



7.9.1 Circuits



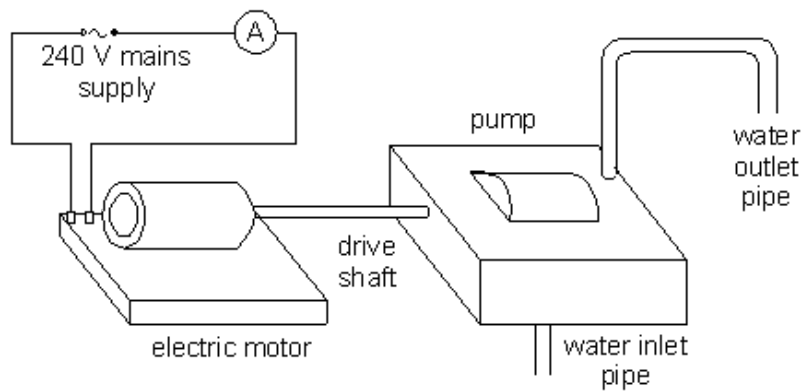
123 minutes



170 marks

##

The diagram shows a motor, connected to a 240 V supply, driving a water pump. The ammeter reads 5.0 A.



- (a) How much charge flows through the motor in one minute? Give the unit.

.....
.....

1 mark

- (b) (i) What is the resistance of the motor? Give the unit.

.....
.....

1 mark

- (ii) What is the power of the motor? Give the unit.

.....
.....

1 mark

- (c) (i) The motor and pump together have an efficiency of 50% (0.5). How much energy is given to the water every second? Give the unit.

.....

1 mark

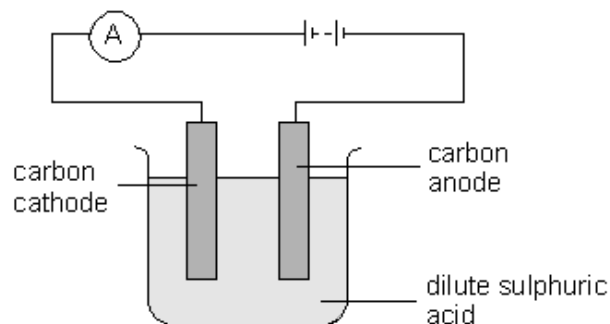
- (ii) The pump has to raise the water up to a vertical height of 12 m. What mass of water will the pump raise each second? Give the unit. The value of g is 10 N/kg.

.....
.....

1 mark

Maximum 5 marks

Q2. The diagram below shows apparatus used for the electrolysis of dilute sulphuric acid.



- (a) Hydrogen molecules are formed at the cathode from hydrogen ions. Give a balanced ionic equation for this reaction. State symbols are not required.

Use the symbol H^+ for a hydrogen ion and e^- for an electron.

.....

2 marks

- (b) The ammeter shows that there is a current.

- (i) State in terms of electrons what is happening in the wires.

.....

1 mark

- (ii) Explain how the battery causes the electrons to behave in this way.

.....

.....

1 mark

- (c) The carbon anode is replaced by a piece of copper foil. A reaction takes place which may be described by the following equation.



Describe **one** change you would see as a result of this reaction.

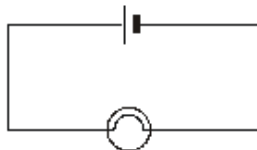
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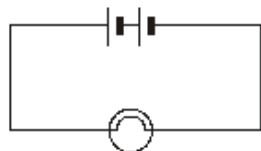
1 mark

Maximum 5 marks

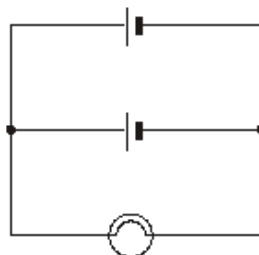
Q3. John connects up the circuit shown below.



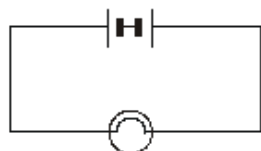
The bulb is not bright enough. His friend suggests four circuits which could be used to make the bulb brighter.



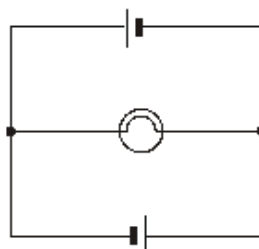
circuit A



circuit B



circuit D

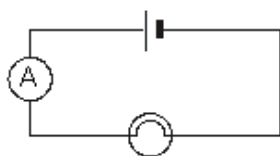


circuit C

(a) Which is the correct circuit to use: A, B, C or D?

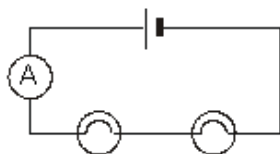
1 mark

Next John sets up circuit E and notes the reading on the ammeter.



circuit E

He then places another bulb in the circuit, to make circuit F. He notes the ammeter reading in circuit F.



circuit F

- (b) How will the ammeter reading in circuit F compare with that in circuit E?

The reading in F is

1 mark

Explain your answer.

.....

1 mark

- (c) Draw a circuit diagram in which **two** bulbs are lit as brightly as the bulb in circuit E, and the ammeter reading is the same as in circuit E.

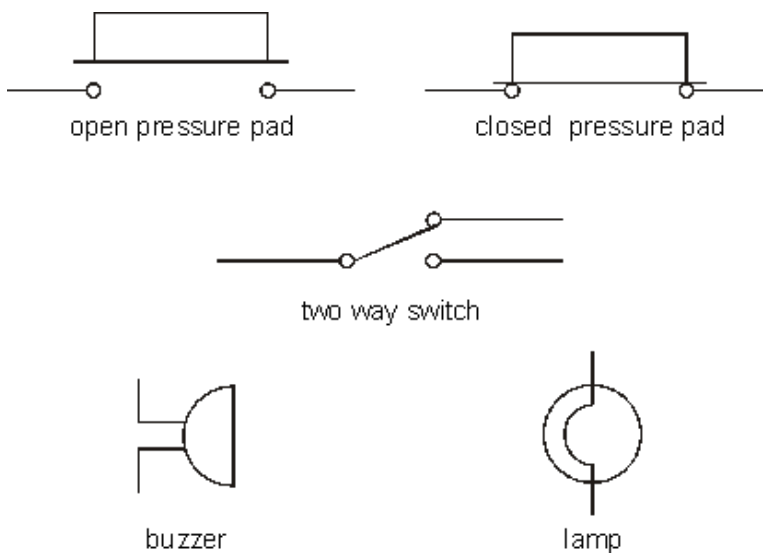
1 mark

Maximum 4 marks

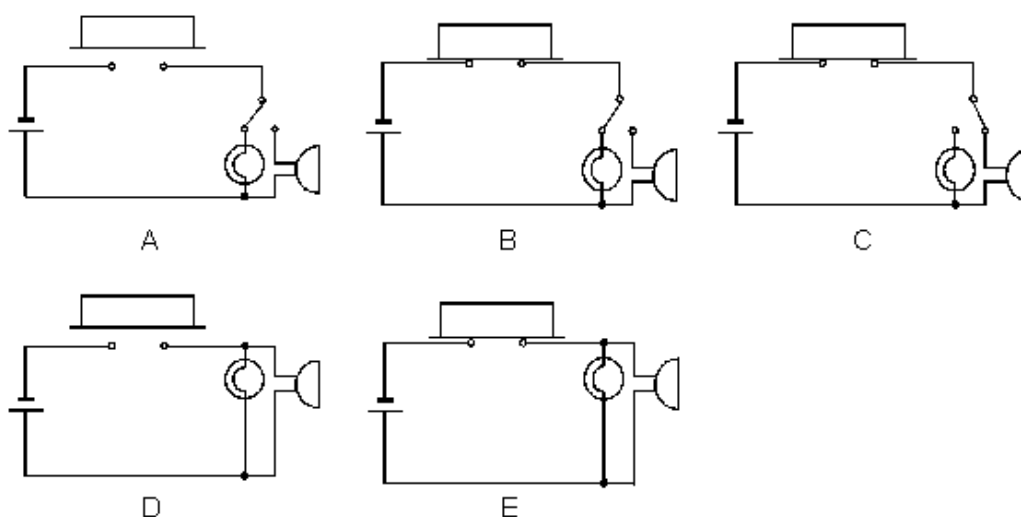
##

Pressure pads can be used to set off burglar alarms. The alarm is set off when someone steps on the pad. The alarm works by sounding a buzzer **or** switching on a lamp **or** both.

The symbols for a pressure pad, a two way switch, a buzzer and a lamp are shown below.



Here are five circuit diagrams.



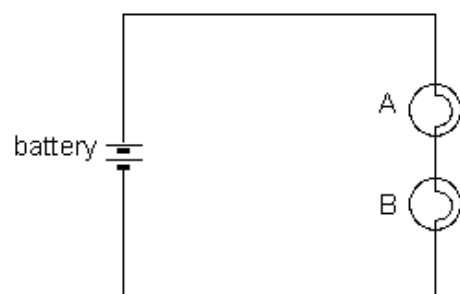
Look carefully at the five circuit diagrams.

Tick the correct box to show what is happening in each circuit.

circuit diagram	only the buzzer is on	only the lamp is on	both the buzzer and the lamp are on	neither the buzzer nor the lamp is on
A				
B				
C				
D				
E				

5 marks

Q5.



In the circuit above, both the bulbs light up. Suddenly they both go out.

The two bulbs are tested. Bulb A works but bulb B is broken.

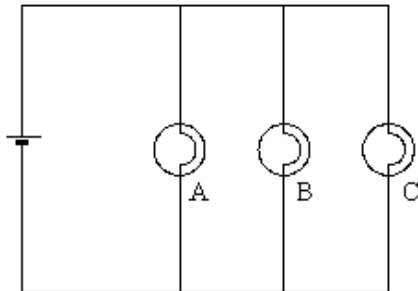
- (a) Bulb A was not broken but it went out. Why did it go out?

.....

.....

1 mark

In the circuit below, only bulb B is broken.



- (b) (i) Does bulb A light up?

Tick the correct box.

Yes ☐ No ☐

1 mark

- (ii) Does bulb C light up?

Tick the correct box.

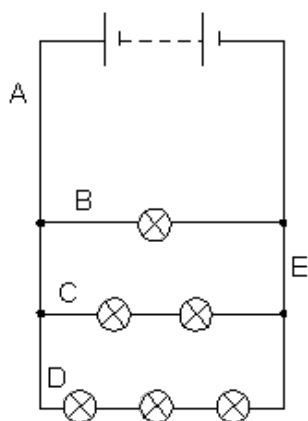
Yes ☐ No ☐

1 mark

Maximum 3 marks

##

- (a) An electrical current is a flow of charge. The diagram shows a circuit containing six identical bulbs.



In which part of the circuit, A, B, C, D or E, is there:

- (i) the greatest flow of charge?
- (ii) the least flow of charge?

2 marks

- (b) Sulphur is an electrical insulator, but it can be made to conduct electricity if a very bright light shines on it.

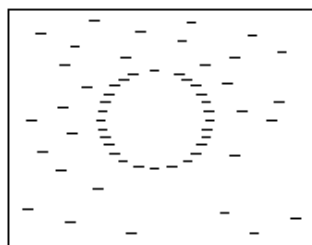
- (i) A slab of sulphur is rubbed with a piece of woollen cloth.
Explain how this gives the sulphur a negative electrical charge.

.....

.....

1 mark

- (ii) A very bright light shines onto a small circular area in the centre of the charged slab of sulphur. The pattern of charge on the sulphur alters. The simplified diagram represents the new pattern of charge.



Explain why the pattern alters in this way.

.....

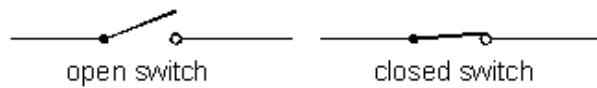
.....

1 mark

Maximum 4 marks

- Q7.** A pupil makes some electrical circuits.
Each circuit contains a motor and a buzzer.
The motor and the buzzer can be switched on or off by three switches, A, B and C.

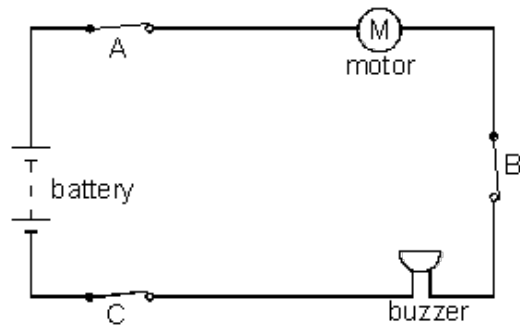
Symbols for an open switch and a closed switch are shown below.



