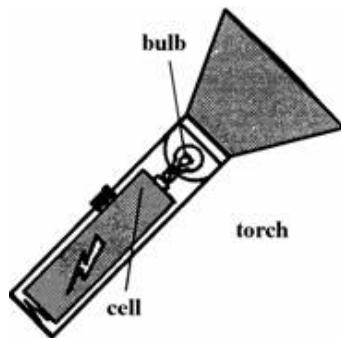


- Q1.** A small torch uses a single cell to make the bulb light up.

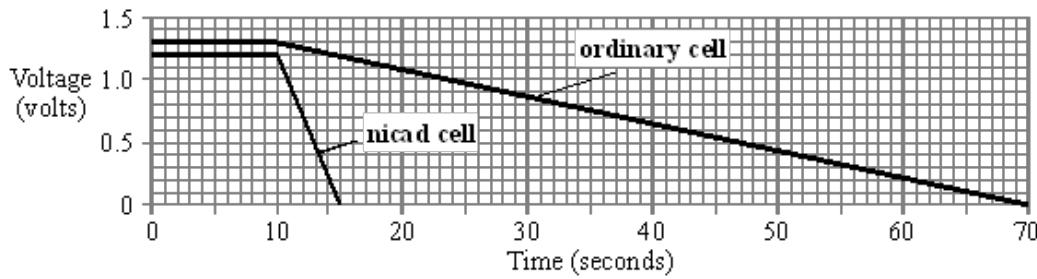


- (a) Label the symbol for a cell and the symbol for a bulb (lamp)



(2)

- (b) The graphs show the voltage across two different types of cell as they transfer the last bit of their stored energy through the torch bulb.

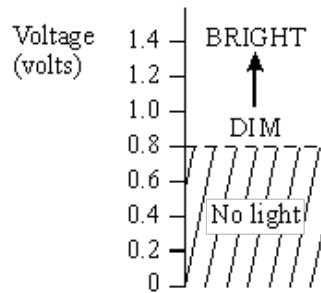


Describe the differences that the graphs show between the two types of cell.

.....
.....
.....

(3)

- (c) The diagram shows how bright the torch bulb is for different voltages.



From the point when the voltage of each cell starts to fall, how long will the bulb stay lit:

- (i) with the ordinary cell?

.....

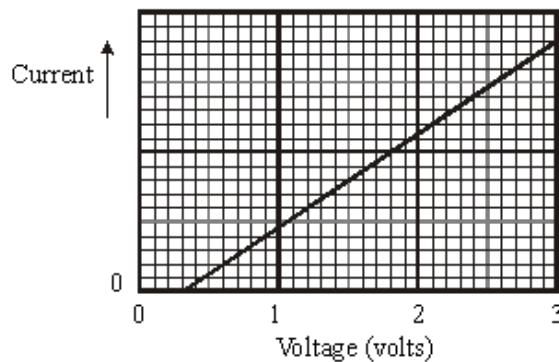
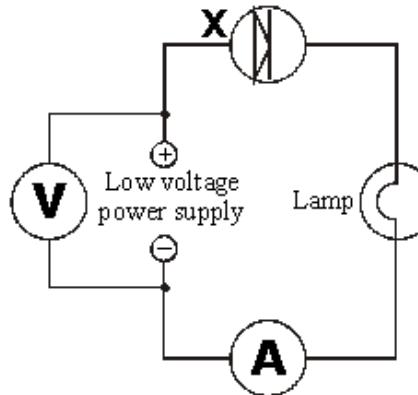
- (ii) with the nicad cell?

.....

(4)
(Total 9 marks)

- Q2.** Some students want to find out how the current through component X changes with the voltage they use.

The diagram shows their circuit. The graph shows their results.



- (a) Describe, as fully as you can, what happens to the current through component X as the students increase the voltage.

.....
.....
.....

(4)

- (b) The students want to find out whether component X allows the same current to flow through it in the opposite direction.

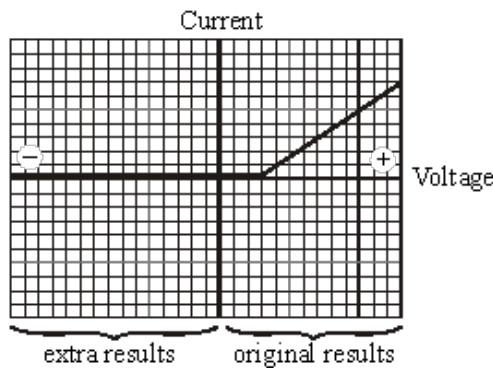
- (i) How should they change the circuit to test this?

.....

(1)

- (ii) The graph shows the students' extra results.

