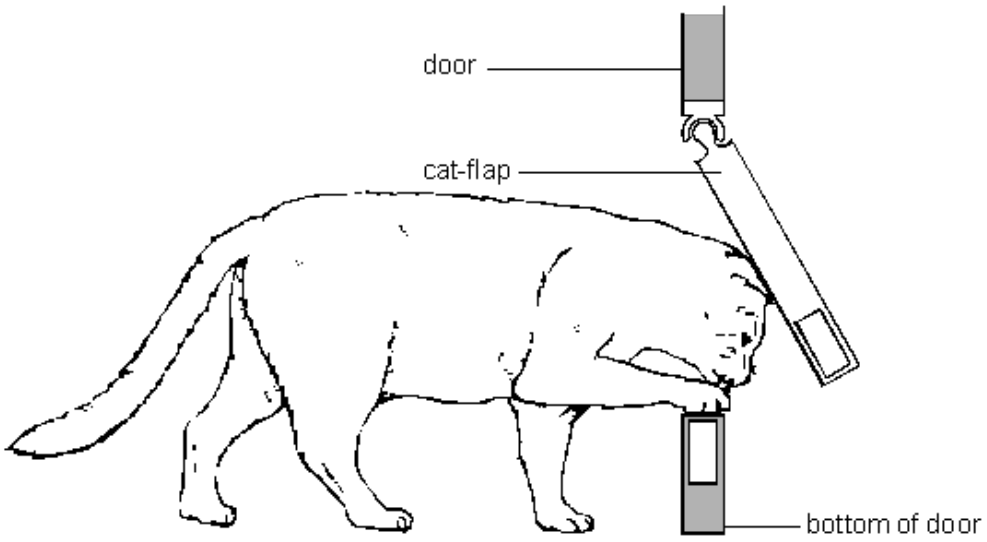
……

2 marks
Maximum 6 marks

Q13. Ali made a cat-flap to fit into a door.



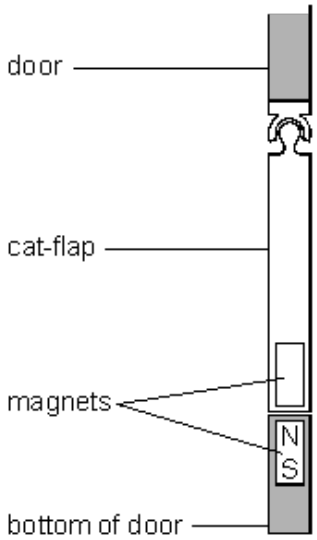
(a) (i) On the diagram above, draw an arrow to show the direction of the force of the cat's head on the cat-flap.

1 mark

(ii) Add a label to the diagram to show the pivot of the cat-flap.
Label it P.

1 mark

When the cat has gone through the cat-flap, the weight of the cat-flap makes the flap close.



(b) Ali used two bar magnets to keep the cat-flap closed, so that it does **not** blow open in the wind.

On the diagram above, label **both** the North and South poles on the magnet in the cat-flap.

1 mark

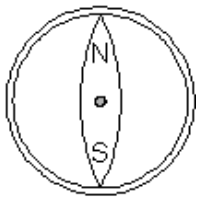
(c) Friction at the pivot made the cat-flap squeak. What could Ali put on the pivot to make the friction less?

……

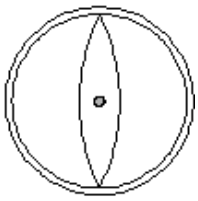
1 mark
Maximum 4 marks

Q14. (a) Sam has two small compasses. When he puts them a long way apart, they both point North.

Label the North and South magnetic poles on compass B.



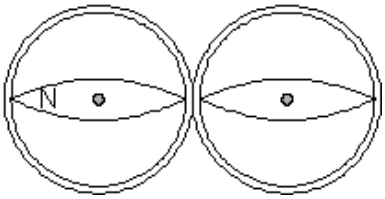
compass A


compass B

1 mark

(b) Sam puts the compasses side by side.

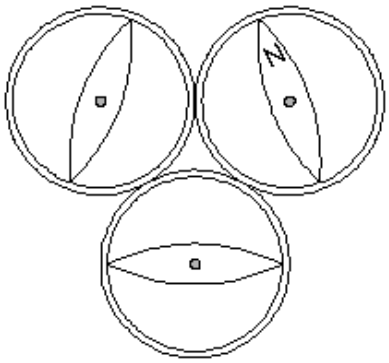
Label the North and South magnetic poles on **both** compasses.
One pole has been done for you.



1 mark

(c) Sam then puts three compasses close together.

Label the North and South magnetic poles on each of the **three** compasses.
One pole has been done for you.



1 mark

(d) What metal are compass needles made from?

.....

1 mark
Maximum 4 marks

Q15. (a) Debbie put a paper cup into a glass beaker.
She glued a magnet in the bottom of the paper cup.
She glued another magnet in the bottom of the beaker.
The magnets repelled.

