Electricity and Magnetism

From circuits to magnets, electricity and magnetism are closely linked ideas that run throughout KS3 physics and into GCSE Science.

(d) Sophie tests each material with a magnet.

Which two materials are attracted to the magnet?
Tick the **two** correct boxes.

aluminium	☐	slate	☐
iron	☐	plastic	☐
marble	☐	steel	☐

KS3 Science SATs, Tier 3-6, Paper 1 (2009) - Q5(d)

(i) On the line below each diagram, give the name of the part.



_____ _____ _____

(ii) In the space below, draw a circuit diagram to show how these **three** parts are connected in a torch.

KS3 Science SATs, Tier 3-6, Paper 1 (2005) - Q6(b)

4. The drawings show six objects made from different materials.



iron nail



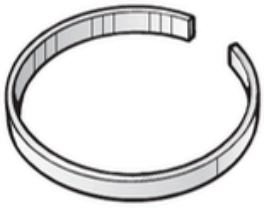
steel paper-clip



silver earrings



gold ring



copper bracelet



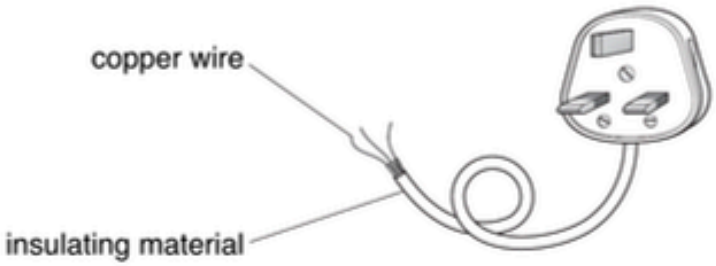
aluminium can

(a) Fill the gaps in the sentences below.

The objects are made from materials that are all types of _____. All the materials are good conductors of electricity and _____.

Modern Tuition

(c) The drawing below shows part of an electric cable and a plug.



(i) What material could be put around the wires to insulate them?

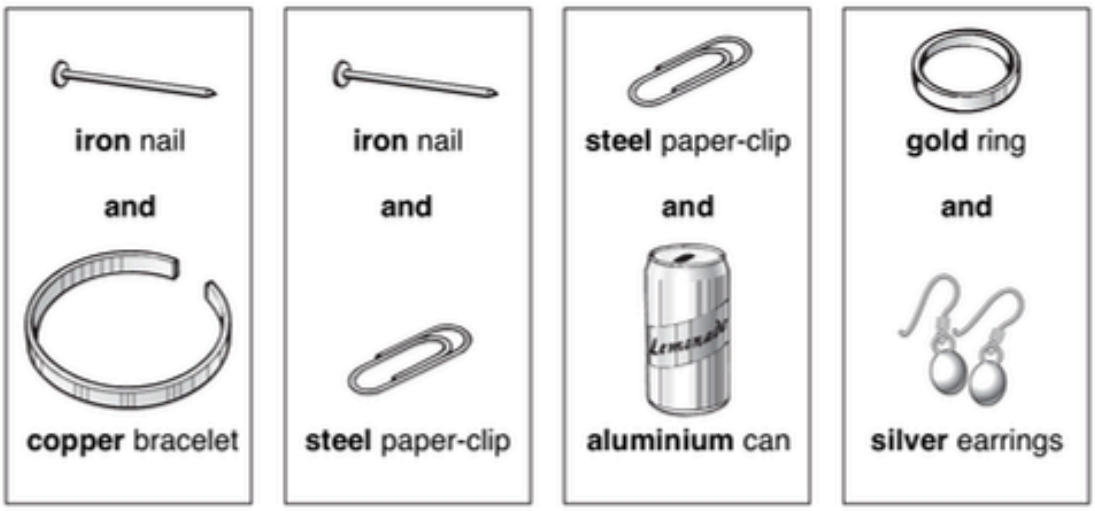
_____

(ii) Why is this insulating material needed?