By each circuit diagram, state whether:

the motor is **on** or **off**;
the buzzer is **on** or **off**.

(i)

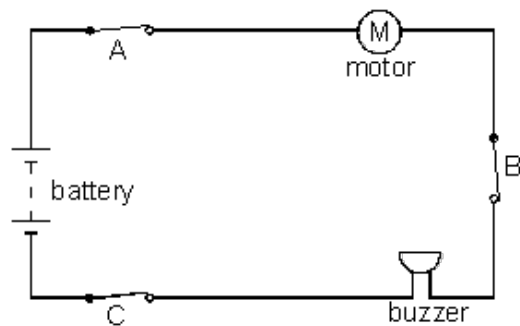


The motor is

The buzzer is

1 mark

(ii)

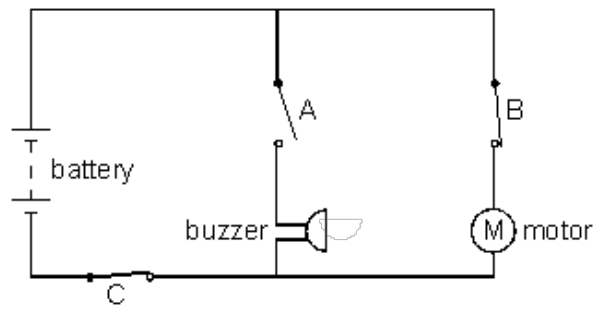


The motor is

The buzzer is

1 mark

(iii)

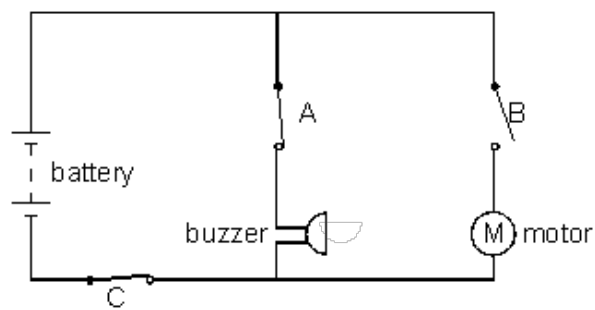


The motor is

The buzzer is

1 mark

(iv)

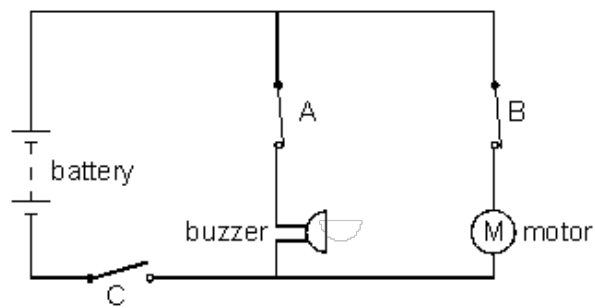


The motor is

The buzzer is

1 mark

(v)



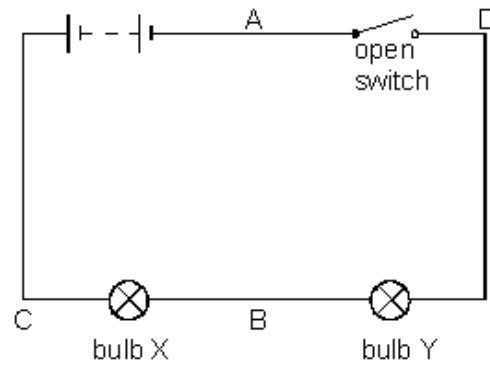
The motor is

The buzzer is

1 mark

Maximum 5 marks

Q8. A circuit is shown below.



- (a) The switch is **open**. Steven connects point **A** to point **B** with a piece of copper wire.

Which bulbs, if any, light up?

.....

1 mark

- (b) Steven removes the copper wire and uses it to connect point **C** to point **D**.

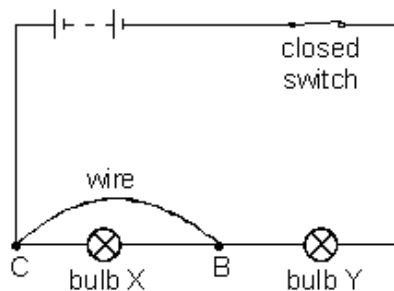
The switch is still **open**.

Which bulbs, if any, light up?

.....

1 mark

- (c) Steven removes the copper wire and **closes** the switch. Both bulbs light up, but not very brightly. He then uses the copper wire to connect point **B** to point **C**.



Choose from the following words to answer the questions below.

gets brighter stays the same goes out

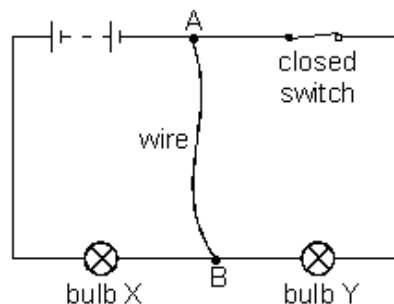
- (i) What happens to bulb **X**?

1 mark

- (ii) What happens to bulb **Y**?

1 mark

- (d) Steven removes the copper wire. The switch is still **closed**. Both bulbs light up, but not very brightly. He then uses the copper wire to connect point **A** to point **B**.



Choose from the following words to answer the questions below.

gets brighter stays the same gets dimmer goes out

- (i) What happens to bulb **X**?

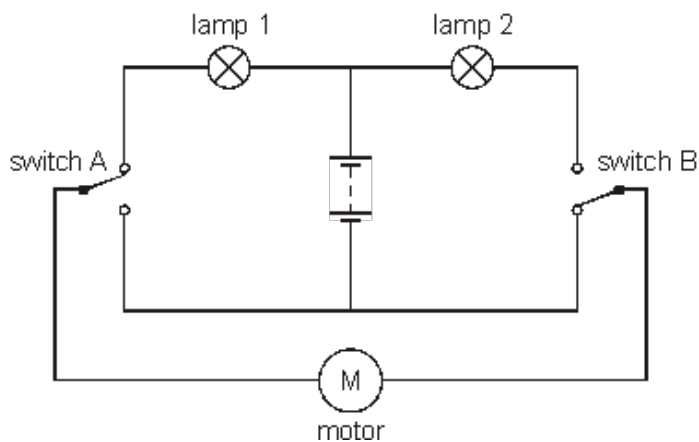
1 mark

- (ii) What happens to bulb **Y**?

1 mark

Maximum 6 marks

- Q9.** The diagram shows a circuit for controlling an electric motor.



This circuit can make the motor turn forwards or backwards.

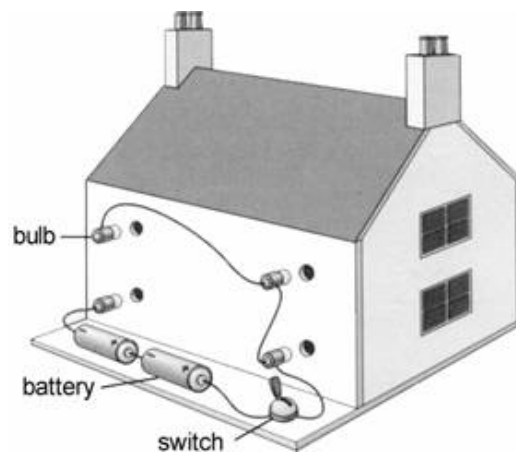
Complete the table to show which lamp, if any, is lit and in which direction, if any, the motor turns.

The first row has been done for you.

switch A	switch B	Which lamp, if any, is lit?	In which direction, if any, does the motor turn?
up	down	lamp 1	forwards
up	up		
down	up		
down	down		

4 marks

- Q10.** Alice connects four light bulbs for her model house, as shown. She puts the bulbs into the holes in the back wall.



- (a) When Alice turns the switch on, the bulbs do **not** light up. The batteries are **not** flat. None of the bulbs is broken.
Why do the bulbs **not** light up?

.....

1 mark

- (b) Alice makes the circuit work. When she turns the switch on, the bulbs are **not** very bright.
What must Alice add to the circuit to make the bulbs brighter?

.....

1 mark

- (c) The four bulbs in the circuit are the same. Which statement is correct?
Tick the correct box.

Each bulb is the same brightness.

☐

Each bulb is a different brightness.

☐

The bulbs at the top are brighter.

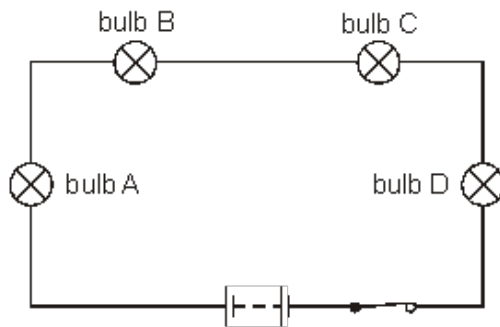
☐

The bulbs at the bottom are brighter.

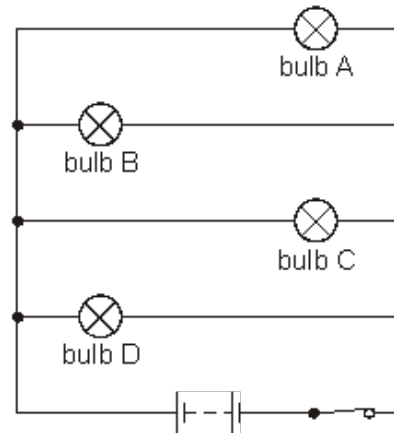
☐

1 mark

The diagrams show two ways to wire the model house.



circuit 1



circuit 2

- (d) (i) In circuit 1, bulb B breaks and goes out.
What happens to the other bulbs in this circuit?

.....

.....

1 mark

- (ii) In circuit 2, bulb C breaks and goes out.
What happens to the other bulbs in this circuit?

.....

.....

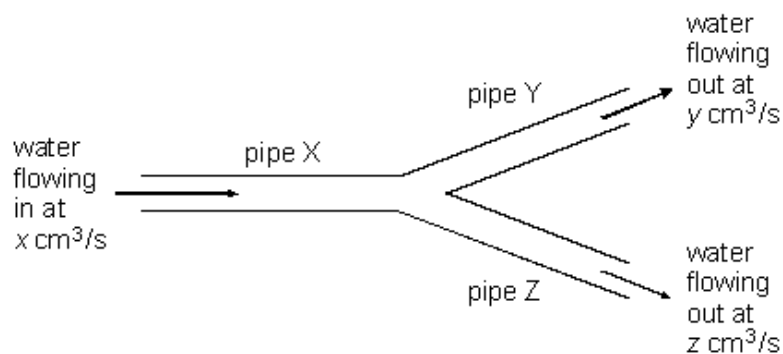
1 mark

- (e) In circuit 2, Alice adds another switch so that she can turn bulb A off while the other bulbs stay on.
Write the letter S on circuit 2 to show where Alice should add the switch.

1 mark
Maximum 6 marks

##

The flow of water through tubes can be used as a model to explain some of the rules about electrical circuits.



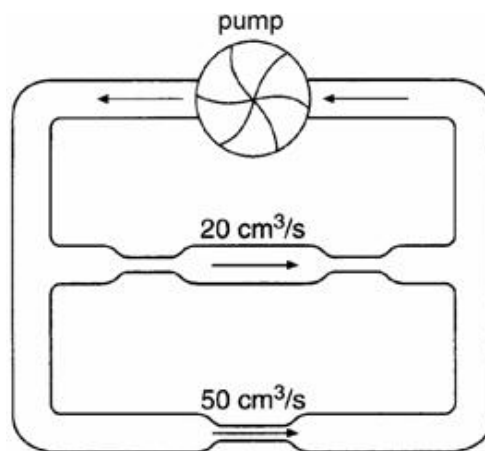
The diagram shows a junction in a water pipe.
The rate of flow in the pipes is measured in cm^3/s .

- (a) What is the relationship between the rate of flow in the three pipes, **X**, **Y** and **Z**?

.....

1 mark

- (b) The diagram below shows a 'water circuit', in which water is forced round by a pump. The rates of flow at two places are written on the diagram.



- (i) At what rate is water flowing:

into the pump? cm^3/s

out of the pump? cm^3/s

1 mark

- (ii) The 'water circuit' can be used as a model of an electrical circuit.
Each part of the 'water circuit' is equivalent to a part of an electrical circuit.

What is the electrical equivalent of the water?

.....

