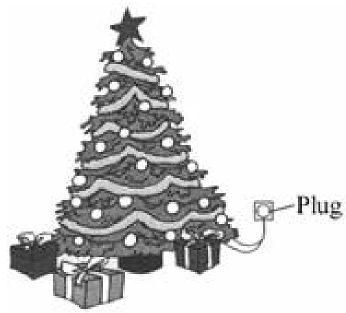
7.2.9 Conductors

30 minutes

32 marks

Q1. A set of Christmas tree lights is made from twenty identical lamps connected in series.



(a) Each lamp is designed to take a current of 0.25 A. The set plugs directly into the 230 V mains electricity supply.

(i) Write down the equation that links current, potential difference and resistance.

....

....

(1)

(ii) Calculate the resistance of **one** of the lamps. Show clearly how you work out your final answer and give the unit.

....

....

....

....

Resistance = ...

(4)

(iii) What is the total resistance of the set of lights?

....

....

Total resistance = ...

(1)

(b) How does the resistance of a filament lamp change as the temperature of the filament changes?

....

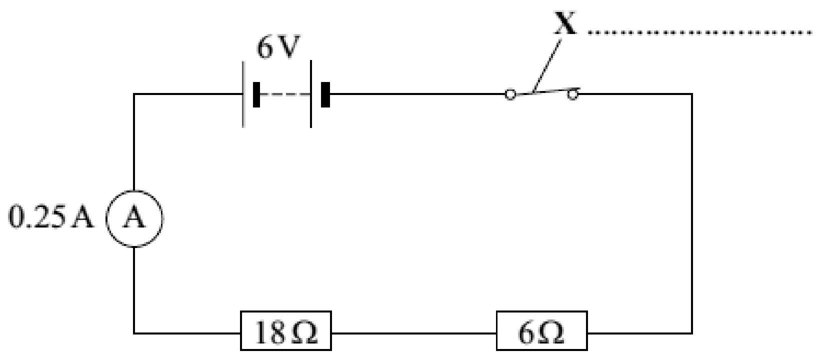
....

....

....

(1)
(Total 7 marks)

Q2. A circuit diagram is shown below.



(a) Use a word from the box to label component **X**.

fuse	**switch**	**thermistor**

(1)

(b) Calculate the total resistance of the two resistors in the circuit.

....

Total resistance = ... Ω

(1)

(c) The reading on the ammeter is 0.25 A.

The current through the 6 Ω resistor will be:

bigger than 0.25 A **equal to 0.25 A** **smaller than 0.25 A**

Draw a ring around your answer

(1)

(d) The 6 V battery is made by correctly joining several 1.5 V cells in series.

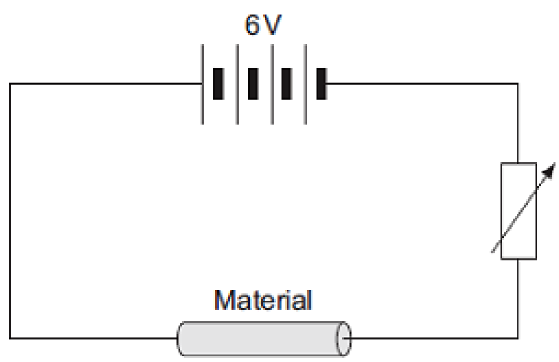
Calculate the number of cells needed to make the battery.

....

Number of cells = ...

(1)
(Total 4 marks)

Q3. (a) The diagram shows the circuit used to investigate the resistance of a sample of a material.
The diagram is not complete; the ammeter and voltmeter are missing.



(i) Draw the symbols for the ammeter and voltmeter on the diagram in the correct places.

(2)

(ii) How can the current through the material be changed?

....