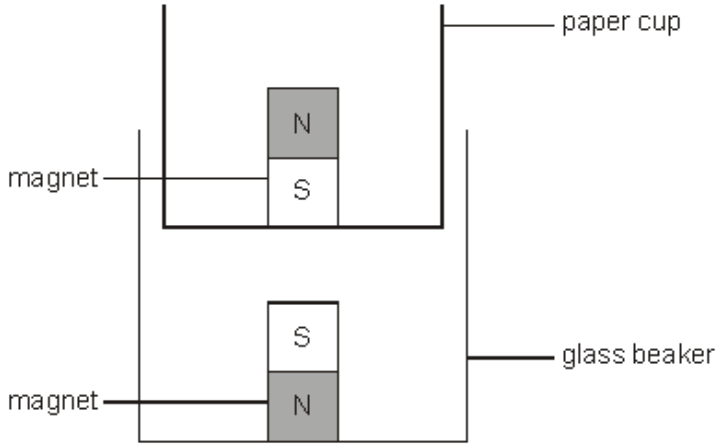


diagram A

not to scale

What **two** forces act on the paper cup and its contents to keep it in this position?

1. .....

1 mark

2. .....

1 mark

(b) Debbie put 5 g of aluminium rivets into the paper cup.
It moved down a little as shown in diagram B.

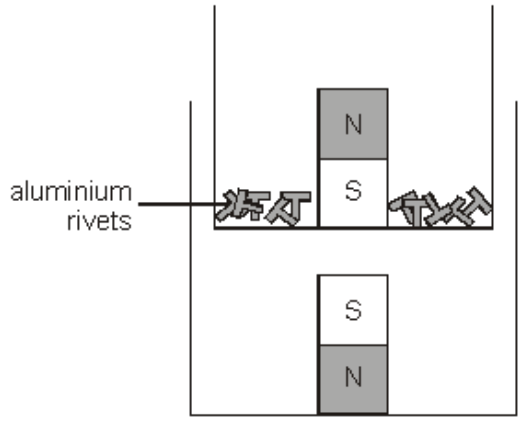
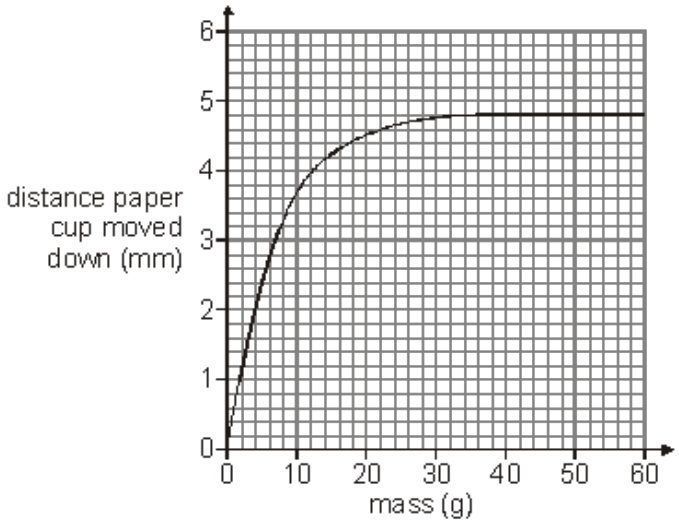


diagram B

not to scale

Debbie plotted a graph to show how the mass of aluminium rivets affected the distance the cup moved down.



(i) Use the graph to find the mass that made the cup move down 4 mm.

..... g

1 mark

(ii) Why did the graph stay flat with masses greater than 40 g?

.....

1 mark

(c) Debbie removed the 5 g of aluminium rivets and put 5 g of iron nails into the cup.

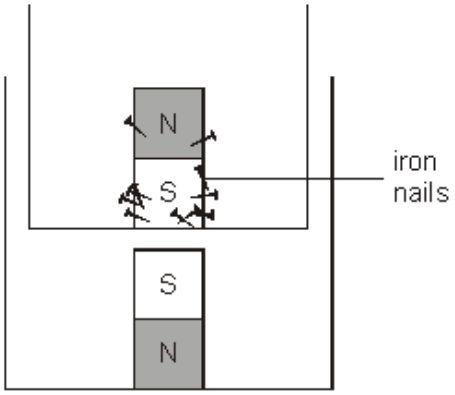


diagram C

not to scale

The paper cup moved down more with 5 g of iron nails than with 5 g of aluminium rivets as shown in diagram C.
Give the reason for this.