_____

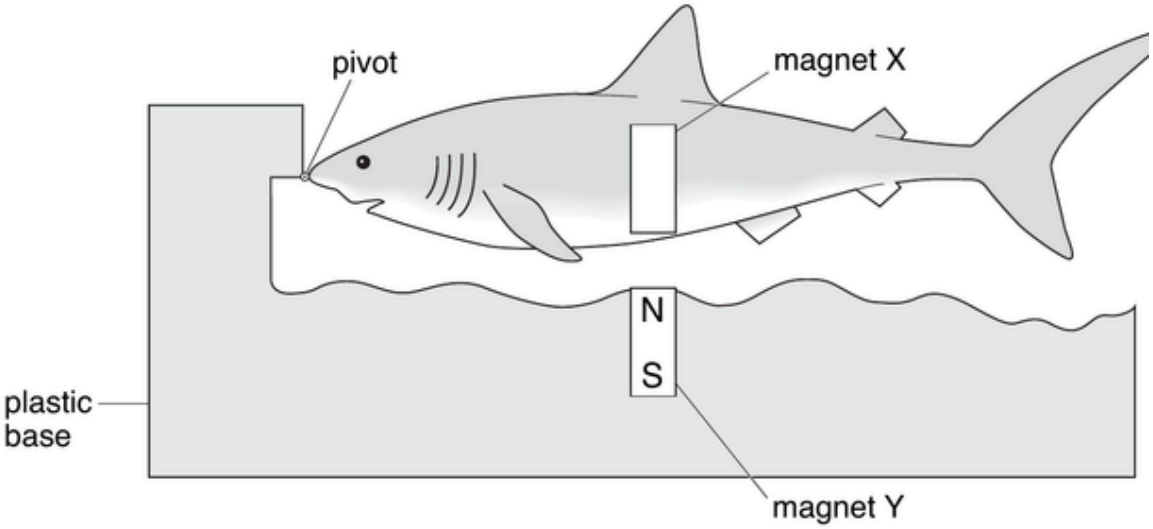
_____

(d) Which pair of objects is attracted to a magnet?
Tick the correct box.



Modern Tuition

7. 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.

7a
1 mark

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

attract **cancel** **repel**

7bi
1 mark

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

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

What happened to the shark when she removed her finger?

7bii
1 mark

_____

Modern Tuition

(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 _____.

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

What happened to the shark?

_____

15. Alex makes an electromagnet.
She winds insulated wire around an iron nail.
She connects the wire to a power supply.
She uses the electromagnet to pick up some steel paper-clips.



This is her prediction.

The more turns of wire around the iron nail, the stronger the electromagnet becomes.

(a) (i) Give the **one** factor she should change as she investigates her prediction.

15ai
1 mark

(ii) Give **one** factor she should keep the same.