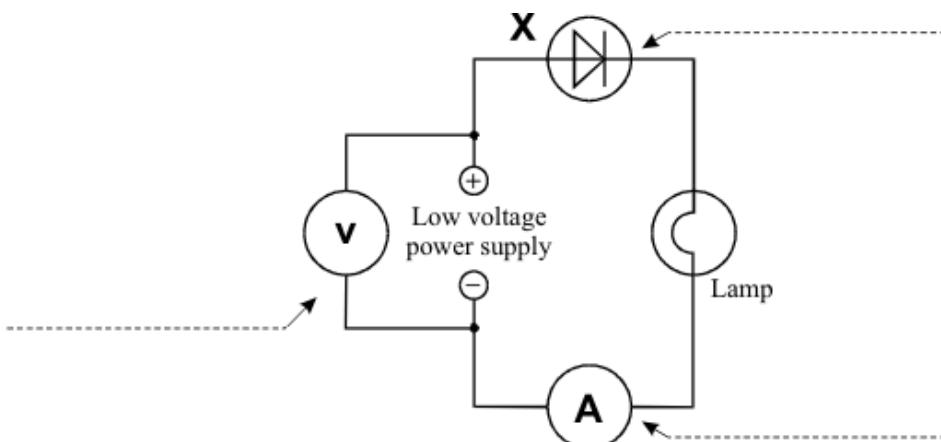
What do the extra results tell you?



.....
.....
.....

(1)
(Total 6 marks)

- Q3.** (a) Add the missing labels to the diagram.

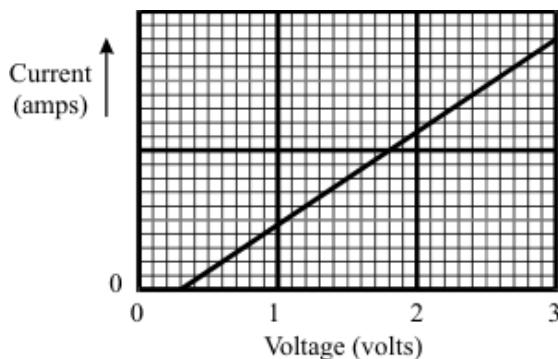


(3)

- (b) Some students use the circuit shown above.

They want to find out how the current through component X changes as they change the voltage.

The graph shows their results.

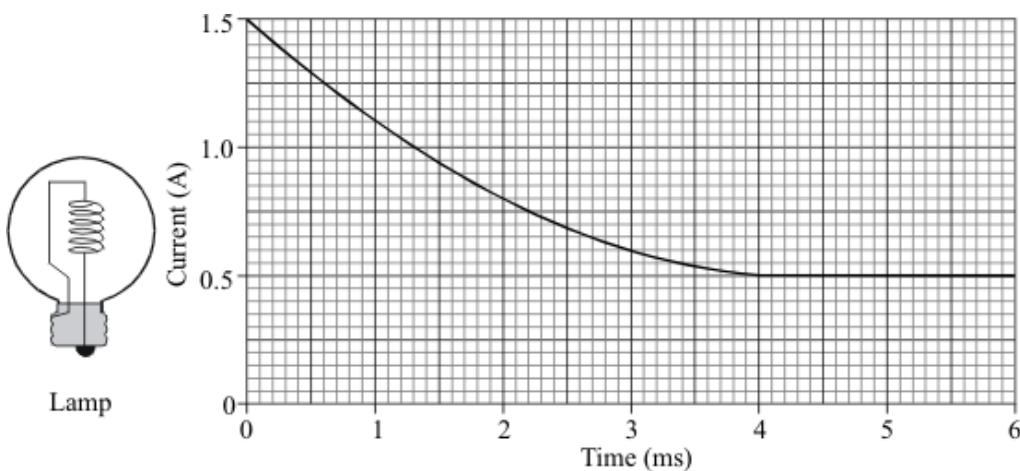


Describe, as fully as you can, what happens to the current through component X as the students increase the voltage.