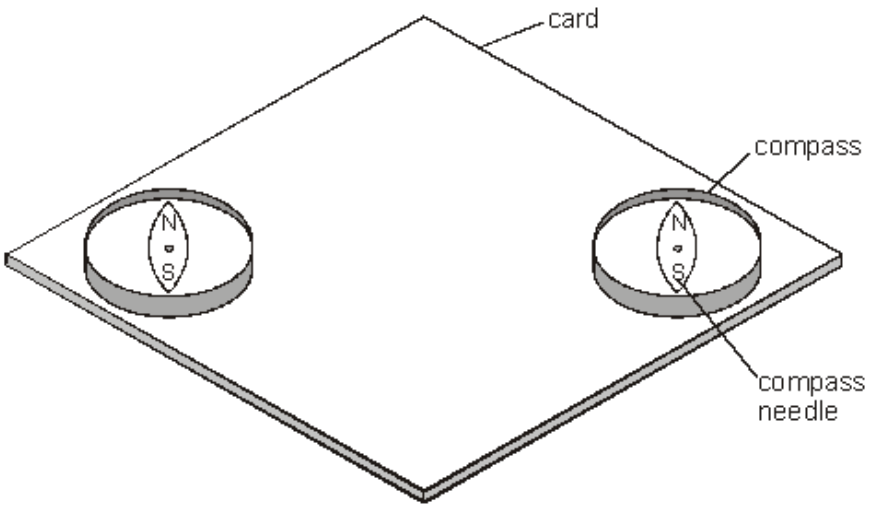
.....

.....

1 mark
maximum 5 marks

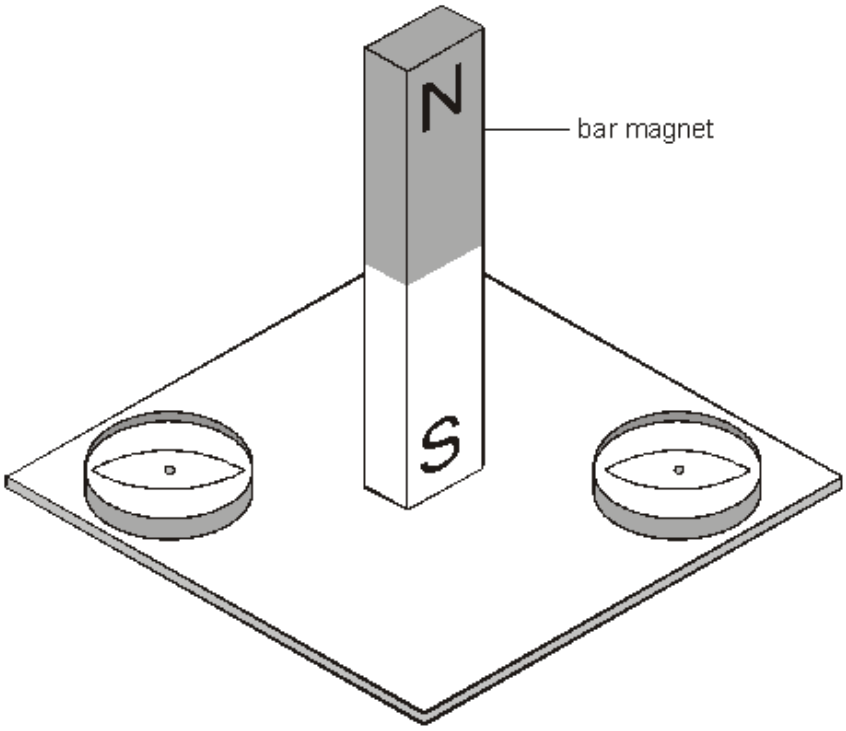
Q16. A compass needle is a small magnet with a North pole, N, and a South pole, S.

Ruth placed two compasses onto a piece of card.
Both compass needles pointed in the direction shown below.



(a) Ruth placed a bar magnet with its **South pole** between the two compasses.
The compass needles moved as shown below.

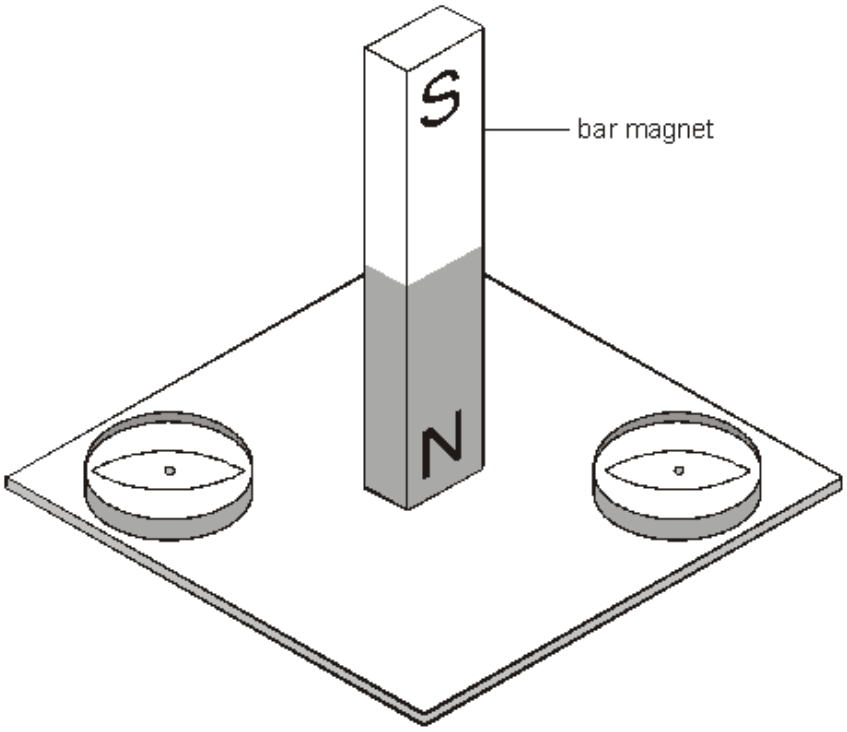
On the diagram below, label the North pole and South pole of each compass needle.
Use the letters N and S.