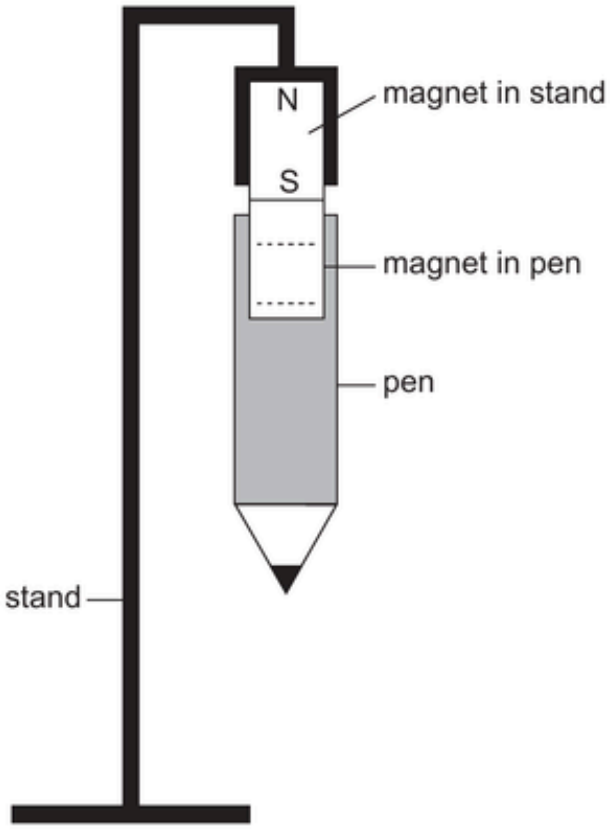
15aii
1 mark

(iii) Describe how she could use the paper-clips to measure the strength of the electromagnet.

15aiii
1 mark

Modern Tuition

6. The diagram below shows a pen.
The pen is held up by two magnets, one in the stand and the other in the pen.

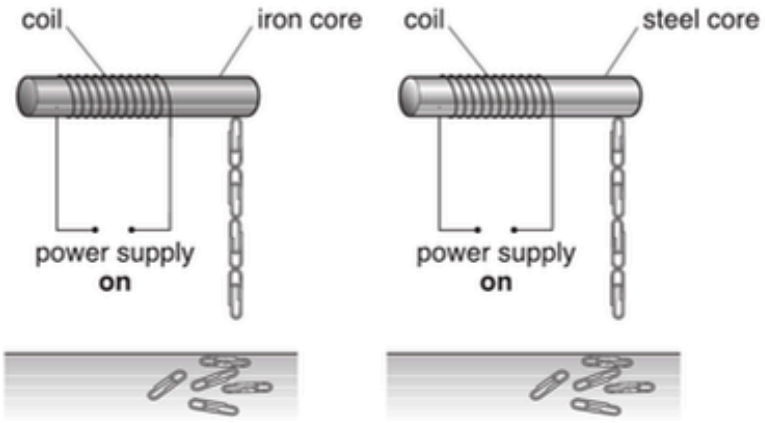


(a) On the dotted lines above, label the North pole and the South pole of the magnet in the pen.

Use the letters N and S.

Modern Tuition

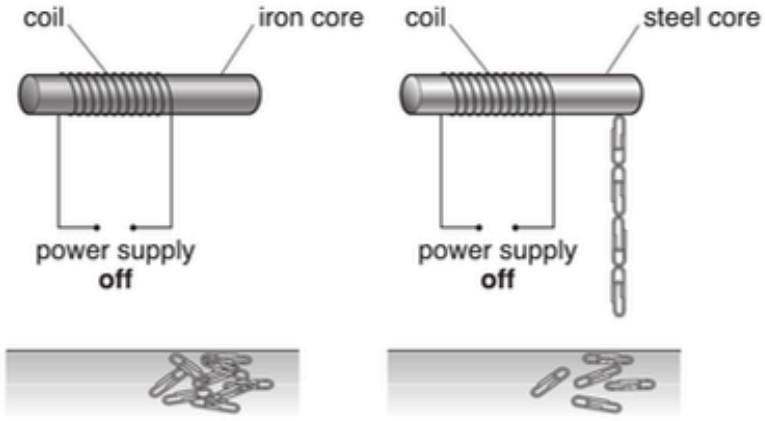
16. David made two electromagnets as shown below.
He used paper-clips to test the strength of each electromagnet.
He switched on the power supply in both circuits.



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

16a
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.

