Q1.   (a)   The diagram shows the information plate on an electric kettle. The kettle is plugged into the a.c. mains electricity supply.

230 V   **2760 W**
50 Hz

Use the information from the plate to answer the following questions.

(i)   What is the frequency of the a.c. mains electricity supply?

....

(1)

(ii)   What is the power of the electric kettle?

....

(1)

(b)   To boil the water in the kettle, 2400 coulombs of charge pass through the heating element in 200 seconds.

Calculate the current flowing through the heating element and give the unit.

Use the correct equation from the Physics Equations Sheet.

Choose the unit from the list below.

amps   **volts**   **watts**

....

....

....
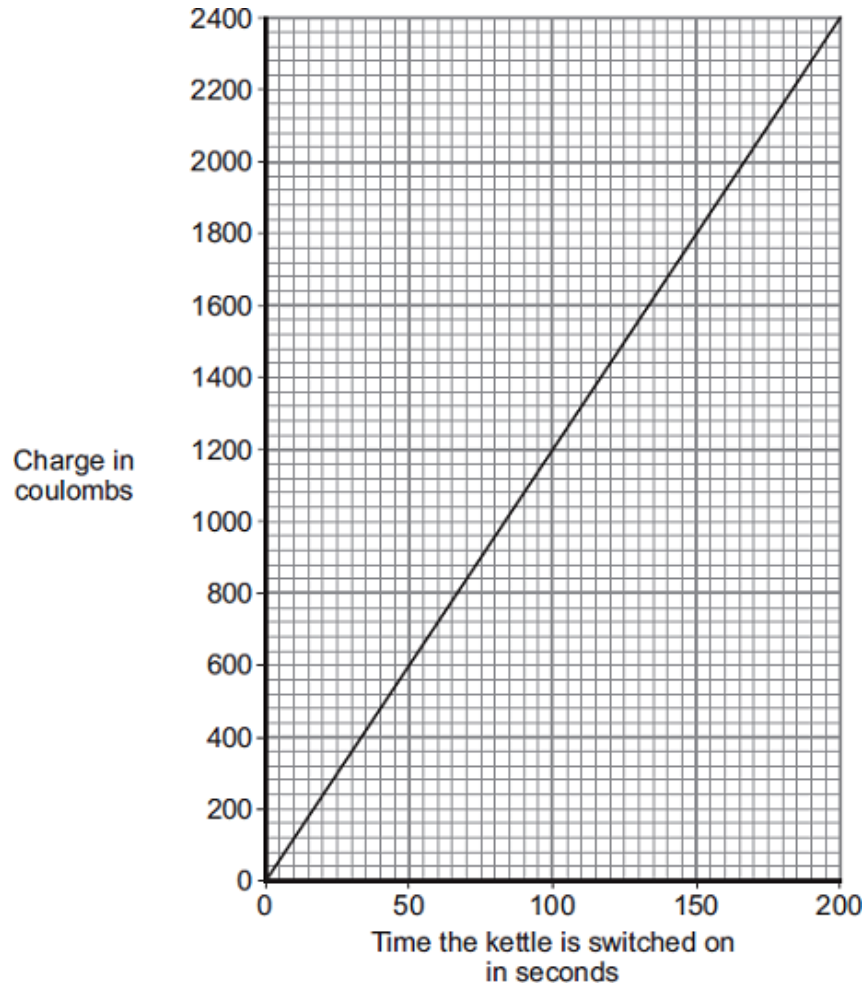
Current = ...

(3)

(c)   The amount of charge passing through the heating element of an electric kettle depends on the time the kettle is switched on.

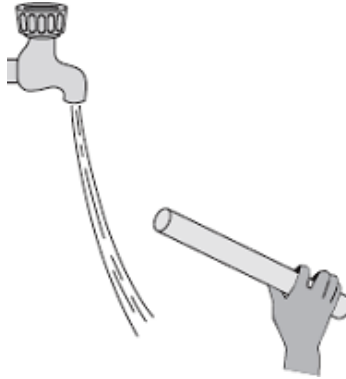Charge in coulombs

Time the kettle is switched on in seconds

What pattern links the amount of charge passing through the heating element and the time the kettle is switched on?

....

....

(2)
(Total 7 marks)

Q2.   (a)   The diagram shows a negatively charged plastic rod held near to a thin stream of water. The water is attracted towards the rod.

Which **one** of the following statements explains what is happening to the charge in the water?

Tick (✔) **one** box.

The positive and the negative charges in the water are attracted to the rod.

The positive and the negative charges in the water are repelled by the rod.