1 mark

A family, who did not understand electricity very well, always made sure there was a bulb in each of the light fittings in their house. They were afraid that electricity would escape from an empty light socket when the switch was turned on.

- (c) Explain why electricity does **not** escape from an empty light socket.

.....

.....

.....

1 mark
Maximum 4 marks

##

- (a) Diagram 1 shows a light bulb **X**, a piece of card and a white screen. Two light rays have been drawn from the bulb to the screen.

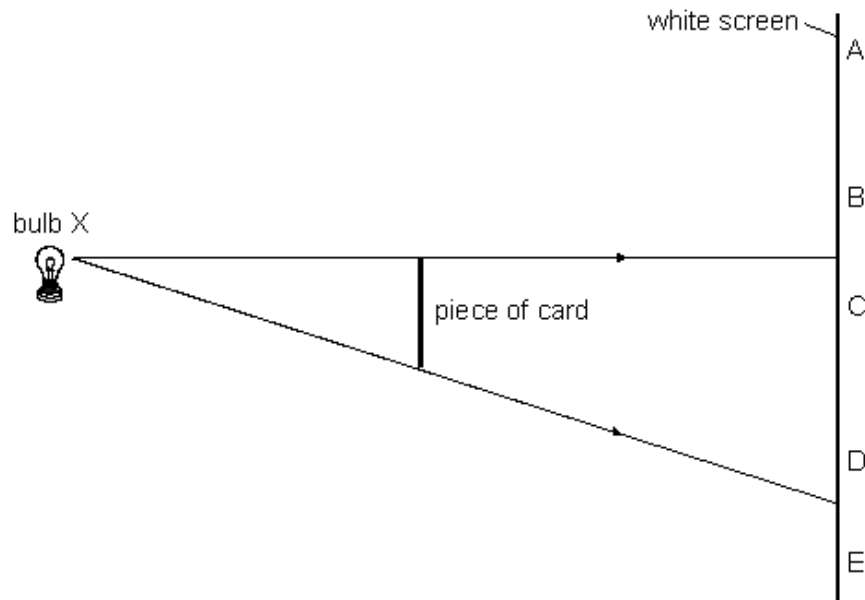


diagram 1

Five points, A, B, C, D and E, have been labelled on the screen.
Give the letter of **one** point which is in shadow.

.....

1 mark

- (b) Bulb Y is added. Diagram 2 shows two light rays from each bulb.

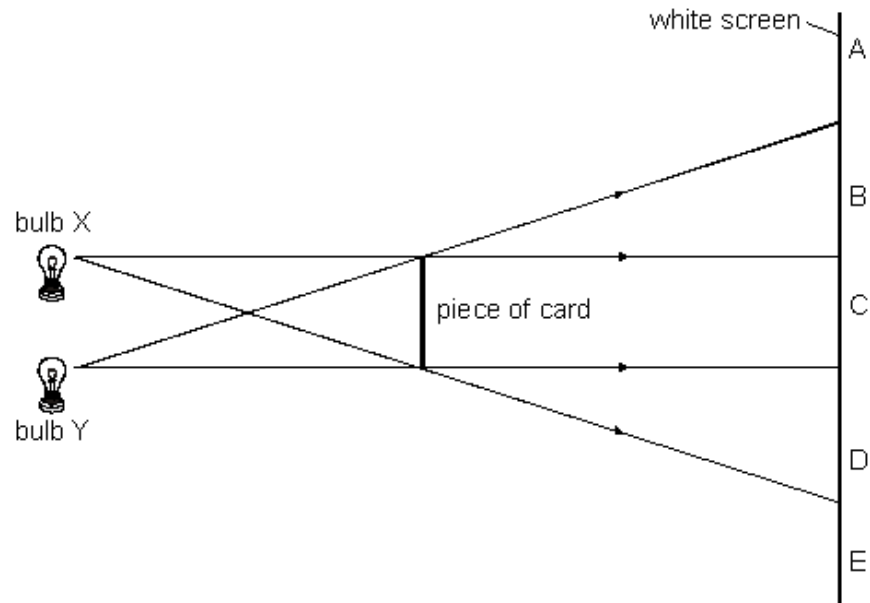


diagram 2

Look at diagram 2.

- (i) Which point on the screen will be in the darkest shadow?

Give the letter.

1 mark

- (ii) Give the letter of **one** point on the screen which will be lit up by **both** bulbs.

.....

1 mark

- (iii) Which point on the screen will be lit up by bulb **X only**?

Give the letter.

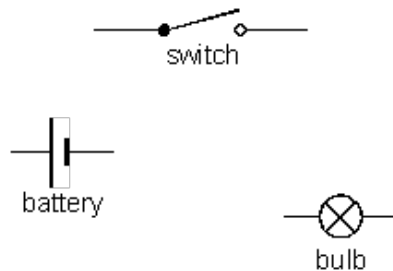
1 mark

- (c) Bulb Y is connected in parallel with bulb X. Draw a circuit diagram below to show how the two bulbs and the battery are connected.

1 mark
Maximum 5 marks

Q13. Jo uses a battery, a switch and a bulb to make a series circuit.

- (a) The diagrams show symbols for a battery, a bulb and a switch. Connect the symbols to make Jo's circuit.



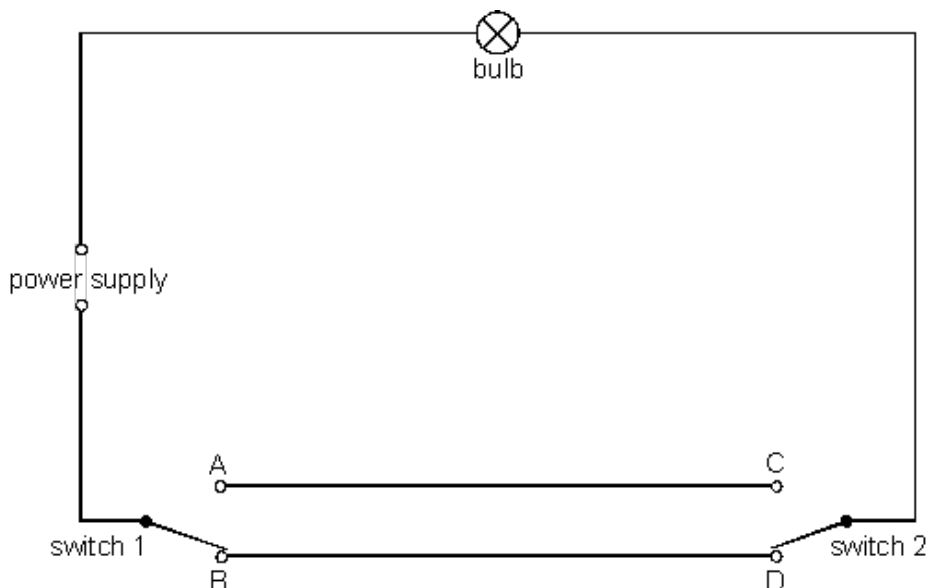
1 mark

- (b) Jo closes the switch and the bulb lights up. Then she connects the battery the other way round. What happens to the bulb when Jo closes the switch again? Tick the correct box.

It is brighter.	<input type="checkbox"/>	It is dimmer.	<input type="checkbox"/>
It is the same brightness.	<input type="checkbox"/>	It does not light up.	<input type="checkbox"/>

1 mark

- (c) A corridor has a switch at each end and one light bulb in the middle. The circuit diagram below shows how they are connected.

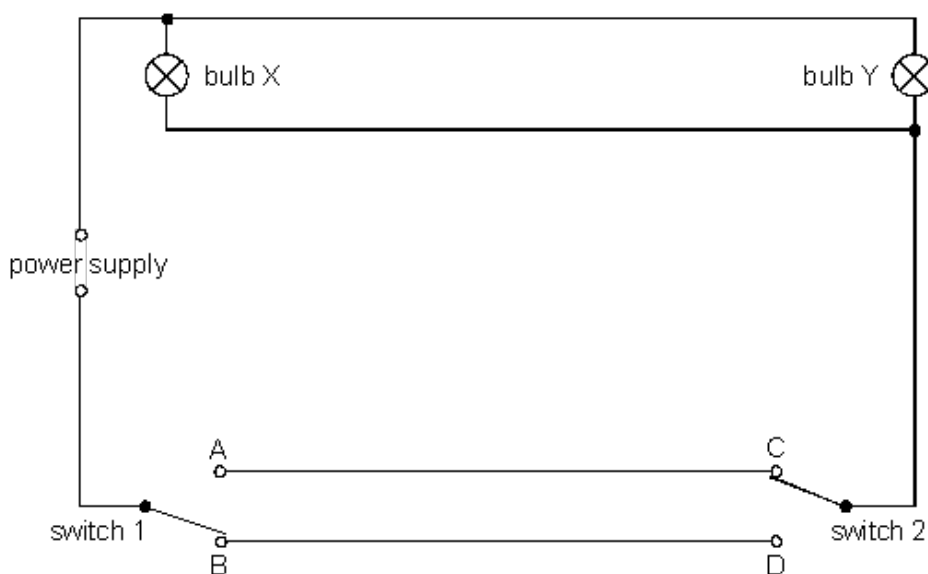


In the diagram above, the switches are shown in positions B and D and the bulb is on. Complete the table below to show whether the light bulb is on or off. Write **on** or **off**.

position of switch 1	position of switch 2	is the bulb on or off?
B	D	on
A	D	
A	C	

1 mark

- (d) The circuit is changed so that there is a bulb at each end of the corridor. They are connected as shown below.



- (i) In the diagram above, the switches are shown in positions B and C. Which bulbs, if any, are on?

.....

1 mark

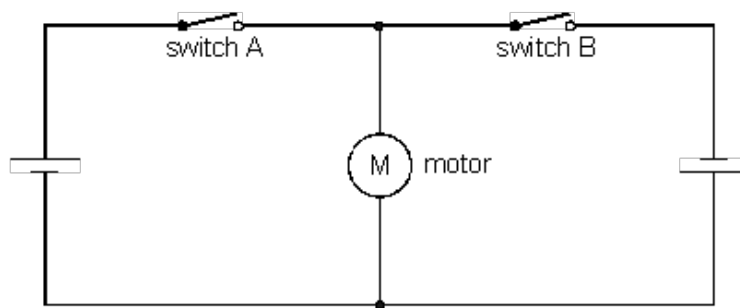
- (ii) The switches are arranged so that both bulbs are on. Bulb X breaks. What, if anything, happens to bulb Y?

.....

1 mark

Maximum 5 marks

Q14. Gary uses the following circuit to operate the electric motor of his model crane.



Look carefully at the way Gary has connected the two cells.
When he closes switch A the motor runs and the crane lifts a load.

- (a) Gary opens switch A and closes switch B.

Describe what happens to the motor.

.....
.....

1 mark

- (b) Gary closes both switches, A and B. Describe what happens to the motor.

.....

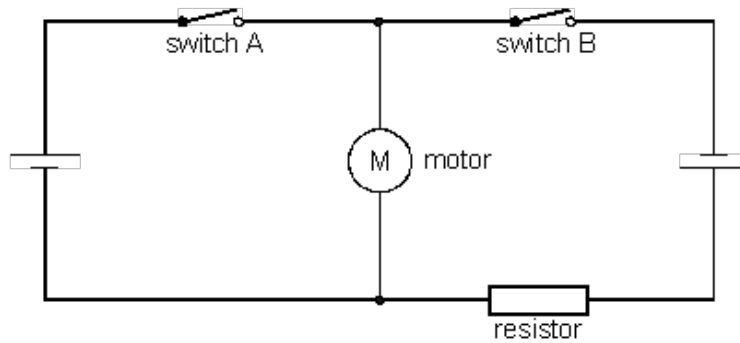
1 mark

- (c) Both switches should **not** be closed at the same time. Explain why.

.....
.....

1 mark

- (d) Gary puts a resistor into his circuit as shown.



What difference does the resistor make to the motor:

- (i) when switch A is closed and switch B is open?

.....

1 mark

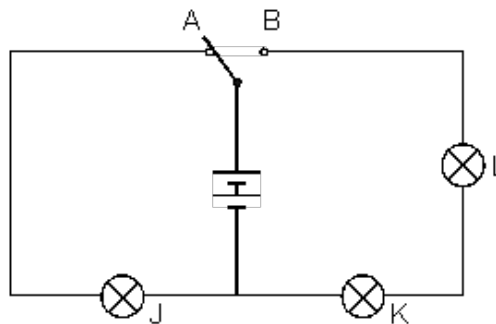
- (ii) when switch A is open and switch B is closed?

.....