1 mark

(b) Ruth turned the bar magnet round so that the **North pole** was between the two compasses.

On the diagram below, label the North pole and South pole of each compass needle now.
Use the letters N and S.



1 mark

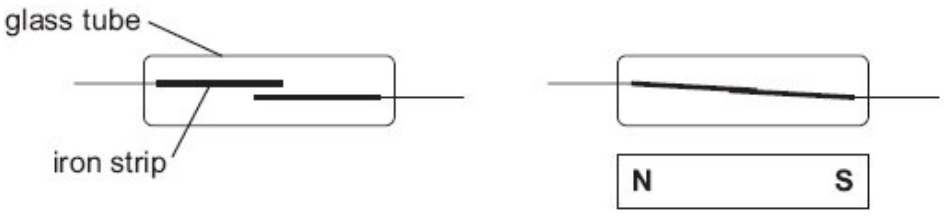
(c) Ruth repeated her experiment with an aluminium bar instead of a bar magnet.

What happened to the compass needles?

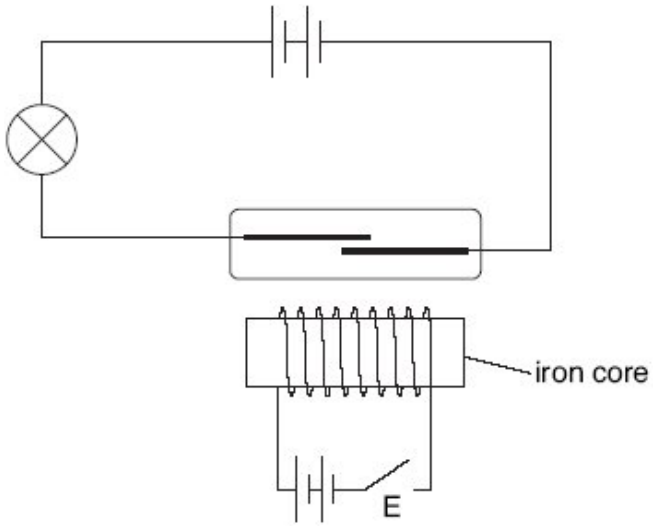
.....

1 mark
maximum 3 marks

Q17. A reed switch is made of two iron strips inside a glass tube.
The iron strips close together when a magnet is brought near.
They spring apart again when the magnet is removed.



(a) Hilary set up the circuit shown below.
She tried to close the reed switch using an electromagnet.



She closed switch E but the electromagnet was **not** strong enough to close the reed switch.

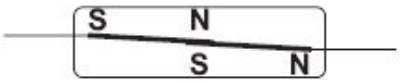
(i) Give **two** ways Hilary could increase the strength of the electromagnet.

1. .....

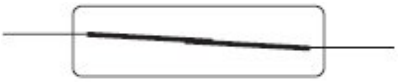
2. .....

2 marks

(ii) Hilary increased the strength of the electromagnet.
The reed switch closed.
The iron strips were magnetised as shown below.



She reversed the current in the coil of the electromagnet.
On the diagram below, label the poles of the iron strips when the current was reversed.



1 mark

(b) (i) Iron and steel are both magnetic materials.
Explain why the strips must be made of iron and **not** steel.

.....

.....

1 mark

(ii) She replaced the reed switch with a piece of copper wire.
The current through the bulb increased.