The negative charge in the water is repelled by the rod and the positive charge is attracted to the rod.

The negative charge in the water is attracted to the rod and the positive charge is repelled by the rod.

(1)

(b) A company that produces bottles of mouthwash found a problem with the automatic filling system.

As the bottles go towards the filler, the bottles move around on the conveyor belt and become electrostatically charged. This causes the stream of mouthwash to move sideways, missing the open top of the bottle.
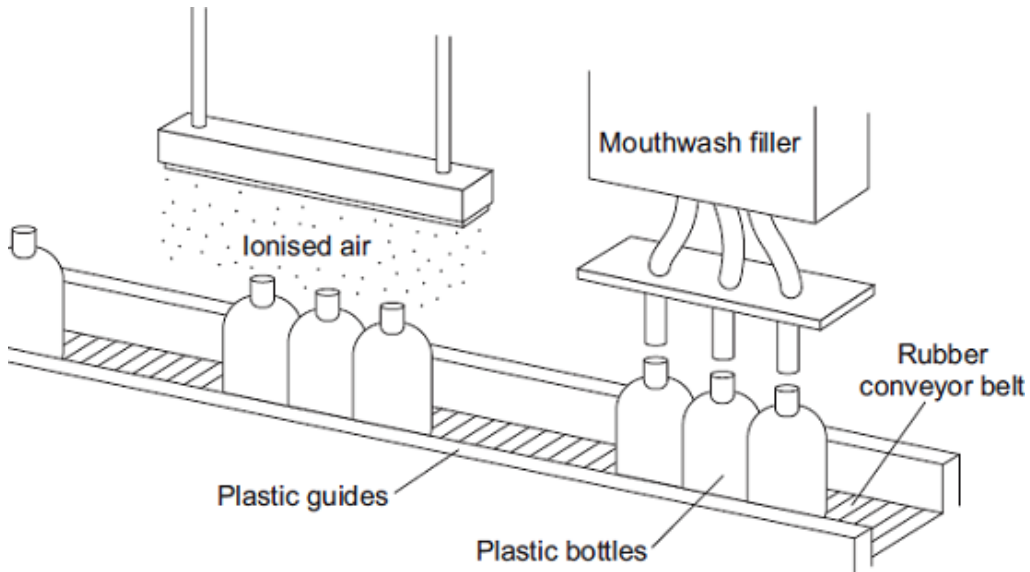
The company came up with an answer to the problem. Before the bottles reach the dfiller, the bottles pass through a stream of ionised air. The ions in the air neutralise the charge on the bottles.

(i) Explain why the plastic bottles became charged.

....

....

....

....

(2)

(ii) What happens to the structure of an atom to change the atom into an ion?

....

....

(1)
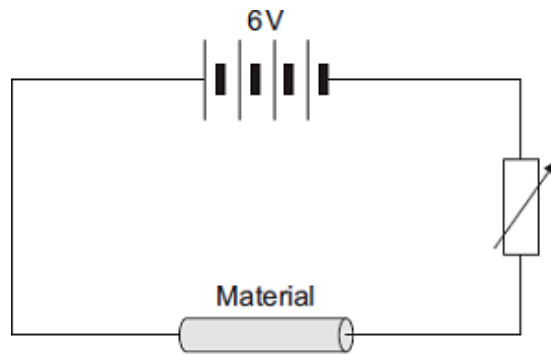
(iii) Earthing the conveyor belt with a conducting wire would not have solved this problem.
Give a reason why.

....

....

(1)
(Total 5 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

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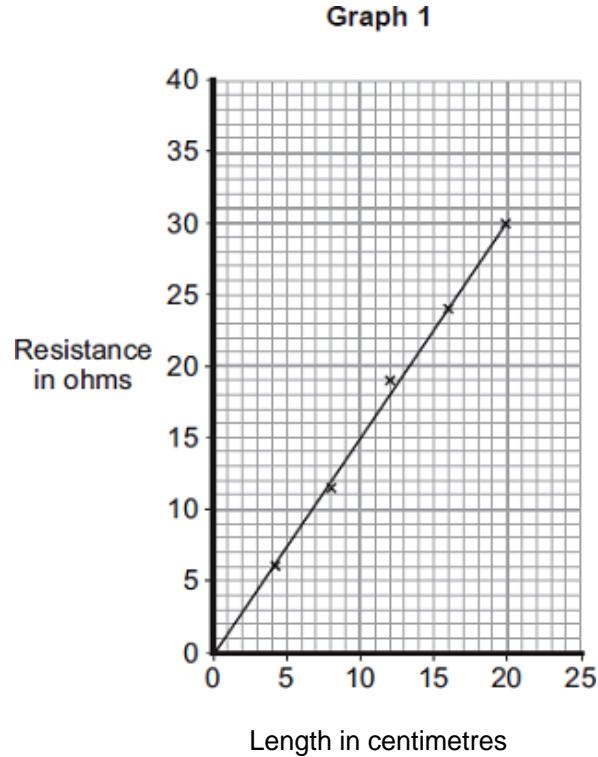
(i)   The current through a 25 cm length of conducting putty was 0.15 A.