1 mark

Maximum 5 marks

- Q15.** Daniel connected up the following circuit, using a battery, three bulbs and a switch.



- (a) The switch is shown in position A. Which bulb is lit up?

.....

1 mark

- (b) Daniel moves the switch from position A to position B.

What, if anything, happens to bulbs J, K and L?

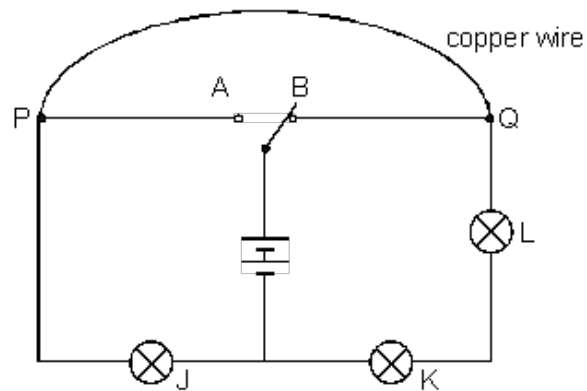
bulb J:

bulb K:

bulb L:

2 marks

- (c) Daniel uses a piece of copper wire to connect points P and Q.



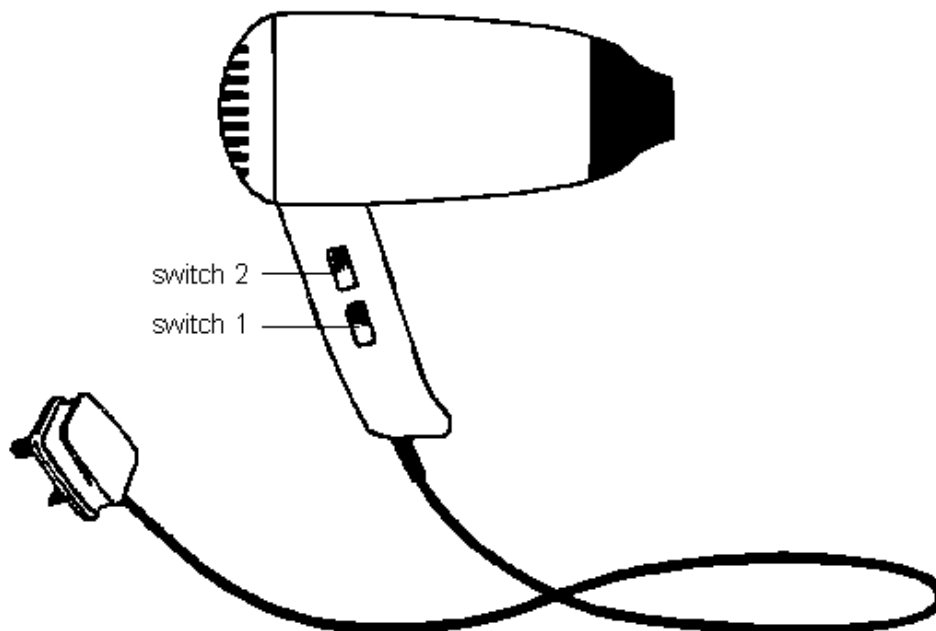
Which of the bulbs, if any, are lit up?

.....

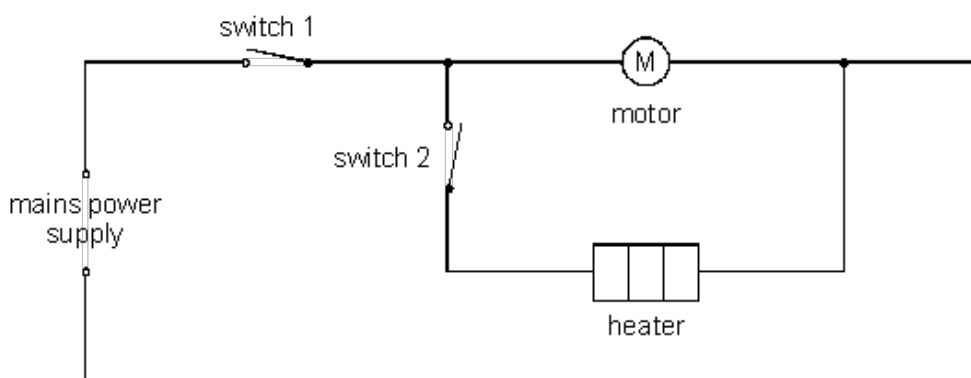
1 mark

Maximum 4 marks

- Q16.** The drawing shows a hairdryer.



Ben drew the diagram below to show the circuit of the hairdryer.



- (a) Which of the switches must be closed for the heater to work? Tick the correct box.

switch
1 only

switch
2 only

switches
1 and 2

neither switch
1 nor 2

☐
☐
☐
☐

1 mark

- (b) With this circuit, is it possible to have the heater on when the motor is switched off?

.....

Explain your answer.

.....
.....

1 mark

- (c) The motor and the heater are both on.
The motor blows air through the hairdryer. If the motor breaks, what would happen to the temperature of the hairdryer?

.....

1 mark

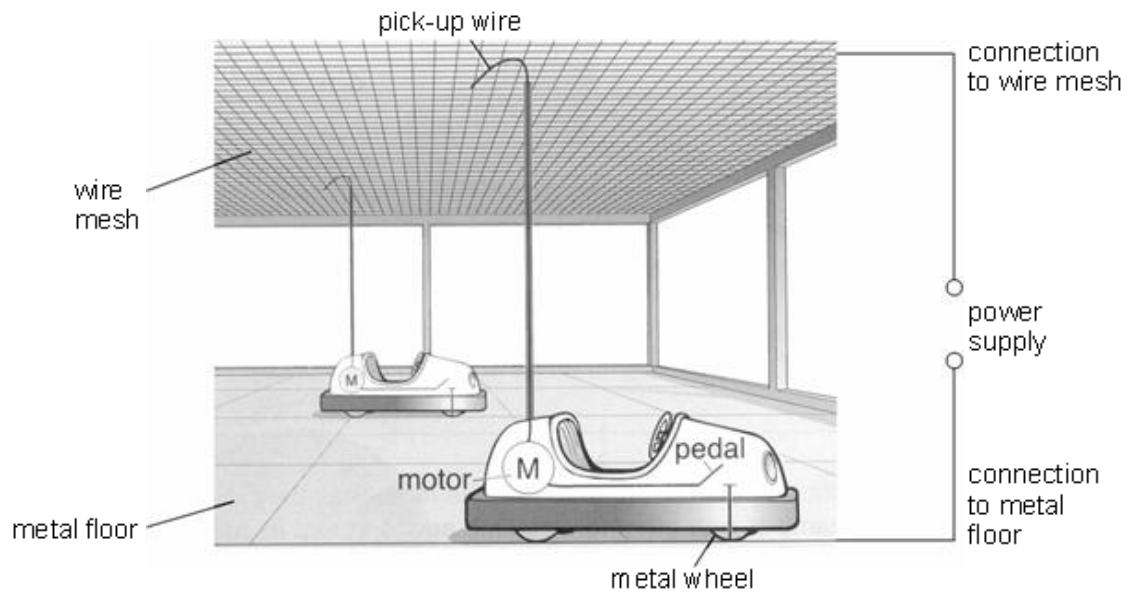
- (d) The motor and the heater are both on. Suddenly the wire in the heater breaks.
What effect, if any, will this have on the motor?

.....

1 mark

Maximum 4 marks

- Q17.** The diagram shows two dodgem cars at a fairground. The circuit symbols for the motor and pedal for each dodgem car are shown on the diagram.





- (a) Complete the following sentence.

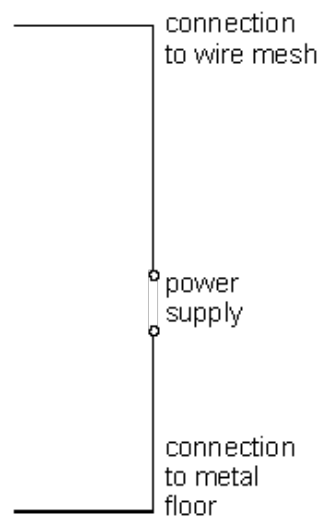
Each dodgem car is connected to the power supply through the which is in contact with the wire mesh, and through the which is in contact with the metal floor.

1 mark

- (b) Dodgem cars are connected using parallel circuits. Complete the circuit diagram below for the **two** dodgem cars.

Use **two** motor symbols, , and **two** switch symbols, .

The power supply for the circuit has been drawn for you.



2 marks

- (c) Even when the power supply is switched on, the dodgem car will **not** move until the pedal is pressed. Give the reason for this.

.....

1 mark

- (d) A man looks after the dodgem cars during the rides.
 Why does the man **not** get an electric shock as he walks across the metal floor?

.....

1 mark

- (e) During one ride, the two dodgem cars are running. The pick-up wire on one car snaps off. Describe how this affects:

- (i) the dodgem car with the broken pick-up wire;

.....

1 mark

- (ii) the other dodgem car.

.....

1 mark

Maximum 7 marks

Q18. Nikki tries to set up four electric circuits.

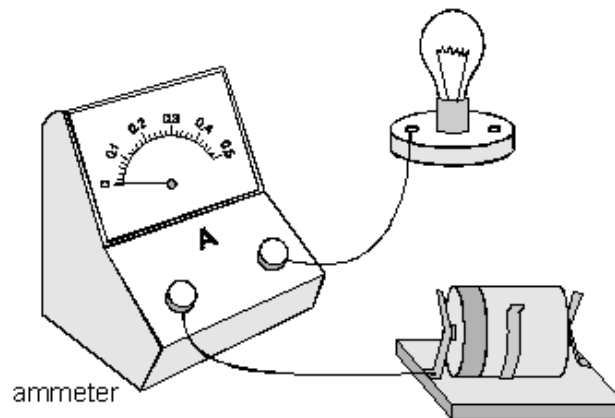


diagram 1

- (a) In diagram 1 the ammeter reading is zero. What is wrong with this circuit?

.....

1 mark

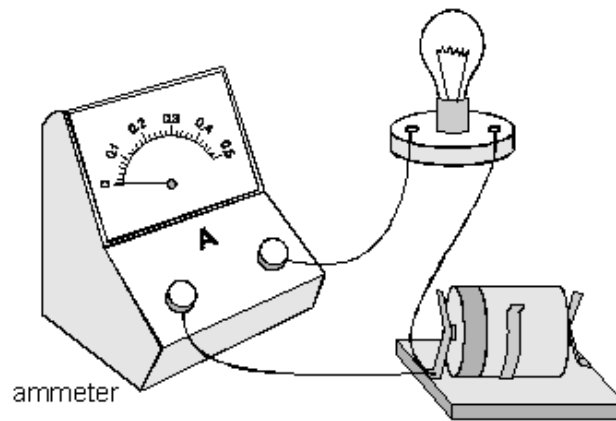


diagram 2

- (b) In diagram 2 the ammeter reading is zero. What is wrong with this circuit?

.....

1 mark

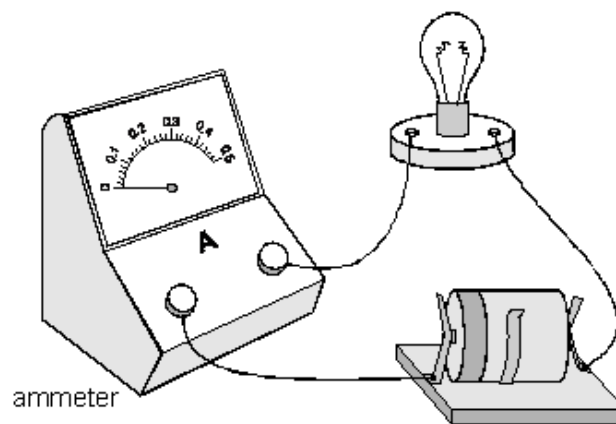


diagram 3

- (c) In diagram 3 the ammeter reading is zero. Why is this **not** a complete circuit?

.....