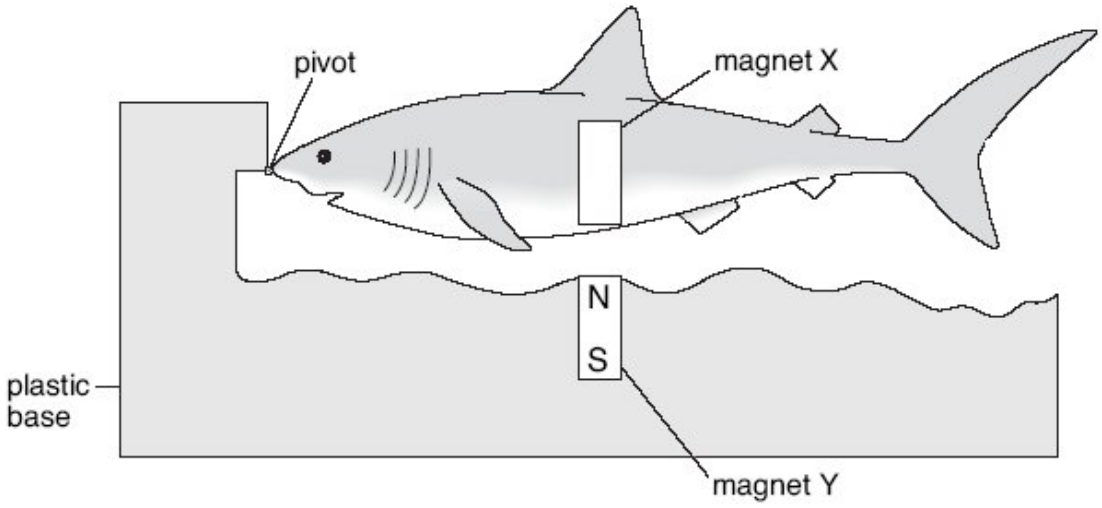
Explain why more current flowed through the bulb when the reed switch was replaced with copper wire.

.....

.....

1 mark
maximum 5 marks

Q18. The drawing shows a toy shark. Magnets X and Y make the shark 'float' above the plastic base.



(a) On magnet X, write the letters N and S to label the poles of the magnet.

1 mark

(b) (i) Choose a word from the list below to complete the sentence.

attract **cancel** **repel**

The toy shark 'floats' because the magnets ..... each other.

1 mark

(ii) Sophie pressed down on the tail of the shark with her finger.

What happened to the shark when she removed her finger?

.....

1 mark

(c) Sophie added weights to the toy shark and measured the distance between the two magnets.
Her results are shown below.

weight added to the toy shark (N)	distance between the magnets (mm)
0.1	6
0.2	4
0.3	3

Complete the sentence below.

As the weight on the toy shark increased, the distance between the magnets

.....

1 mark

(d) Sophie turned the magnet in the plastic base the other way up.

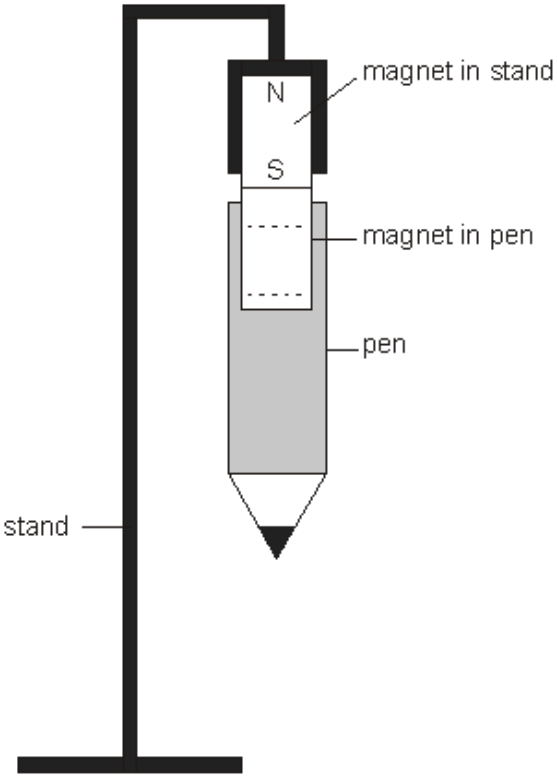
What happened to the shark?

.....

1 mark
maximum 5 marks

Q19. The diagram below shows a pen.

The pen is held up by two magnets, one in the stand and the other in the pen.

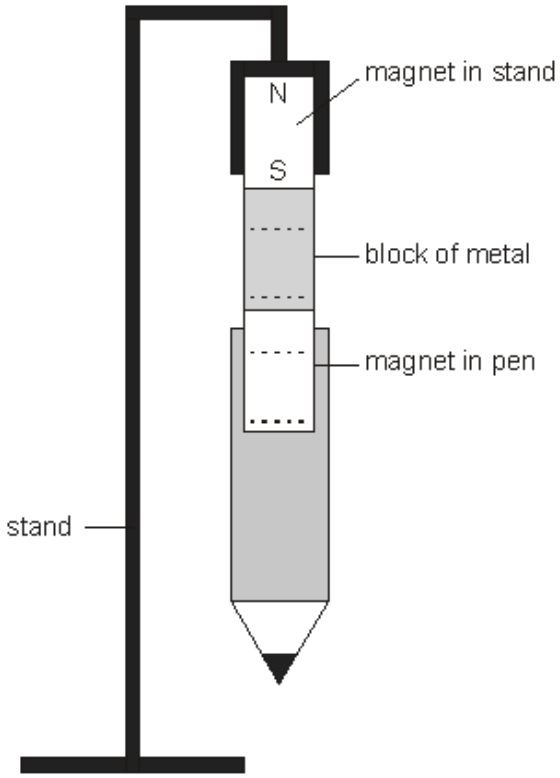


(a) **On the dotted lines above**, label the North pole and the South pole of the magnet in the pen.