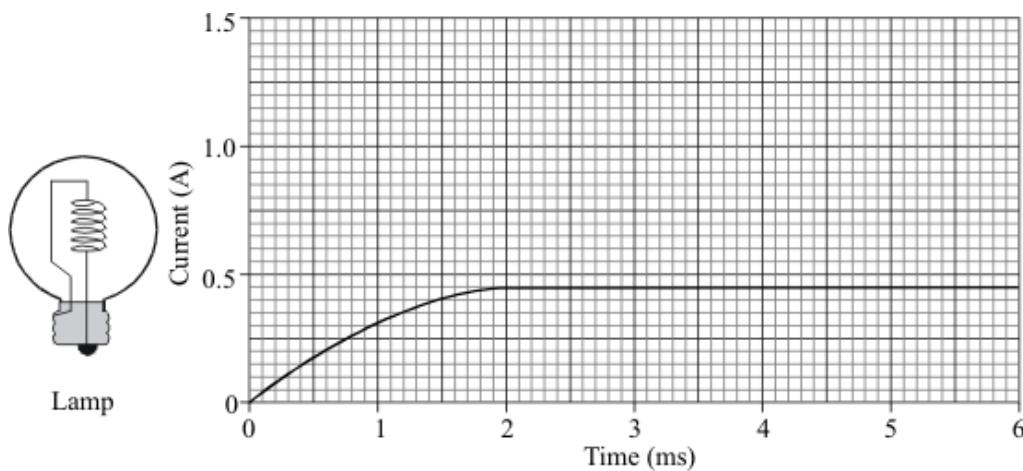
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(4)
(Total 7 marks)

- Q4.** A computer is set up to produce a graph of the current through an electric lamp during the first few milliseconds after it is switched on.



The lamp is modified then tested in the same way.



- (a) Describe **three** differences in the way the lamp behaves after it has been modified.

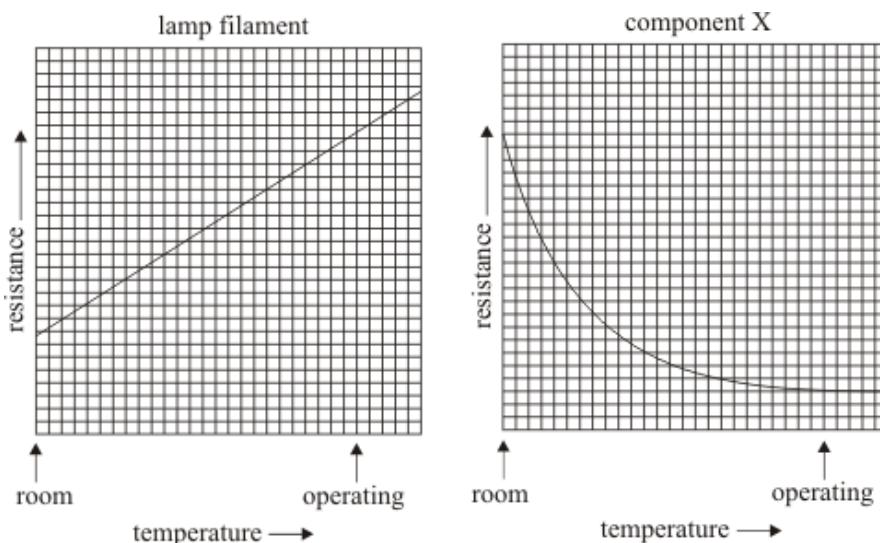
1.
2.
3.

(3)

- (b) The current through the modified lamp depends on the total resistance of the filament and component X.

The smaller this total resistance is, the greater the current.

The following graphs show how the resistance of the lamp filament and component X change as the lamp heats up to its operating temperature.

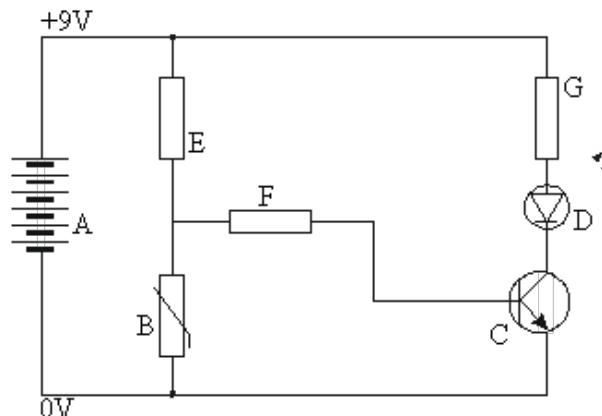


Use the information shown on the graphs to explain the behaviour of the modified lamp.

.....
.....
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.....
.....

(4)
(Total 7 marks)

- Q5.** The diagram shows an electronic circuit.



- (a) Write down the names of the components in the list below.