1 mark

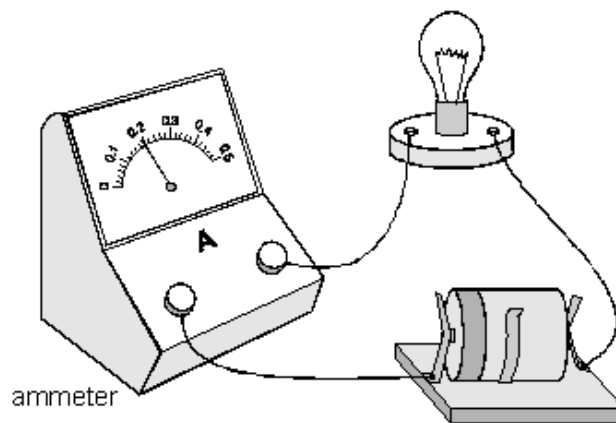


diagram 4

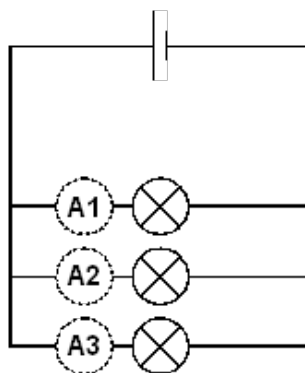
(d) In diagram 4, why is there a reading on the ammeter?

.....

.....

1 mark
Maximum 4 marks

Q19. Peter measured the current through each of three similar bulbs in a parallel circuit.



He had only one ammeter and he placed it first at A1, then A2, then A3, in order to measure the currents.

The table shows his results.

position of ammeter	current, in amps
A1	0.14
A2	0.16
A3	0.15

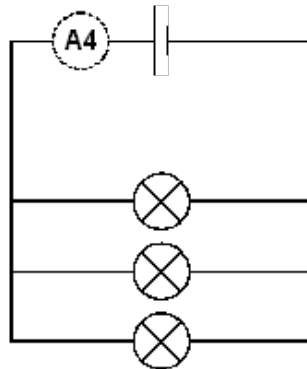
- (a) He expected the current readings to be the **same** for each bulb but found they were **different**.

Suggest **two** reasons why the readings were different.

1.
2.

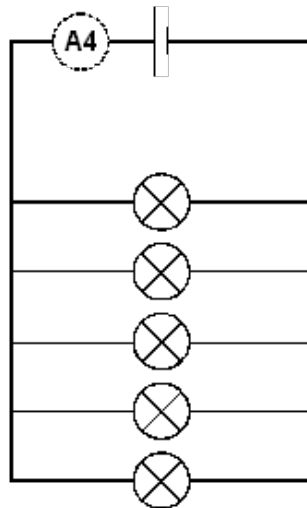
2 marks

- (b) Peter then measured the current at **A4** and recorded it as 0.45 A. He concluded that the current at **A4** could be calculated by adding together the currents through each of the bulbs at positions **A1**, **A2** and **A3**.



He added two more similar bulbs to his circuit, in parallel. The current through each bulb was 0.15 A.
Use Peter's conclusion to predict the current at **A4** with the 5 bulbs in the circuit.

..... A



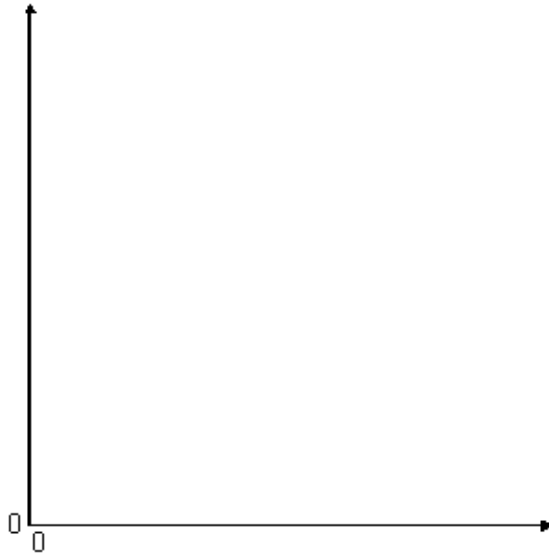
1 mark

- (c) Peter left the circuit connected overnight. He used a datalogger to measure the current at position **A4** at regular intervals of time. The next morning the bulbs were dim.

Using the axes below, sketch (do **not** plot) how the current at position **A4** might change with time.

Indicate on the graph:

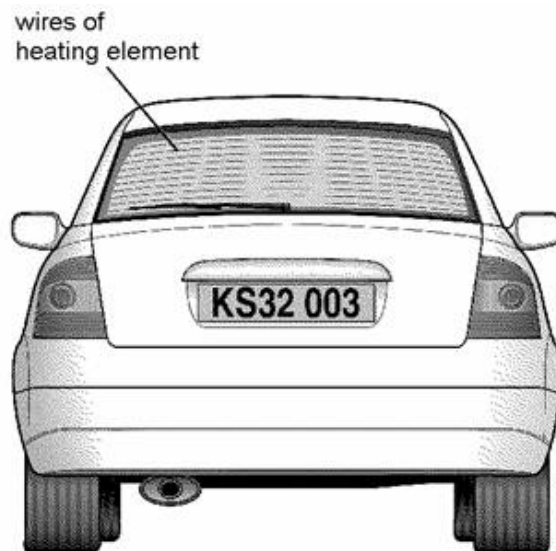
- (i) The correct labels for each axis, including the correct units.
- (ii) The shape of the graph you would expect to obtain.



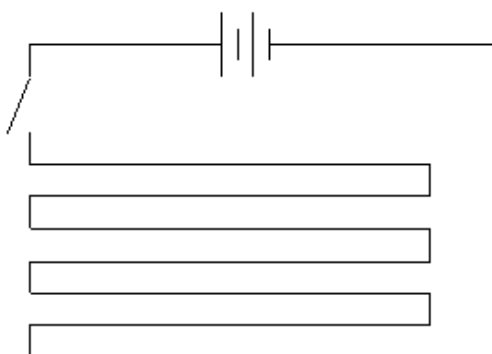
2 marks
Maximum 5 marks

Q20. The back window of this car contains a heating element.

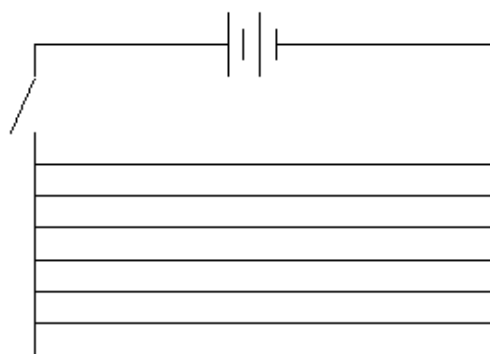
The heating element is part of an electrical circuit connected to the battery of the car.



The diagrams below show **two** ways of connecting the circuit of a heating element.



circuit A



circuit B

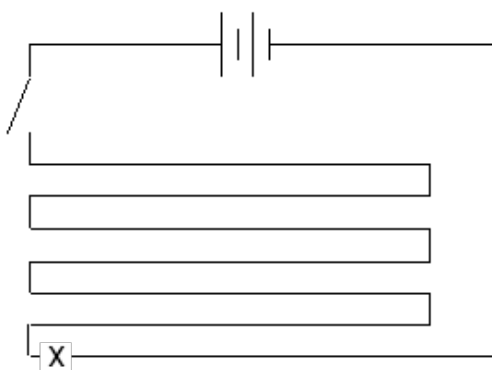
- (a) Give the name of each type of circuit:

circuit A

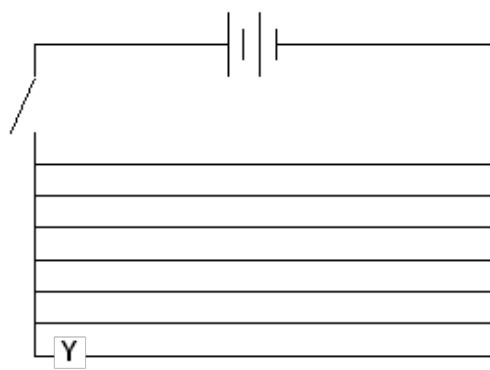
circuit B

1 mark

- (b) A wire gets broken at point X on circuit A and at point Y on circuit B.



circuit A



circuit B

When the switch is closed, how does the broken wire affect the heating element in:

- (i) circuit A?

.....

1 mark

- (ii) circuit B?

.....

1 mark

- (c) In very cold weather, ice may form on the back window of the car. When the heating element is switched on, the ice will disappear and the surface of the window will become clear and dry.

- (i) Fill the gap below to show the energy transfer that takes place.

When the heater is switched on, energy is transferred from the wires to the ice.

1 mark

- (ii) As the window becomes clear and dry, physical changes take place in the ice. Fill the gaps below to show the physical changes which take place.

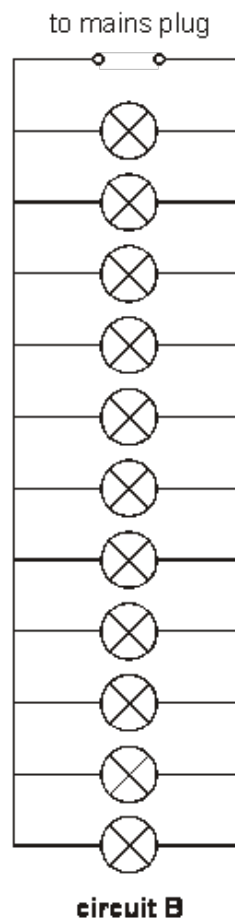
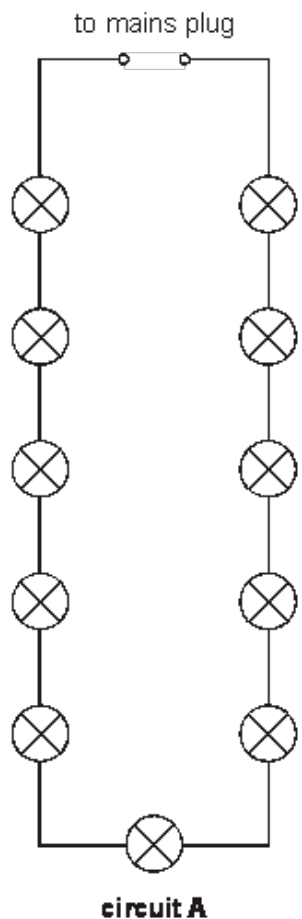
from to to

1 mark

Maximum 5 marks

Q21.

- (a) Ahmed bought two sets of lights to put on a tree in his garden. Circuit diagrams for the two sets of lights are shown below.



Choose words from the list below to fill the gaps in the sentences.

all none some parallel series short

(i) **Circuit A** is a circuit.

If one of the bulbs breaks in **circuit A** of the
other bulbs will go out.

1 mark

(ii) **Circuit B** is a circuit.

If one of the bulbs breaks in **circuit B** of the
other bulbs will go out.

1 mark

(b) Light rays from the bulbs hit the mirror of Ahmed's car.

What happened to the light rays when they hit the mirror?

.....

1 mark

(c) The tree has root hairs.
What are the functions of root hairs?
Tick the **two** correct boxes.

They absorb water from
the soil.

☐

They absorb sunlight.

☐

They produce seeds.

☐

They absorb minerals
from the soil.

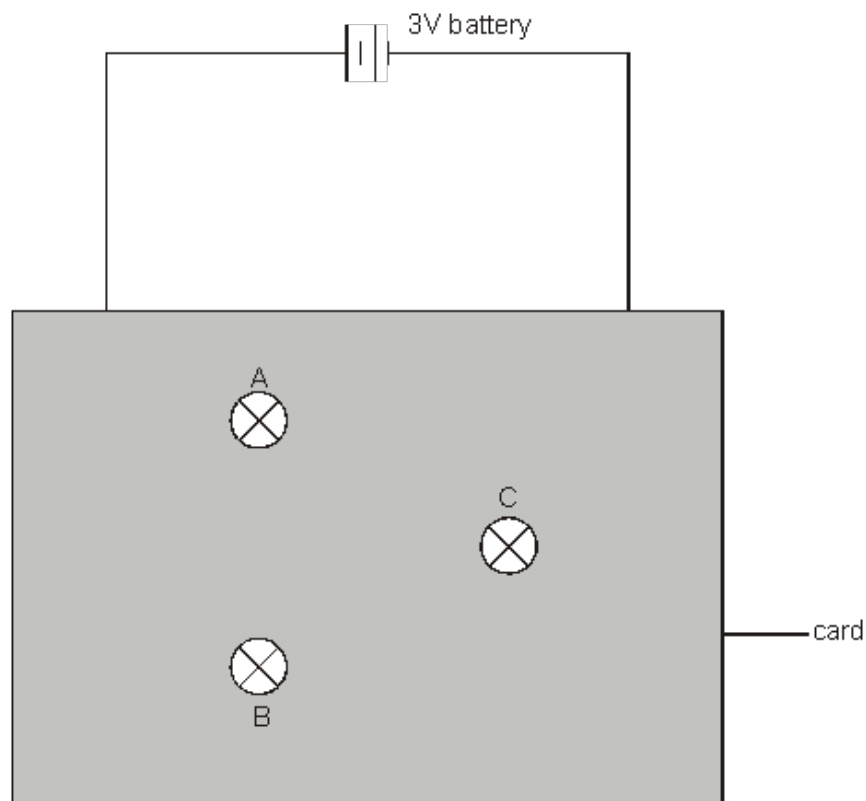
☐

They attract bees for
pollination.