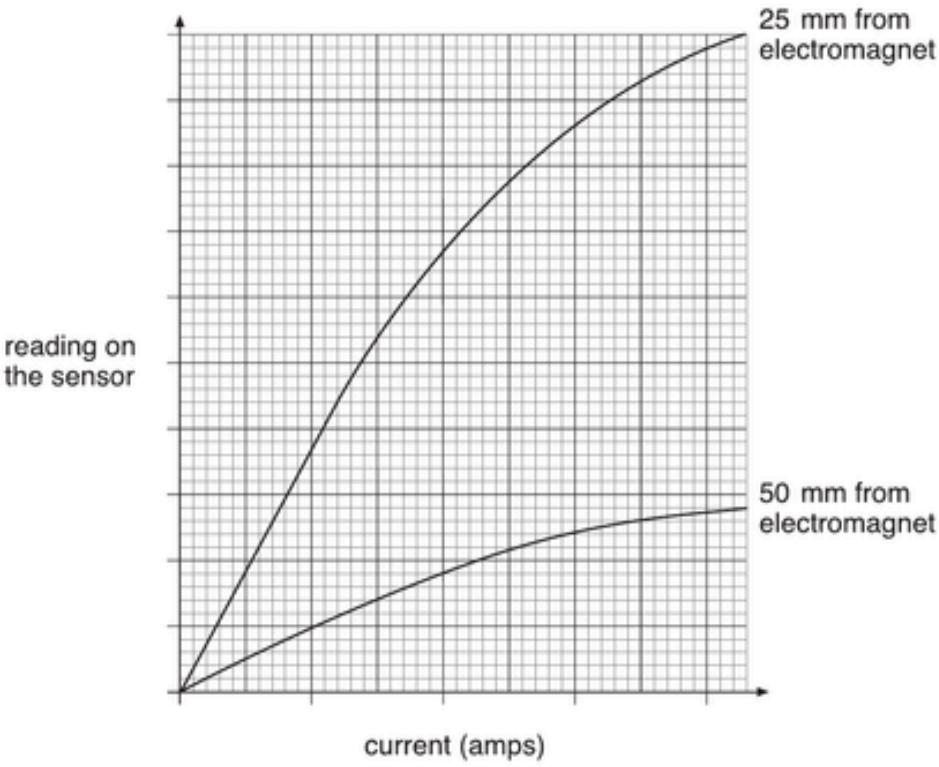


Why is iron used, rather than steel, for the core of an electromagnet?
Use the diagrams above to help you.

16b
1 mark

Modern Tuition

(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?

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

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

Modern Tuition

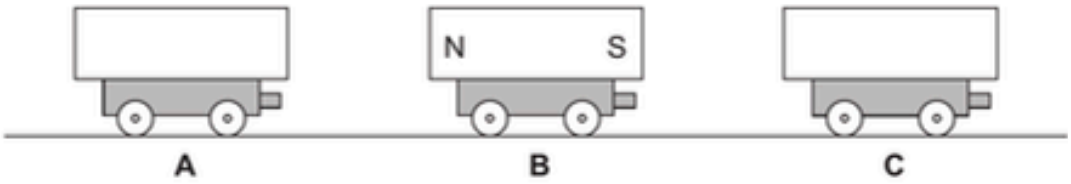
7. The diagram below shows three trolleys.
Peter put a bar magnet on each trolley.

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

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

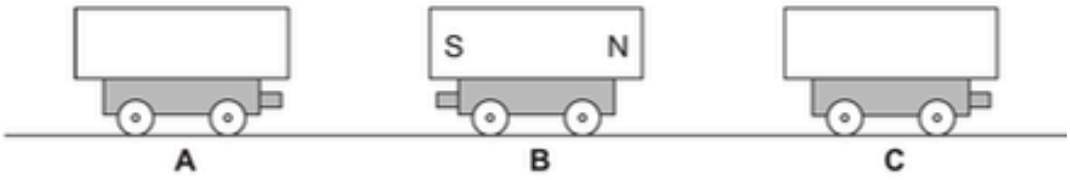
7a
1 mark

7a
1 mark



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

(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.

7b
1 mark

Modern Tuition

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

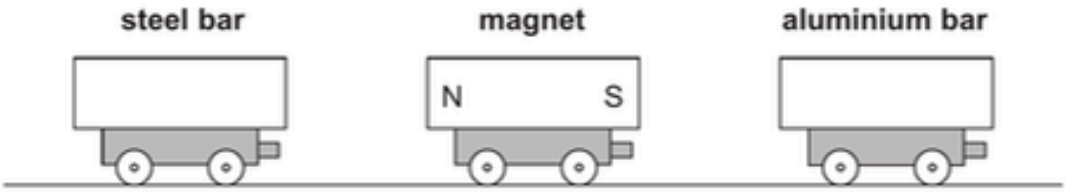


The magnets repelled each other.