Use the letters N and S.

1 mark

(b) John put a block of metal between the two magnets as shown below.



The block of metal became a magnet.

(i) **On the dotted lines above**, label the North poles and the South poles of both the block of metal **and** the magnet.

Use the letters N and S.

1 mark

(ii) What metal could the block be made of?

.....

1 mark

(c) John repeated the experiment using a piece of wood instead of a block of metal.
The pen did **not** stay up.
Give the reason for this.

.....

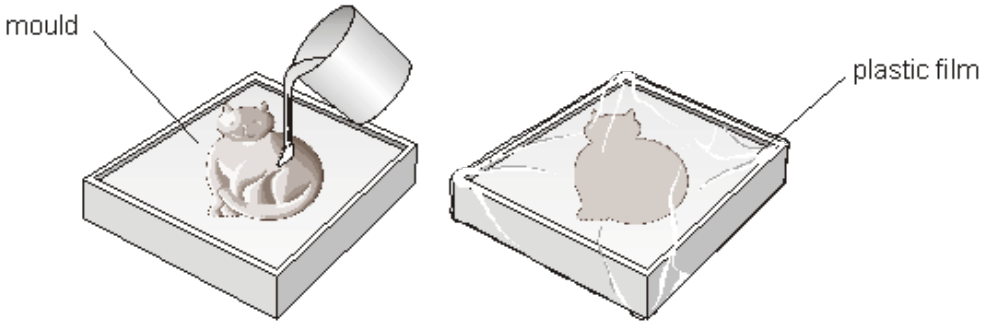
1 mark
maximum 4 marks

Q20. Sam made a model cat.

He mixed modelling powder with water.

He poured all of the mixture into a mould.

He covered the mould with plastic film so that water could **not** evaporate.



(a) (i) After 10 minutes, Sam removed the model cat from the mould.

Sam had mixed 40 g of modelling powder with 12 g of water.
What was the mass of the model cat?

..... g

(ii) Complete the sentence below using words from the list.

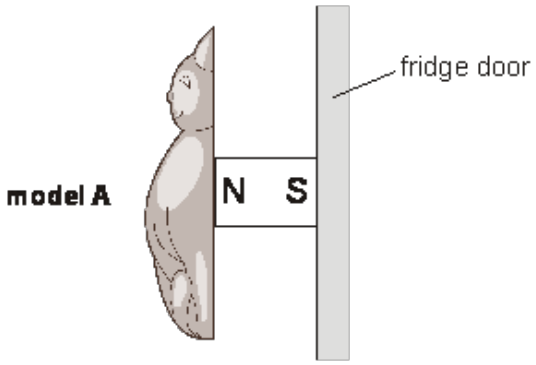
gas **liquid** **solid** **vapour**

After 10 minutes, the mixture in the mould changed from a

..... into a .....

2 marks

(b) Sam attached a small magnet to the model cat.
The magnet was attracted to the fridge door.



What metal are magnets made from?

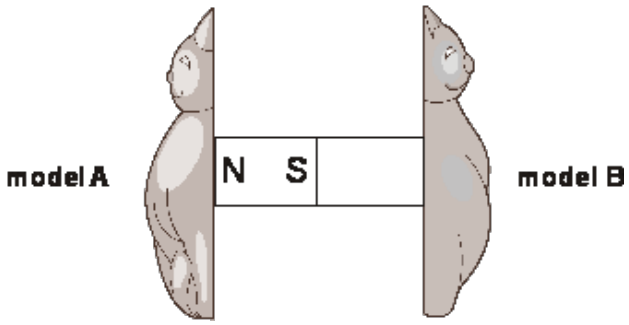
.....

1 mark

(c) Sam made another model, B. He attached a small magnet to model B.

(i) Sam placed model A next to model B. The magnets attracted each other.

Label the poles on the magnet on model B
Use the letters N and S.



(ii) Sam then turned the magnet on model A around.
What would happen to model B?

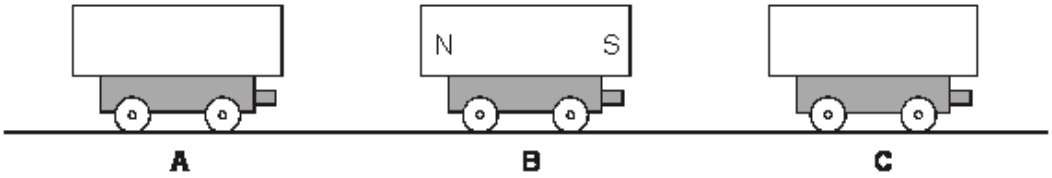
.....