☐

2 marks
maximum 5 marks

- Q22.** Imran built a puzzle circuit with three identical bulbs and a 3V battery. He covered the connections to the bulbs with a piece of card as shown below. The bulbs could be seen through holes in the card.

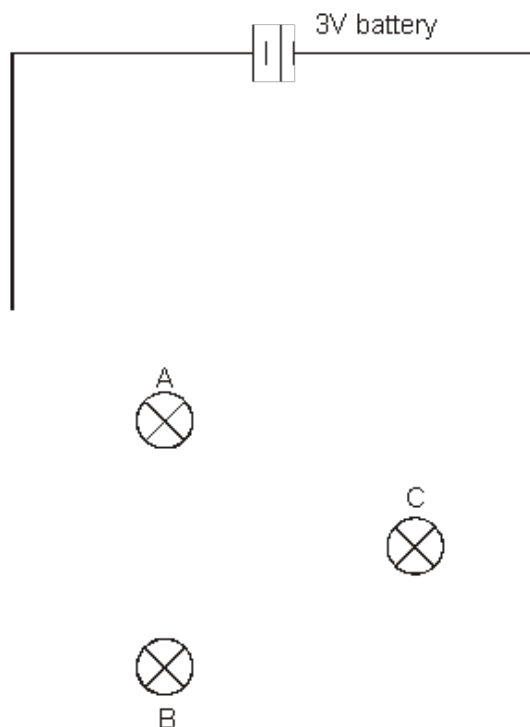


All the bulbs were on but their brightness was different.

Lucy removed bulbs A, B and C in turn. Before connecting each bulb back into the circuit she observed the effect on the other two bulbs. She recorded her observations in the table below.

bulb removed	observations
A	B and C stayed on
B	C went off A stayed on
C	B went off A stayed on

- (a) Complete the circuit diagram below to show how the three bulbs could be connected. Use your knowledge of series and parallel circuits, and the observations in the table to help you.



2 marks

- (b) Imran used three identical bulbs but their brightness was different.

Which bulb was the brightest? Give the letter.

.....

Give the reason for your choice.

.....

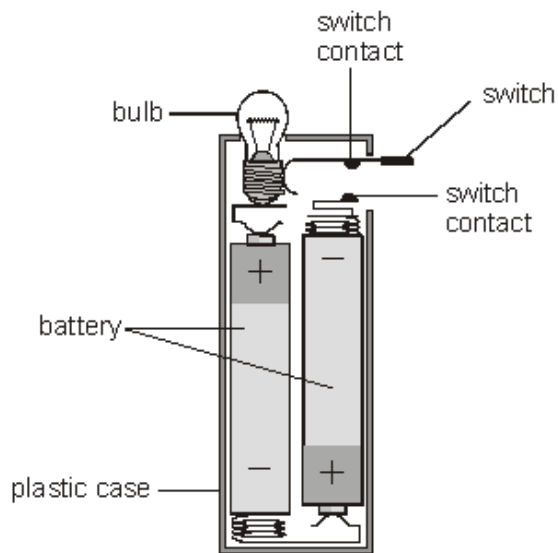
1 mark

- (c) Imran added a switch to the circuit so that he could turn all three bulbs on and off at the same time.

Place a letter **S** on your circuit diagram where this switch could be placed.

1 mark
 maximum 4 marks

Q23. (a) The drawing below shows the parts of a torch.

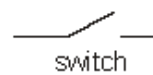
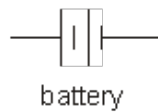
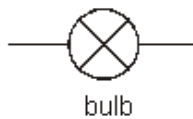


- (i) Paul closed the switch.
Why did this turn on the torch?

.....
.....

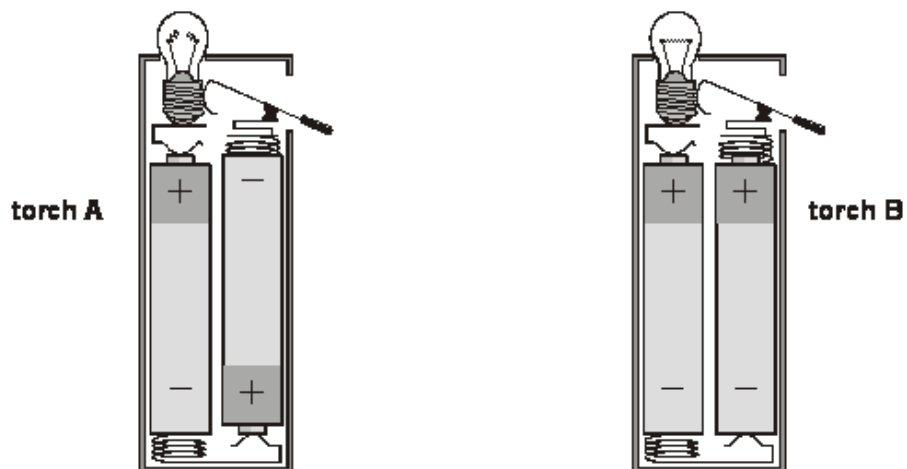
1 mark

- (ii) The diagrams below show symbols for a battery, a bulb and a switch.
Connect the symbols to make a series circuit for the torch.



1 mark

- (b) The drawings below show two other torches. In both torches, the bulbs will **not** light even when Paul closes the switches.



Look carefully at the drawings.

- (i) Why is the circuit of torch A **not** complete?

.....

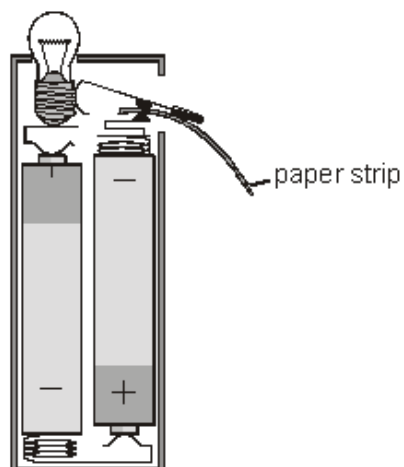
1 mark

- (ii) What could you do to torch B to get the bulb to light?

.....

1 mark

- (c) When Paul bought his torch there was a paper strip between the contacts of the switch as shown below.



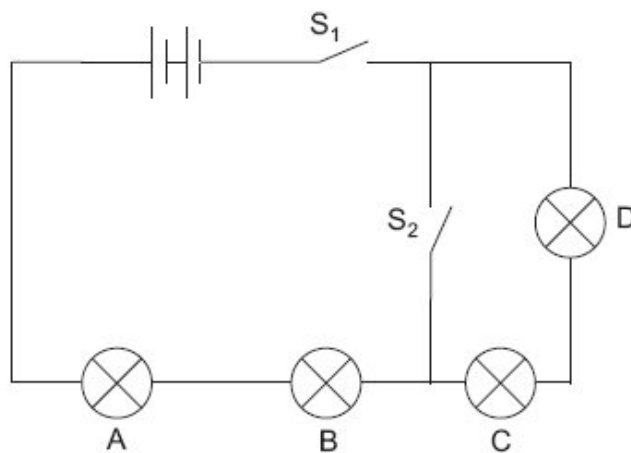
Paul had to remove the paper strip before he could turn the torch on.
Give the reason for this.

.....

.....

1 mark
maximum 5 marks

- Q24.** Lorna built the circuit drawn below. All the bulbs are identical.

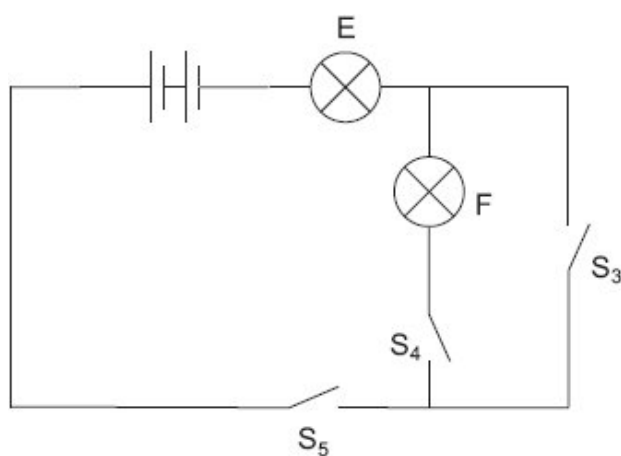


- (a) Complete the table below by writing **on** or **off** for each bulb.

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

3 marks

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

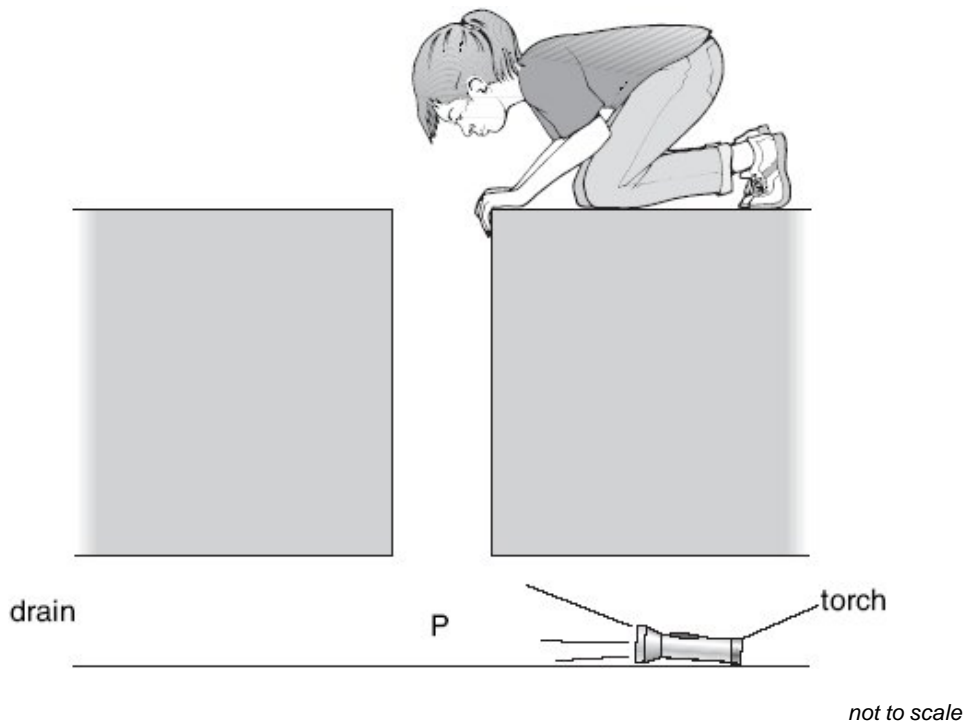


How could Lorna get both bulbs to light at the same time in this circuit?

.....

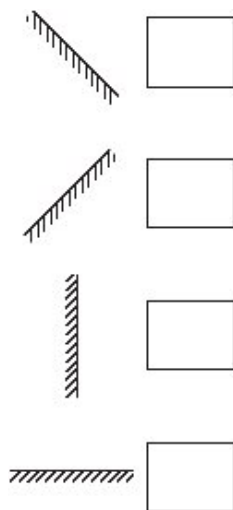
1 mark
 maximum 4 marks

- Q25.** Jenny dropped her torch down a drain.
The torch was still switched on but Jenny could **not** see it.



- (a) (i) Jenny lowered a mirror into the drain and placed it at position P.

At which angle should Jenny put the mirror to see the torch?
Tick the correct box.



1 mark

- (ii) What happens to the light from the torch when it hits the mirror?

.....

1 mark

(b) The diagrams below show the symbols for three parts of the torch circuit.

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



.....

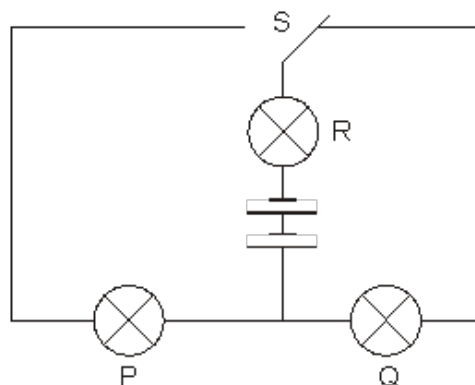
3 marks

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

1 mark
maximum 6 marks

Q26. (a) The diagram below shows a circuit with a two-way switch, S.