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

(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?

_____

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

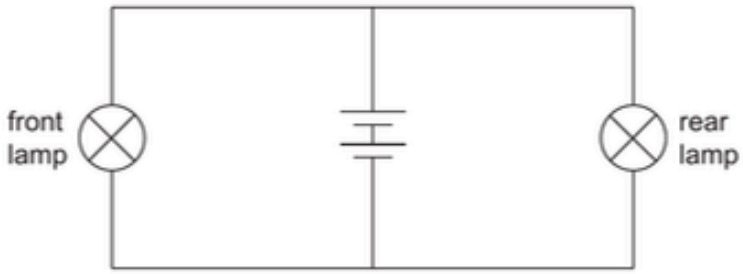
_____

Modern Tuition

15. Nina's bicycle has a front lamp and a rear lamp.
Both lamps are connected to the same battery.



(a) The circuit diagram for the lamps is drawn below.



15ai
1 mark

(i) **On the circuit diagram above**, place a letter **A** to show the position of a switch to turn **only** the front lamp on and off.

15aii
1 mark

(ii) **On the circuit diagram above**, place a letter **B** to show the position of a switch to turn **both** lamps on and off at the same time.

Modern Tuition

(c) Nina replaces the battery with a generator called a dynamo.
When Nina pedals her bicycle, the back wheel turns the generator.

Complete the sentences below using words from the box.

chemical	**electrical**		**gravitational**
kinetic	**light**	**sound**	**thermal**

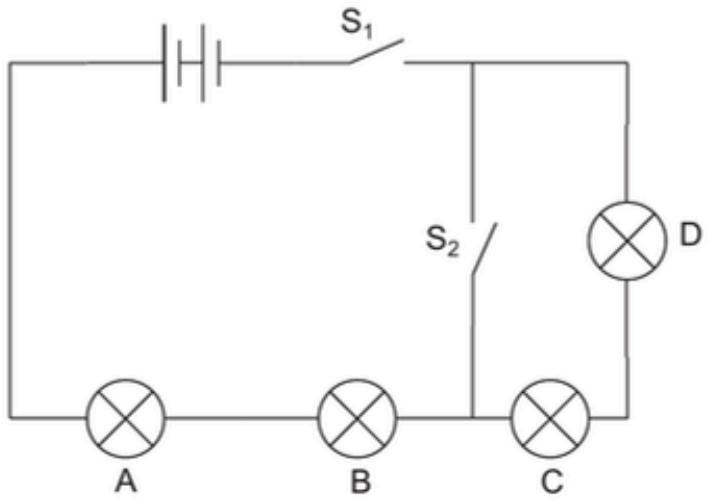
As Nina pedals, _____ energy in her muscles is changed to kinetic energy.

When the generator turns, kinetic energy is changed to useful _____ energy in the wires. This energy in the wires is changed to useful _____ energy in the bulb.

When the lamps are on, some of the energy in the bulb is wasted as _____ energy.