2 marks
maximum 5 marks

Q21. The diagram below shows three trolleys.
Peter put a bar magnet on each trolley.

(a) He pushed trolleys A, B and C together.

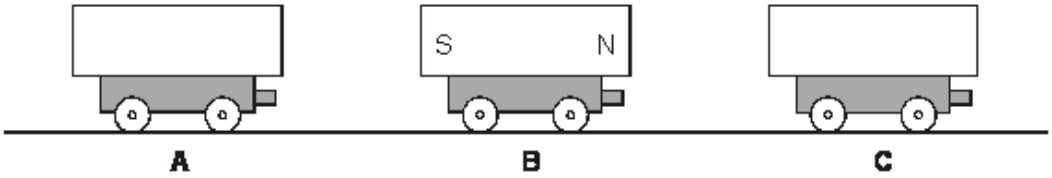
- Magnet B **attracted** magnet A.
- Magnet B **repelled** magnet C.



On the diagram above, label the north and south poles of magnets A and C.
Use the letters N and S.

2 marks

(b) Peter turned trolley B around. Trolleys A and C were **not** turned around.



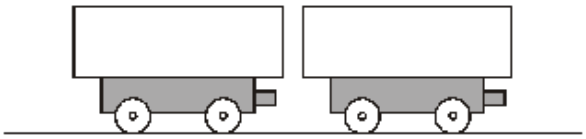
What would happen now when Peter pushed them all together?
Use either **attract** or **repel** to complete each sentence below.

Magnet B would ..... magnet A.

Magnet B would ..... magnet C.

1 mark

(c) Peter held two trolleys close together and then let go.



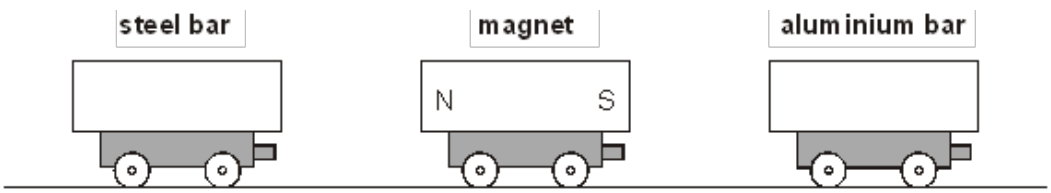
The magnets repelled each other.

Draw an arrow on both magnets to show which way they would move.

1 mark

(d) Peter took a magnet, a steel bar and an aluminium bar.

He put them on three trolleys as shown below.



(i) What happens to the steel bar as he moves it closer to the magnet?

.....

1 mark

(ii) What happens to the aluminium bar as he moves it closer to the magnet?

.....

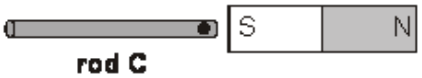
1 mark
maximum 6 marks

Q22. 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.

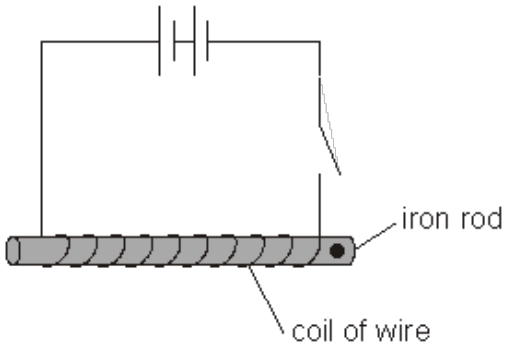
(a) Hannah uses **only** a bar magnet to identify each rod.
She puts each pole of the bar magnet next to the dotted end of each rod.

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

test	observations	type of rod
	attract	Rod A is ..... .
	attract	
	nothing happens	Rod B is ..... .
	.....	
	attract	Rod C is ..... .
	.....	

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.

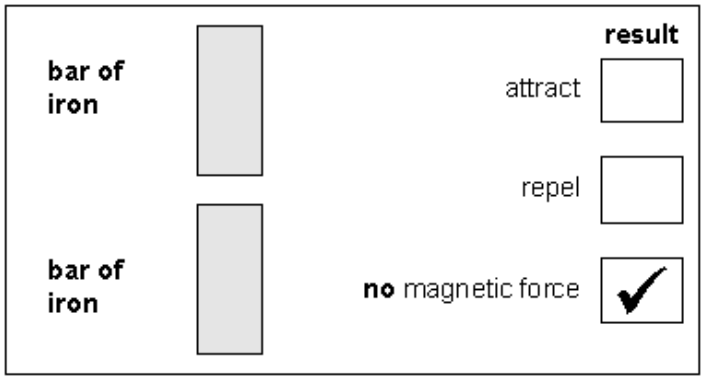
1. .....

1 mark

2. .....