Rosie puts the switch in the position shown below.



Complete the table below to show if the bulbs are on **or** off.
Write **on** or **off** for each bulb.

bulb	on or off
P	
Q	
R	

1 mark

(b) Give the name of the part that provides energy for the circuit.

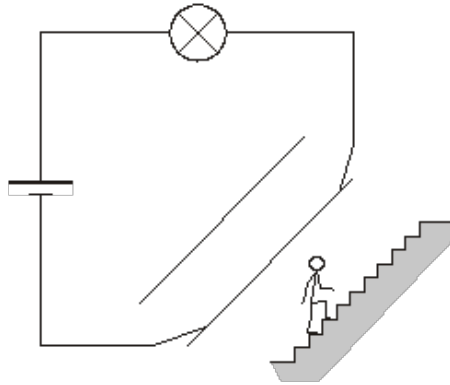
.....

1 mark

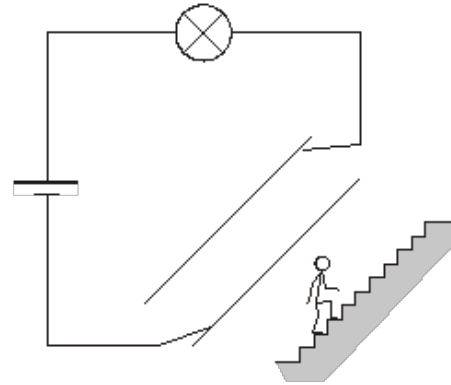
(c) The diagrams below show a light-bulb over a staircase of a model house.

There is a two-way switch at the bottom of the stairs and another two-way switch at the top.

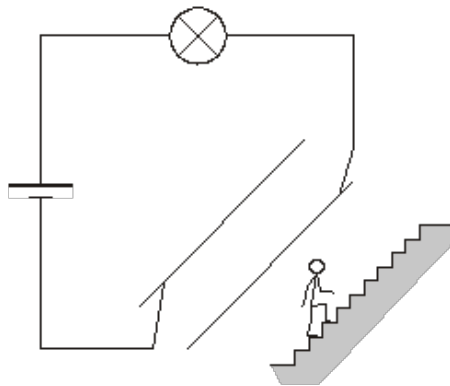
Under each diagram, tick **one** box to show if the bulb is **on** or **off**. The first one has been done for you.



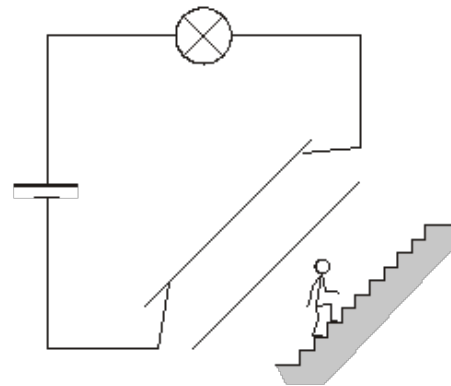
on	<input checked="" type="checkbox"/>
off	<input type="checkbox"/>



on	<input type="checkbox"/>
off	<input type="checkbox"/>



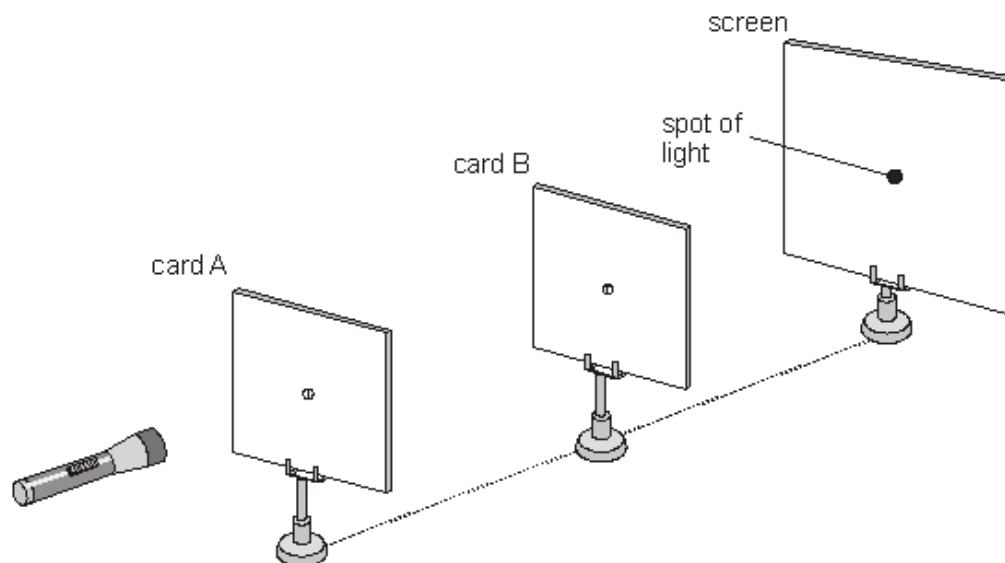
on	<input type="checkbox"/>
off	<input type="checkbox"/>



on	<input type="checkbox"/>
off	<input type="checkbox"/>

2 marks
maximum 4 marks

- Q27.** Gabby arranged a torch, two cards and a screen as shown below.
Light from the torch passed through holes in the cards and onto the screen.



- (a) Why did a spot of light appear on the screen? Tick the correct box.

Light can be split up into many colours.

☐

Light can travel through empty space.

☐

Light travels in straight lines.

☐

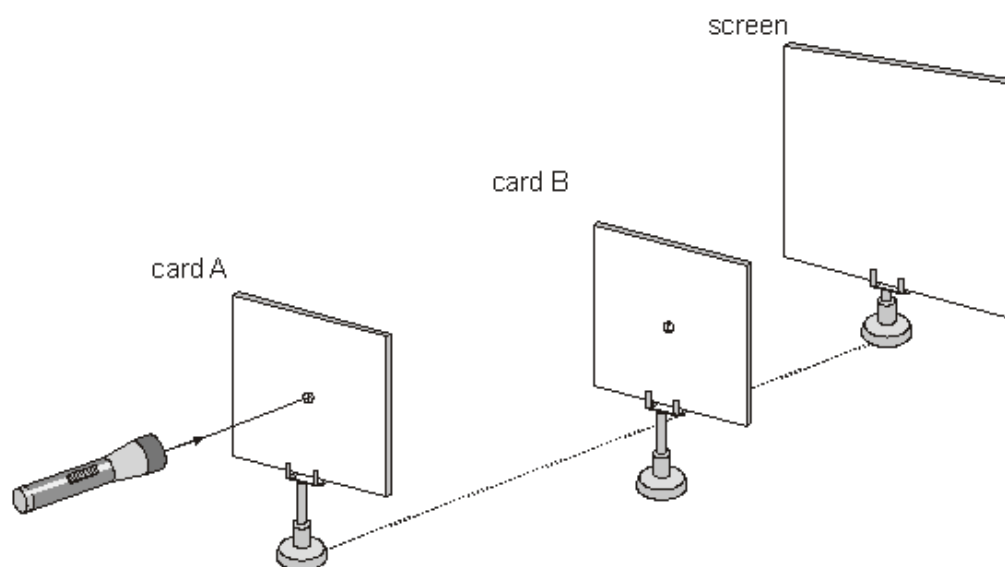
Light travels very fast.

☐

1 mark

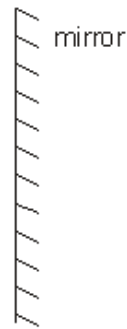
- (b) Gabby moved card B to one side as shown below.
The ray of light passed through the hole in card A and onto card B.

Continue the ray of light from the torch to show where it would hit card B.
Use a ruler.



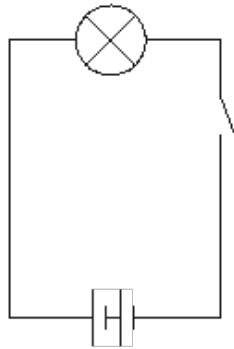
1 mark

- (c) Gabby used a torch to shine a ray of light towards a mirror. Continue the ray of light to show how it reflects off the mirror. Add an arrow to show the direction of the reflected ray. Use a ruler.



3 marks

- (d) Gabby built a circuit like the circuit in her torch.



What could she do to the circuit to make this bulb brighter?
Tick the correct box.

Add another battery.

☐

Add another bulb.

☐

Add another switch.

☐

Add longer wires.

☐

1 mark
maximum 6 marks

- Q28.** 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?

.....

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?

.....

1 mark

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

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

.....

1 mark

- (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

1 mark

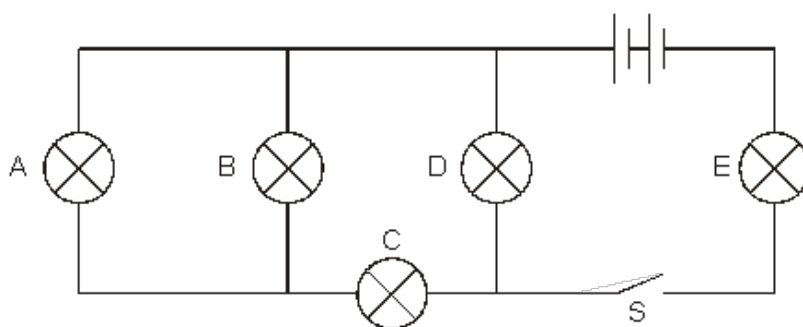
- (e) Look at the results in the table above.

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

.....

1 mark
 maximum 5 marks

- Q29.** (a) Max built **circuit 1** as shown below.



circuit 1

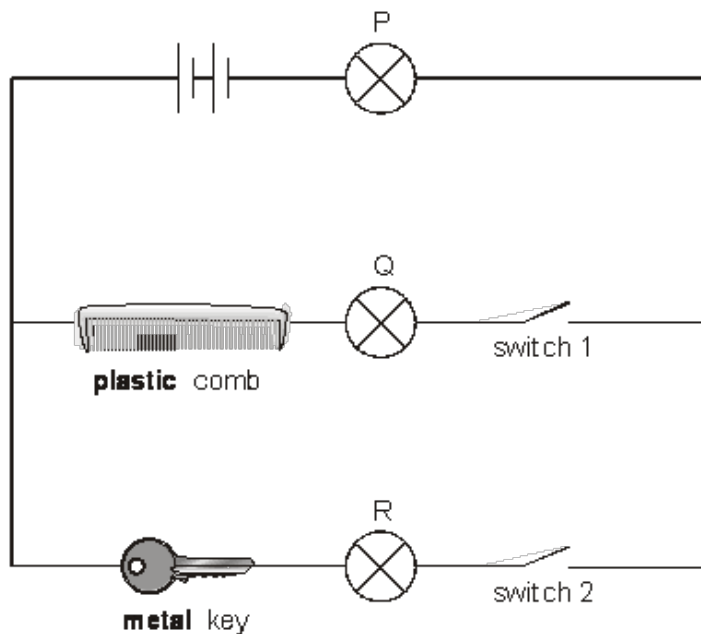
He closed the switch, S, and all the bulbs came on. One of the bulbs then broke and **all** the bulbs went off.

Which bulb must have broken?
 Give the letter.

.....

1 mark

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



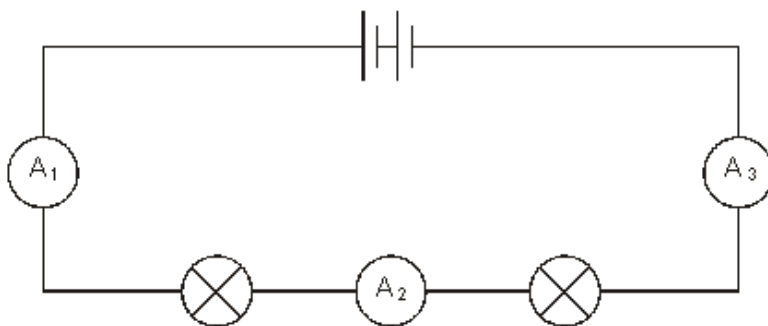
circuit 2

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			

2 marks

- (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.

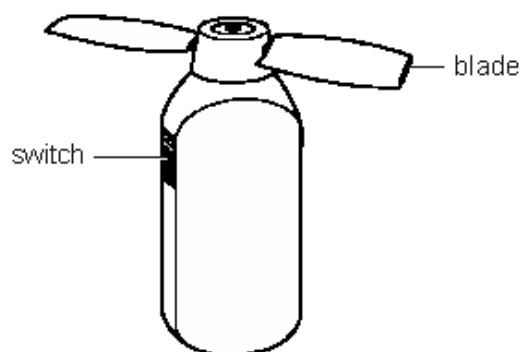
What would be the reading on ammeters A_2 and A_3 ?