Modern Tuition

9. Lorna built the circuit drawn below. All the bulbs are identical.

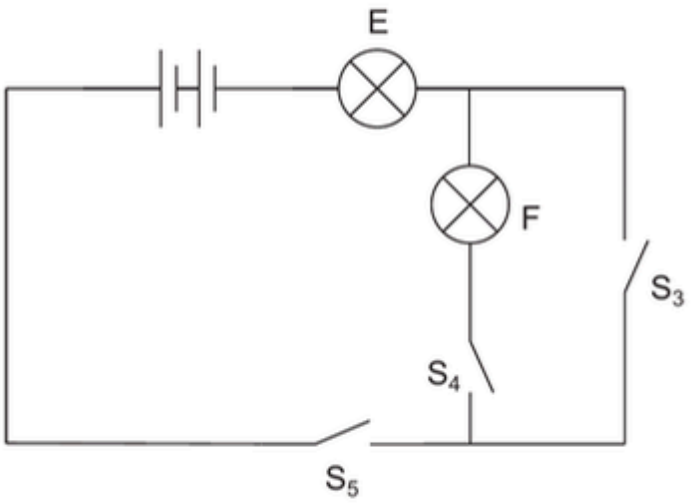


(a) Complete the table below by writing **on** or **off** for each bulb.
One has been done for you.

switch		bulb			
S_1	S_2	A	B	C	D
open	open	off	off	off	off
open	closed				
closed	open				
closed	closed				

Modern Tuition

(b) Lorna then built a different circuit as shown below.



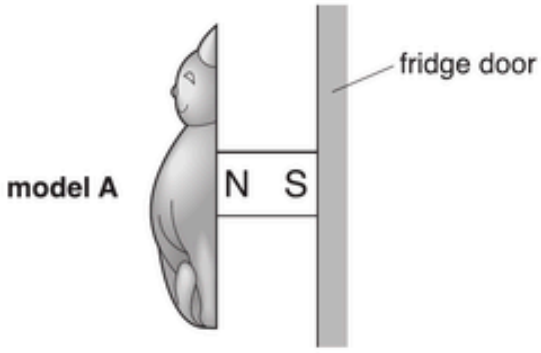
How could Lorna get both bulbs to light at the same time in this circuit?

_____

_____

Modern Tuition

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



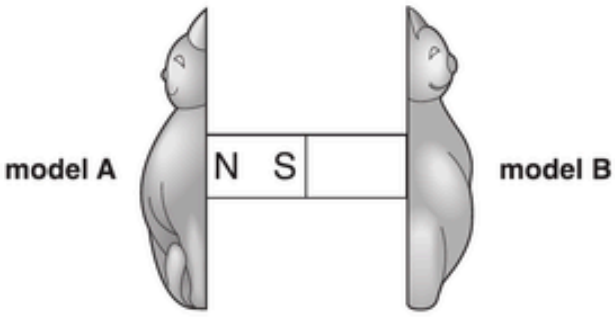
What metal are magnets made from?

_____

(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.

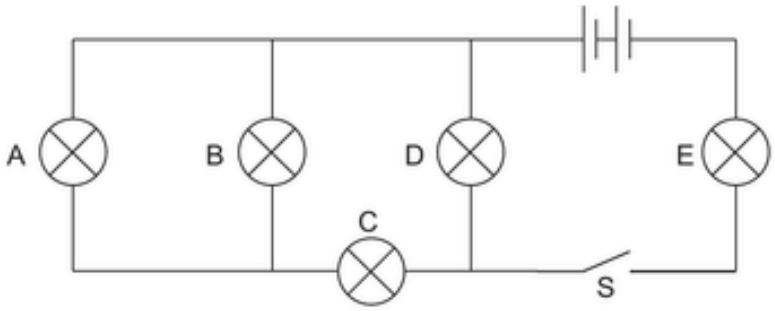


(ii) Sam then turned the magnet on model A around.
What would happen to model B?

_____

Modern Tuition

10. (a) Max built **circuit 1** as shown below.