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

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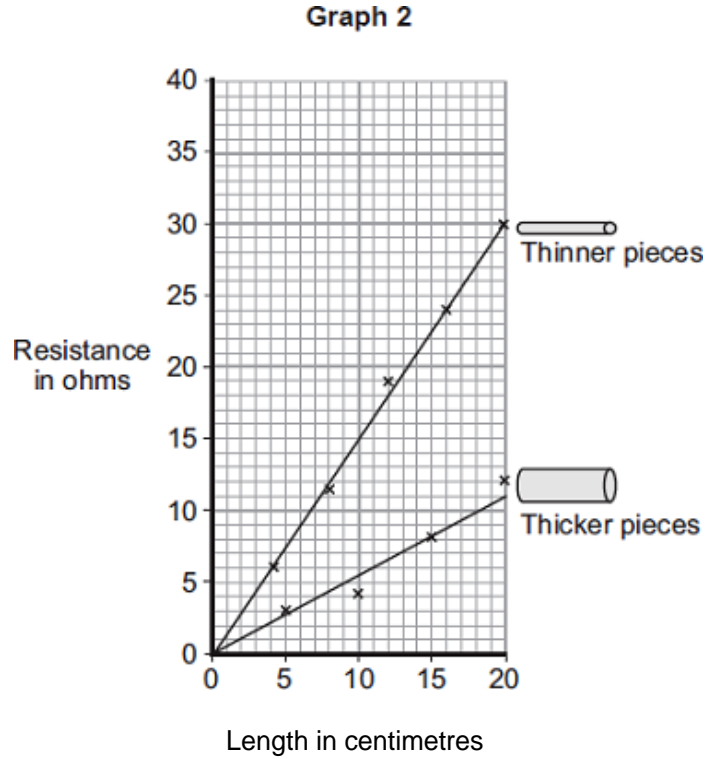
(i)   What is the relationship between the resistance and the thickness of the conducting putty?

....

....

(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)

Q4. (a) The diagram shows the circuit used to obtain the data needed to plot the current–potential difference graph for a filament bulb.
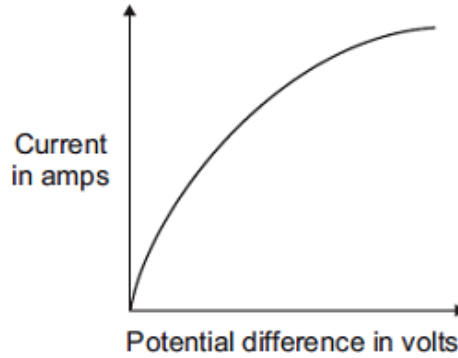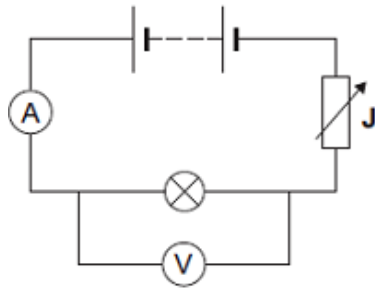
(i) Why is the component labelled '**J**' included in the circuit?

....

....

(1)

(ii) The resistance of the bulb increases as the potential difference across the bulb increases. Why?

....

....

(1)

(iii) The bulb is at full brightness when the potential difference across the bulb is 12 V. The current through the bulb is then 3 A.

Calculate the power of the bulb when it is at full brightness and give the unit.

Use the correct equation from the Physics Equations Sheet.

....

....

....

Power = ...

(3)

(b)   *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The table gives data about two types of light bulb people may use in their homes.

Type of light bulb	Energy efficiency	Cost of one light bulb	Average lifetime in hours
Halogen	10%	£1.95	2 000
Light Emitting Diode (LED)	32%	£11.70	36 000

Both types of light bulb produce the same amount of light.

Evaluate, in terms of cost and energy efficiency, the use of the two types of light bulb.

To gain full marks you must compare both types of light bulb and conclude which light bulb would be the best to use.

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....

....

(6)
(Total 11 marks)