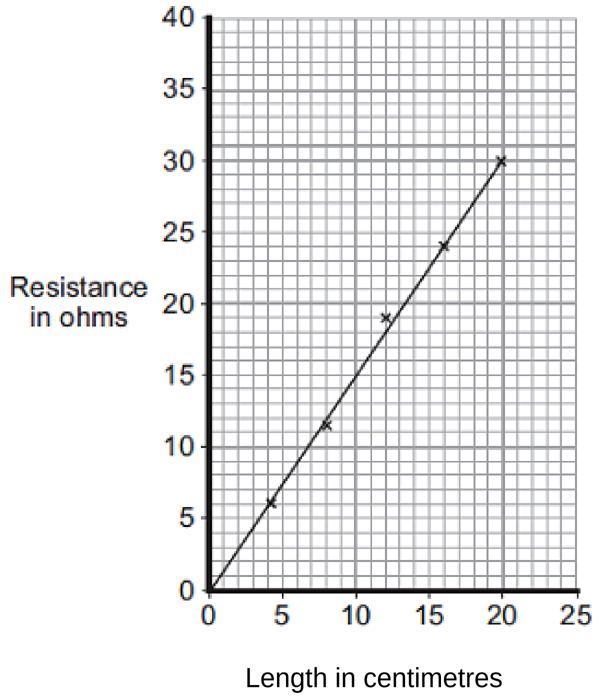
....

(1)

(b) The material, called conducting putty, is rolled into cylinders of different lengths but with equal thickness.

Graph 1 shows how the resistance changes with length.

Graph 1



(i) The current through a 25 cm length of conducting putty was 0.15 A.

Use **Graph 1** to find the resistance of a 25 cm length of conducting putty.

Resistance = ... ohms

(1)

(ii) Use your answer to **(b) (i)** and the equation in the box to calculate the potential difference across a 25 cm length of conducting putty.

potential difference = current x resistance

Show clearly how you work out your answer.

....

....

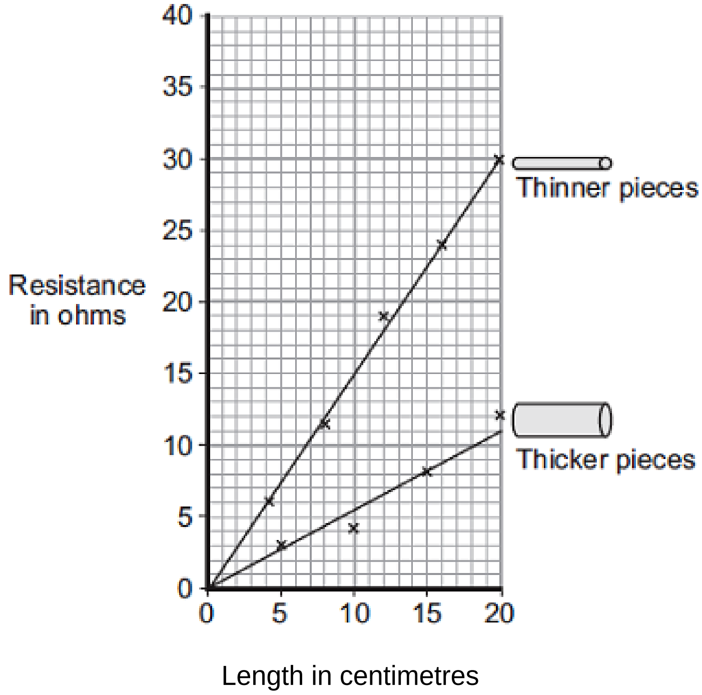
....

Potential difference = ... volts

(2)

(c) A second set of data was obtained using thicker pieces of conducting putty. Both sets of results are shown in **Graph 2**.

Graph 2



(i) What is the relationship between the resistance and the thickness of the conducting putty?

....

....

(1)

(ii) Name **one** error that may have reduced the accuracy of the results.

....

(1)

(iii) How could the reliability of the data have been improved?

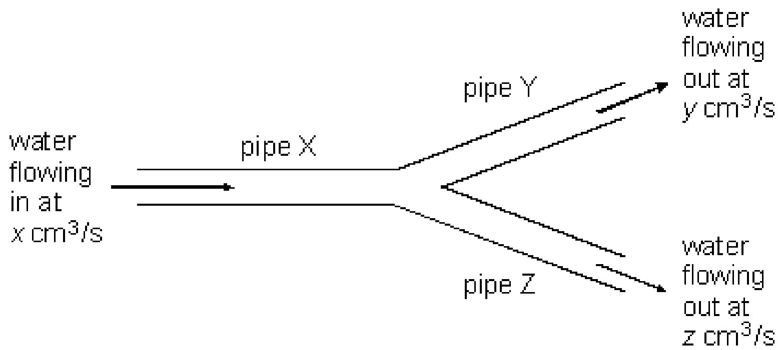
....

....