A =

B =

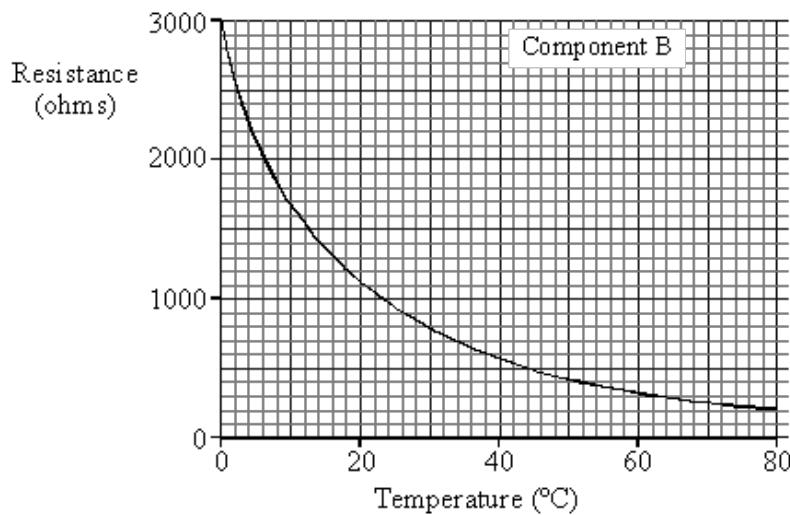
C =

D =

E, F and G =

(5)

- (b) The graph shows how the resistance of component B depends on its temperature.



Describe, in as much detail as you can, how the resistance of component B changes as its temperature rises from 0°C to 80°C .

.....
.....
.....
.....
.....

(4)

- (c) At what temperature does component B have a resistance of 1000 ohms?

Answer $^{\circ}\text{C}$.

(2)
(Total 11 marks)

- Q6.** In a hairdryer circuit there is a heater and a motor. It is important that the motor is always running when the heater is switched on.

- (a) Using the symbols shown below only **once** each, draw a circuit for a hairdryer.



(2)

- (b) Modern hairdryers are described as *double insulated*.

Explain what this term means.

.....
.....
.....

(2)

- (c) On a modern hairdryer handle it states:

1600 W 230 V 50 Hz

- (i) [A] Write an equation which shows the relationship between current, power and voltage.

.....

(1)

- [B] Calculate the current in the hairdryer when it is on full power.
Show clearly how you get your answer.

.....
.....

Current = A

(2)

- (ii) [A] Write an equation which shows the relationship between current, resistance and voltage.

.....

(1)

[B] The resistance of the heater is 20 ohms. Calculate the resistance of the motor.

Show clearly how you get your answer.

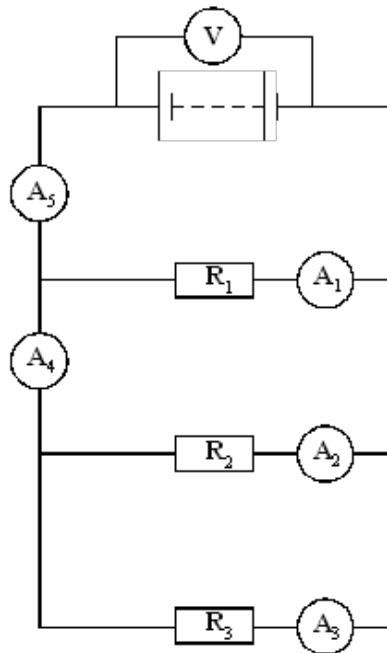
.....
.....

Resistance = ohms

(2)

(Total 10 marks)

Q7. A circuit was set up as shown in the diagram.



- (a) The table gives the current through three of the ammeters. Complete the table to show the current through the other two ammeters.

Ammeter	Reading on ammeter in amps
A_1	0.2
A_2	0.6
A_3	0.3
A_4	
A_5	

(2)

- (b) The reading on the voltmeter is 12 V.

What is the resistance of R_2 ?

Show your working and include the correct unit.

.....
.....
.....

Resistance =

(3)

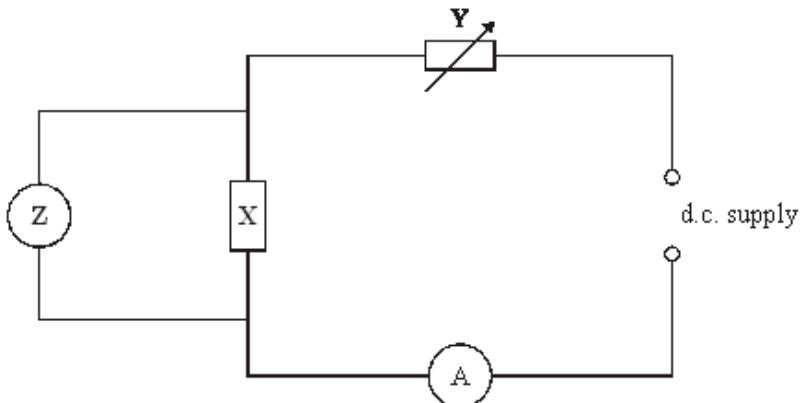
- (c) In the circuit above, the resistor R_2 burned out and current stopped flowing in it. There was no other change to the circuit.