Place **one** tick in the table by the correct pair of readings.

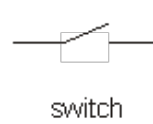
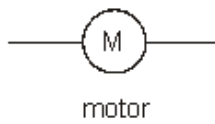
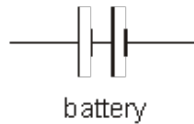
reading on ammeter A_2 (amps)	reading on ammeter A_3 (amps)	correct pair of readings
0.8	0.8	
0.8	0.4	
0.4	0.8	
0.4	0.4	

1 mark
maximum 4 marks

- Q30.** Susan has a small fan to keep herself cool.
When she switches it on, a motor turns the blades to blow air.



- (a) The diagrams below show the symbols for a battery, a motor and a switch.



In the space below, draw a series circuit diagram for the fan using these symbols.

1 mark

- (b) (i) Which part provides energy for the circuit?

.....

1 mark

- (ii) Some of this energy is used to turn the blades.
The rest of the energy is wasted.

Complete the sentence below. Choose words from the list.

chemical heat light sound

1 mark

When the blades are turning, energy is wasted as

..... energy and energy.

1 mark

- (c) Susan built a circuit using a battery, a motor and a switch.
She closed the switch to turn the motor on.

- (i) Susan added a bulb to the circuit.
The current in the circuit **decreased**.

How did this affect the motor?

.....

1 mark

- (ii) Susan removed the motor from the circuit.
The current in the circuit **increased**.

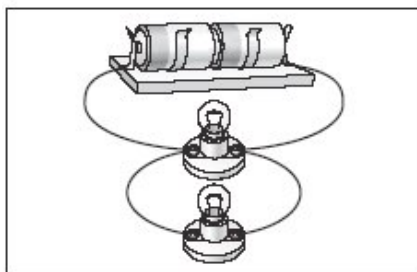
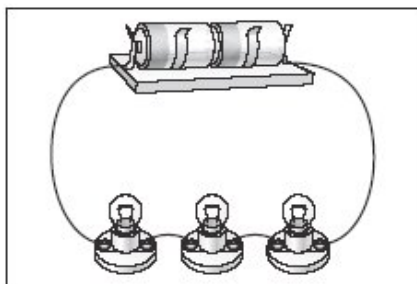
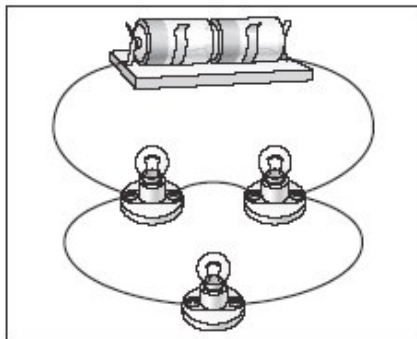
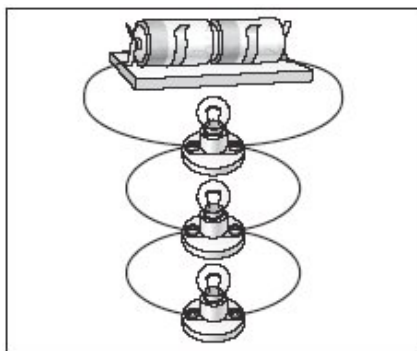
How did this affect the bulb?

.....

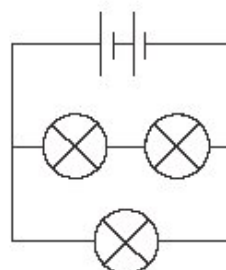
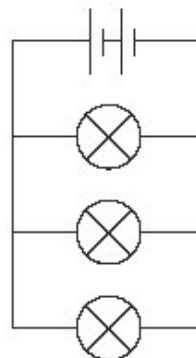
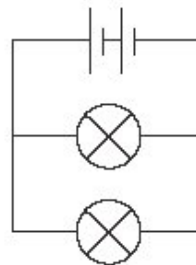
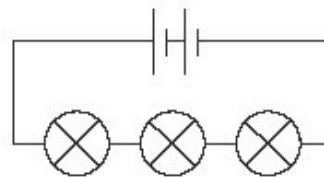
1 mark
maximum 6 marks

- Q31.** (a) Draw a line from each electrical circuit to the correct circuit diagram.
Draw only **four** lines.

electrical circuit



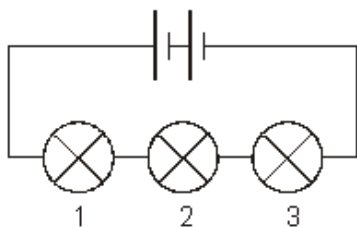
circuit diagram



2 marks

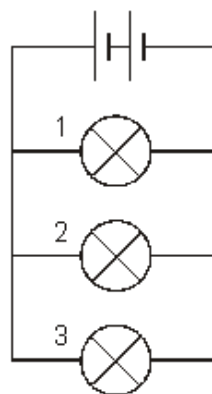
- (b) In each circuit below, **bulb 1 breaks** and goes off.

Under each circuit diagram below, tick the correct boxes to show if bulb 2 and bulb 3 are **on** or **off**.



circuit A

	on	off
bulb 1 breaks		?
bulb 2		
bulb 3		



circuit B

	on	off
bulb 1 breaks		?
bulb 2		
bulb 3		

2 marks

- (c) Give the name of the part that provides energy for each circuit.

.....

1 mark

- (d) Why is copper used for wires in a circuit?

Tick the correct box.

Copper does **not** stick to a magnet. ☐

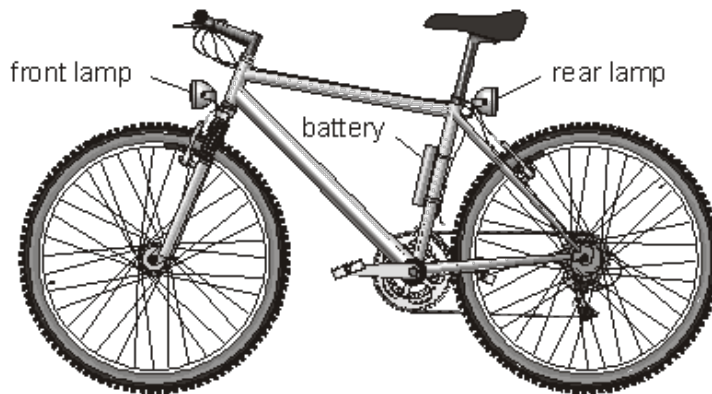
Copper is a good conductor of electricity. ☐

Copper is a brown metal. ☐

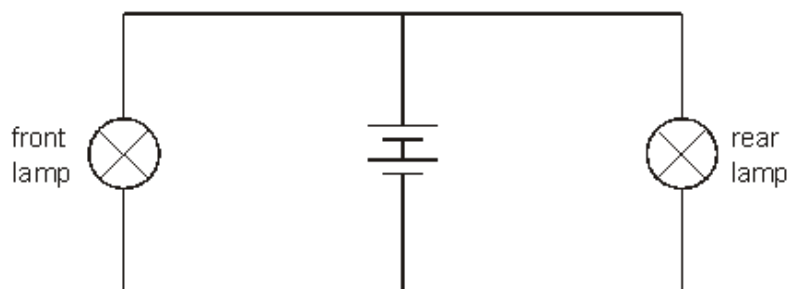
Copper is a good conductor of heat. ☐

1 mark
maximum 6 marks

- Q32.** 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.

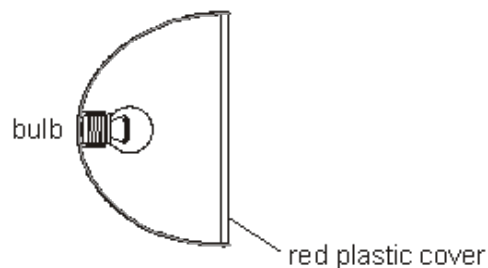


- (i) **On the circuit diagram above**, place a letter **A** to show the position of a switch to turn **only** the front lamp on and off.
- (ii) **On the circuit diagram above**, place a letter **B** to show the position of a switch to turn **both** lamps on and off at the same time.

1 mark

1 mark

- (b) The bulb in the rear lamp gives out white light.
White light is a mixture of all the colours of light.



The plastic cover acts as a red filter.
Red light passes through the filter.

What happens to the other colours that do **not** pass through?

.....

1 mark

- (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.

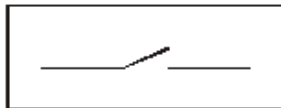
When the lamps are on, some of the energy in the bulb is wasted as
..... energy.

4 marks
maximum 7 marks

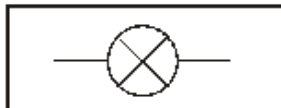
- Q33.** (a) Draw a line from each circuit symbol below to the correct name.
Draw only four lines.

circuit symbol

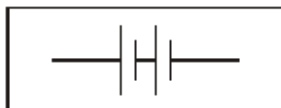
name



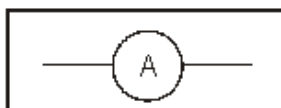
ammeter



switch



motor

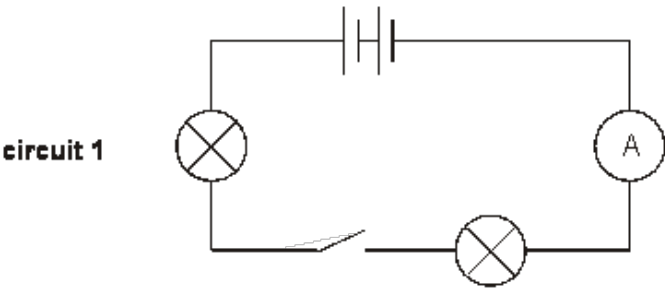


battery

bulb

3 marks

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

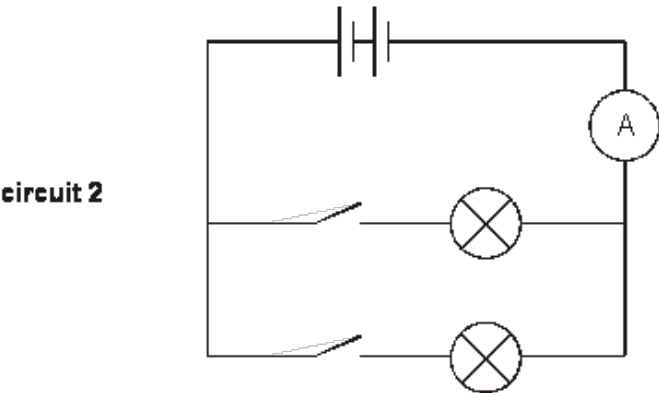


Give the name of the part that is the energy source for the circuit.

.....

1 mark

(c) Fred then made **circuit 2** as shown below.



In the table below, tick a box to show whether **circuit 1** and **circuit 2** are series or parallel circuits.
Tick only **two** boxes.

	series	parallel
circuit 1		
circuit 2		

1 mark

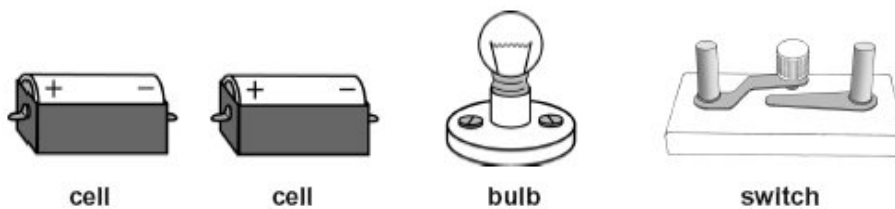
(d) What metal is usually used for wires in electric circuits?

.....

1 mark
maximum 6 marks

Q34.

Ben makes a series circuit using two identical cells, a bulb and a switch to turn the bulb on and off.



- (a) Draw a circuit diagram of Ben's circuit. Use the correct symbols.

The cells have been drawn for you.



3 marks

- (b) Which part of the circuit supplies the energy?

.....

1 mark

- (c) Ben adds another identical bulb to the circuit in series.
How does the **brightness** of the first bulb change?

.....

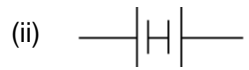
1 mark

- (d) How will the **brightness** of the bulbs change when the cells shown below are placed into Ben's circuit?



.....

1 mark



.....

1 mark

maximum 7 marks