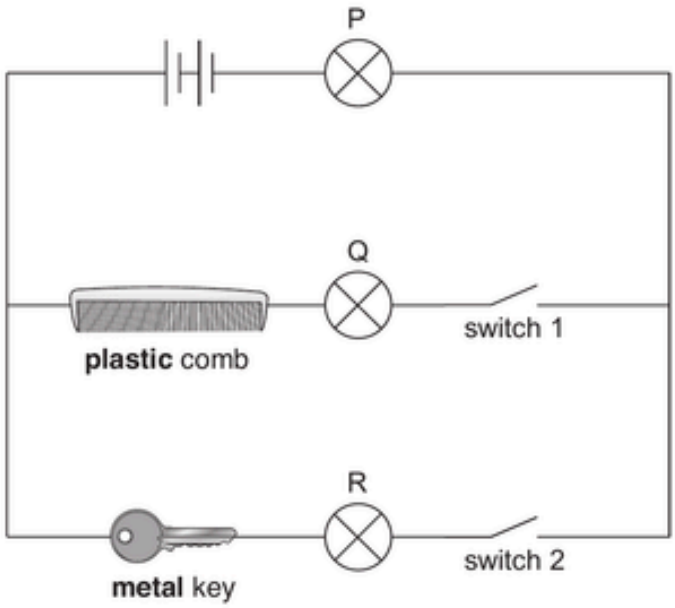
circuit 1

He closed the switch, S, and all the bulbs came on.
One of the bulbs then broke and **all** the bulbs went off.

Which bulb must have broken?
Give the letter.

_____

(b) Max built **circuit 2** as shown below.
He connected a plastic comb and a metal key in different parts of the circuit.



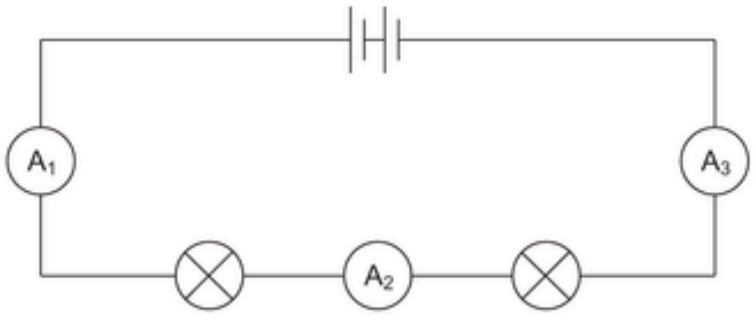
circuit 2

Modern Tuition

Look carefully at **circuit 2**.
Complete the table below to show which bulbs in circuit 2 will be on or off when different switches are open or closed.
Write **on** or **off** in the boxes below.

switch 1	switch 2	bulb P	bulb Q	bulb R
open	open	off	off	off
open	closed			
closed	open			

(c) Max built **circuit 3** using a battery, two bulbs and three ammeters.



circuit 3

The current reading on ammeter A_1 was 0.8 amps.
What would be the reading on ammeters A_2 and A_3?
Place **one** tick in the table by the correct pair of readings.

reading on ammeter A_2 (amps)	reading on ammeter A_3 (amps)	correct pair of readings
0.8	0.8	
0.8	0.4	
0.4	0.8	
0.4	0.4	

Modern Tuition

11. Some pupils made an electric cell using two different metals and a lemon. They put strips of copper and zinc into a lemon and connected them to the terminals of an electric clock.



(a) Look at the photograph.

What evidence is there that they have made an electric cell?

11a

1 mark

(b) The pupils had pieces of copper, zinc, iron and magnesium and some lemons.
They wanted to find out which pair of metals made the cell with the biggest voltage.

What equipment should they use to measure the voltage of their cells?

11b

1 mark

(c) In their investigation they used different pairs of metals.

Give **one** factor that they should keep the same.

11c

1 mark

Modern Tuition

(d) The pupils measured the voltage produced by different pairs of metals. Their results are recorded below.

	voltage produced by each pair of metals (volts)			
	magnesium	zinc	iron	copper
copper	1.7	0.9	0.8	0
iron	1.3	0.1	0	-
zinc	0.8	0	-	-
magnesium	0	-	-	-

Which pair of metals made the cell with the biggest voltage?

_____ and _____

(e) Look at the results in the table above.