(1)
(Total 9 marks)

##

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



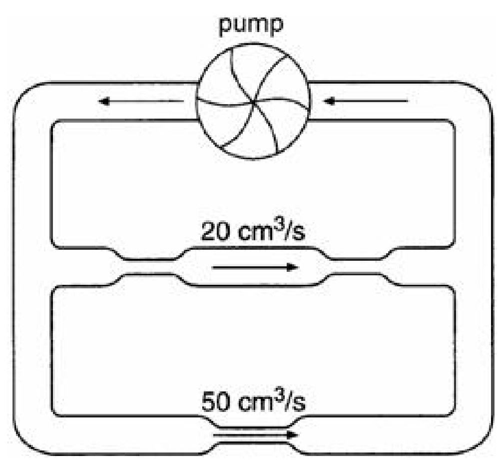
The diagram shows a junction in a water pipe.
The rate of flow in the pipes is measured in cm^3/s.

(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.

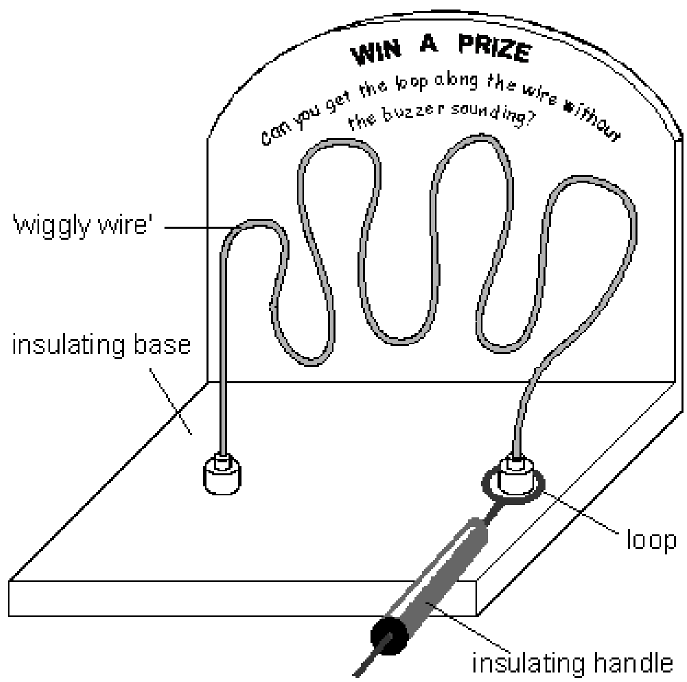
....

....

....

1 mark
Maximum 4 marks

Q5. Anne makes an electrical 'wiggly wire' game for a fête. To win a prize, the loop must not touch the 'wiggly wire'.



(a) The loop is made of a conducting material. The handle is made of an insulating material.

Give the name of **one** material which could be used to make:

(i) the loop;

....

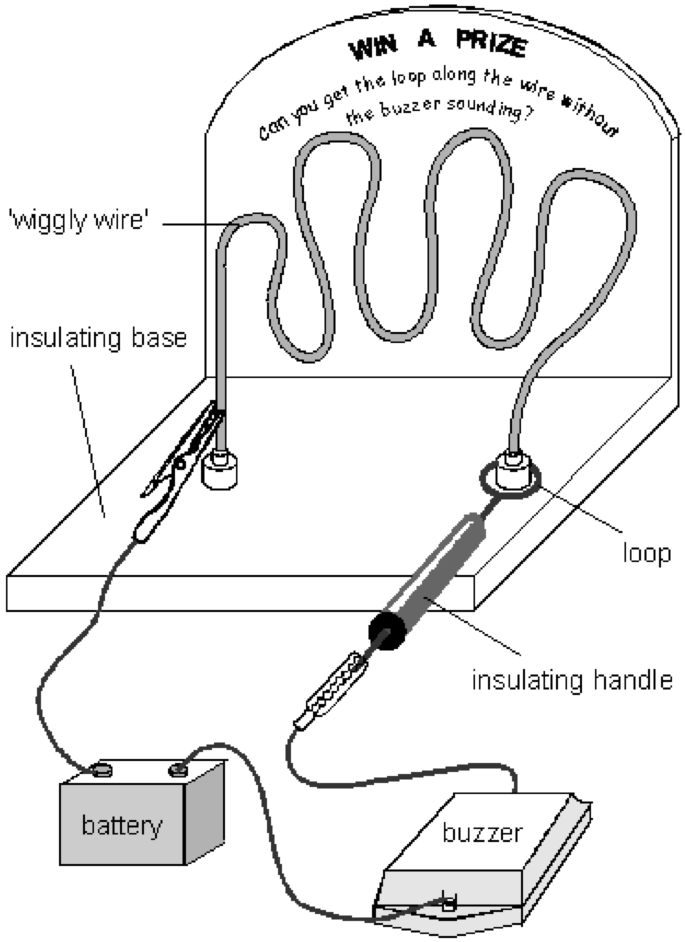
1 mark

(ii) the insulation handle.