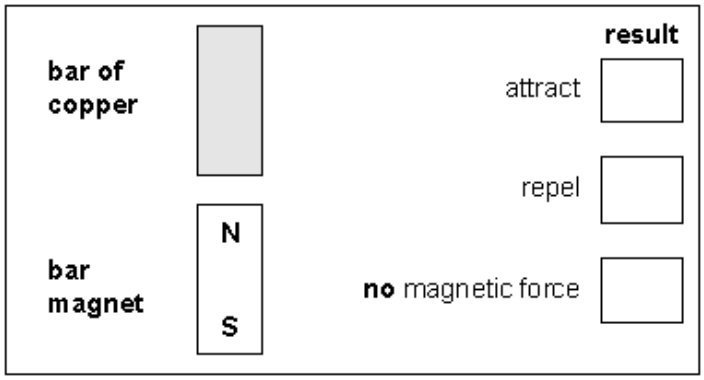
1 mark
maximum 5 marks

Q23. David put two bars of iron close to each other.
There was **no** magnetic force between them.
David recorded the result as shown below.



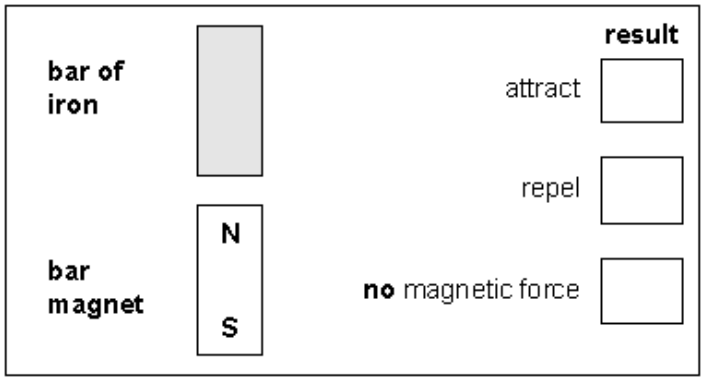
(a) David did three other tests.
Tick the correct box to show the result for each test.

(i)



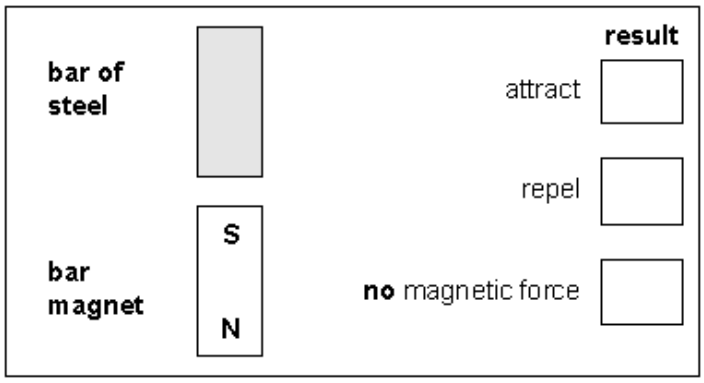
1 mark

(ii)



1 mark

(iii)



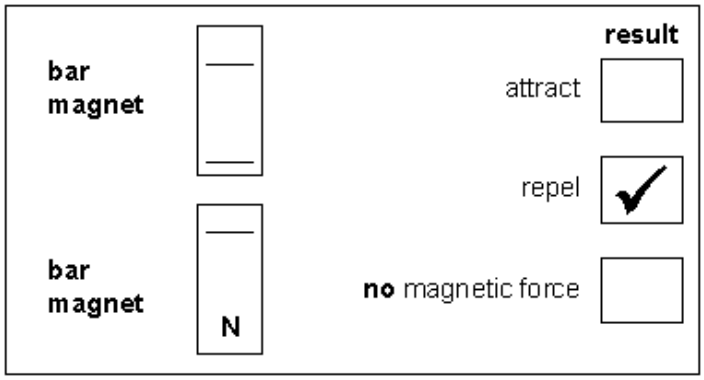
1 mark

(b) David then did two experiments with magnets.

The tick in each box shows David's results in each experiment.

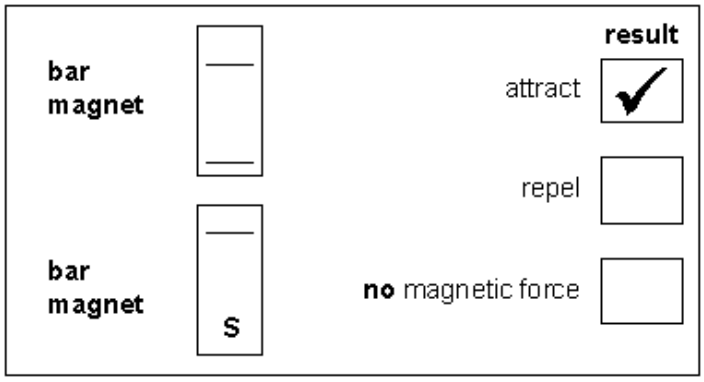
Label the missing poles on **each** magnet to match David's results.

(i)



1 mark

(ii)



1 mark

maximum 5 marks