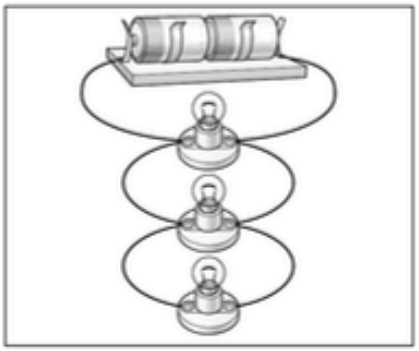
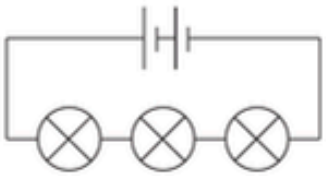
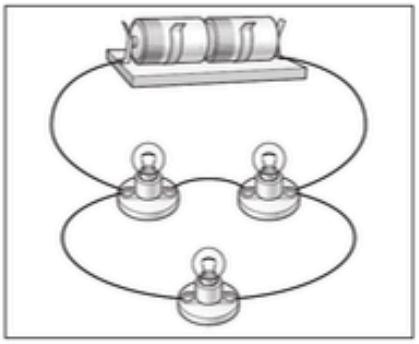
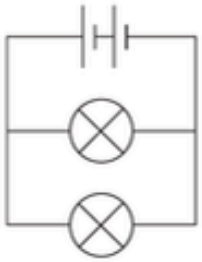
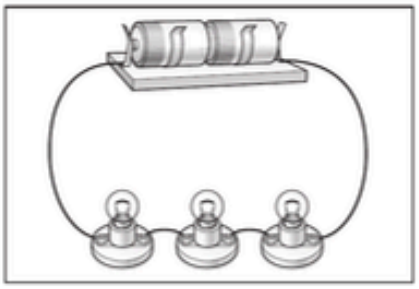
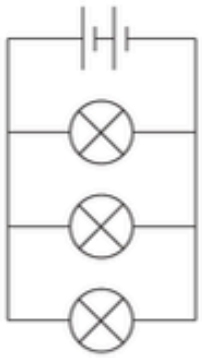
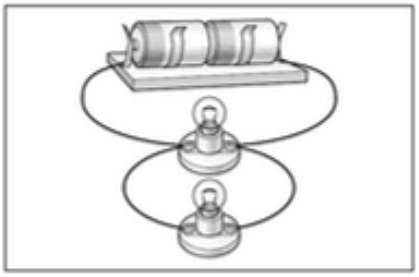
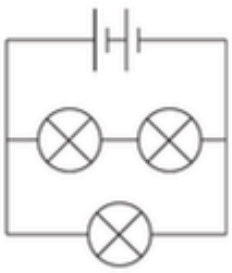
Why should the pupils **not** use pairs of the same type of metal for the clock?

_____

_____

Modern Tuition

1. (a) Draw a line from each electrical circuit to the correct circuit diagram.
Draw only **four** lines.

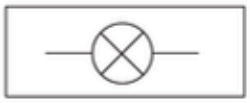
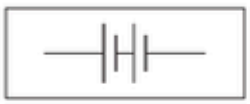
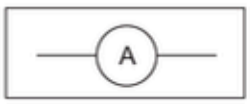
electrical circuit	circuit diagram
	
	
	
	

1a
1 mark

1a
1 mark

Modern Tuition

7. (a) Draw a line from each circuit symbol below to the correct name.
Draw only four lines.

circuit symbol	name
	ammeter
	switch
	motor
	battery
	bulb

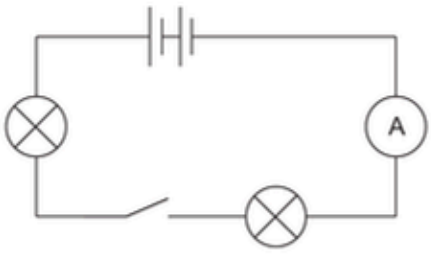
7a
1 mark

7a
1 mark

7a
1 mark

(b) Fred made **circuit 1** as shown below.

circuit 1



Give the name of the part that is the energy source for the circuit.

_____

7b
1 mark

Modern Tuition