....

1 mark

(b) The loop and the 'wiggly wire' are connected to a battery and a buzzer.



The buzzer only makes a noise when the loop touches the 'wiggly wire'.
Explain why.

....

....

1 mark

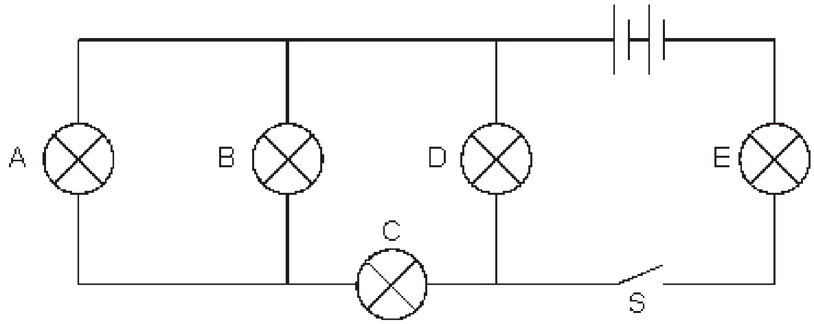
(c) Later, Anne paints the 'wiggly wire', but then the game does **not** work.
Suggest why the game does **not** work with a painted wire.

....

....

1 mark
Maximum 4 marks

Q6. (a) Max built **circuit 1** as shown below.



circuit 1

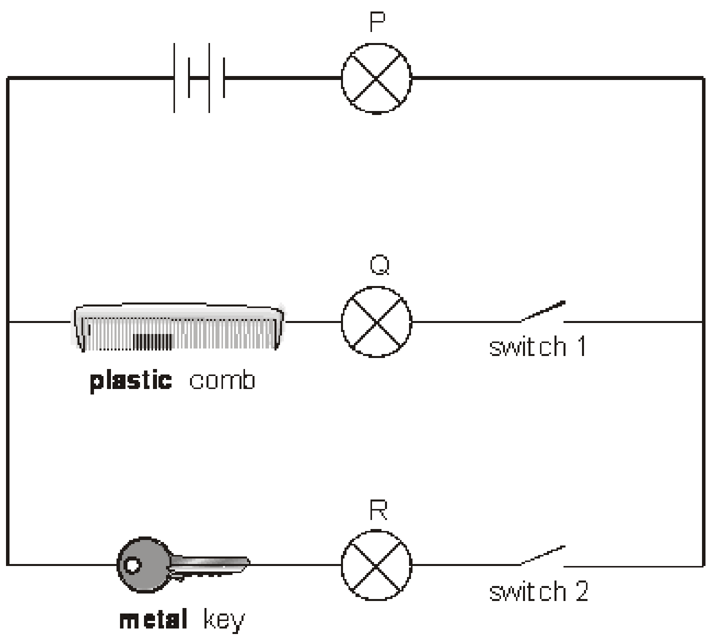
He closed the switch, S, and all the bulbs came on.
One of the bulbs then broke and **all** the bulbs went off.

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.



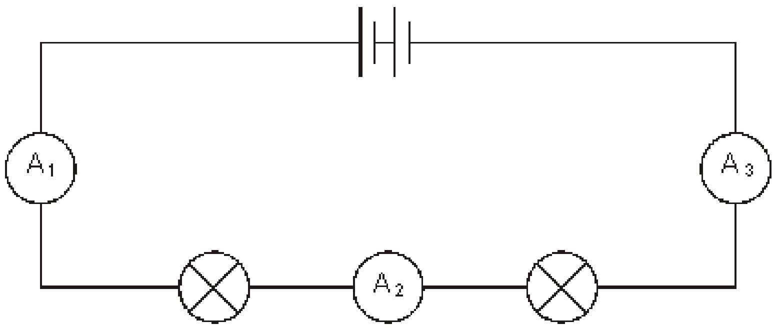
circuit 2

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.

readingon 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