Complete the table below to show the readings on the ammeters after this took place.

Ammeter	Reading on ammeter in amps
A_1	0.2
A_2	0.0
A_3	
A_4	
A_5	

(3)
(Total 8 marks)

- Q8. The current through component X is measured when different voltages are applied across it.



- (a) Name the component labelled Y in the circuit.

.....

(1)

- (b) What type of meter is Z?

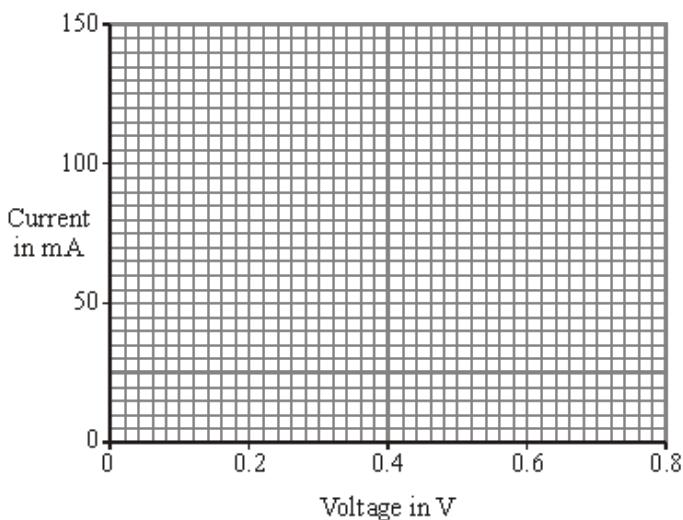
.....

(1)

- (c) The table shows the measurements obtained in this experiment.

Voltage in V	0	0.2	0.4	0.6	0.8
Current in mA	0	0	50	100	150

Draw a graph of the measurements.



(2)

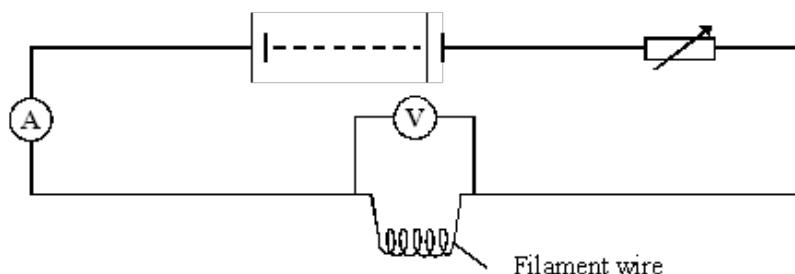
- (d) Use the shape of the graph to name component X.

.....

(1)

(Total 5 marks)

- Q9.** A bulb heats up when an electric current passes through the filament wire. The current was measured when different voltages were applied across the filament wire shown in the diagram below.



- (a) (i) Look at the circuit diagram. How was the voltage changed?

.....

.....

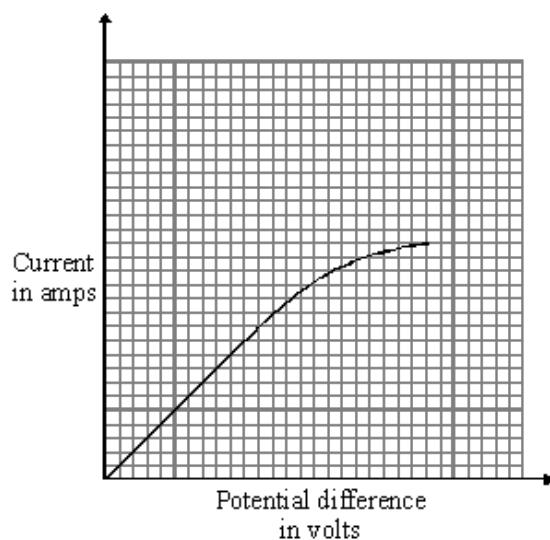
(1)

- (ii) Write an equation that shows the relationship between *current*, *potential difference* and *resistance*.

.....

(1)

- (b) The graph shows how the current through the filament wire changed as the potential difference across it changed.



- (i) Describe the effect of increasing the potential difference on the current flowing through the filament wire.

.....

.....

.....

(2)

- (ii) Explain this effect in terms of the resistance of the filament wire.

.....
.....
.....

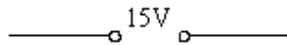
(2)
(Total 6 marks)

- Q10.** A student investigates how the current flowing through a filament lamp changes with the voltage across it.

She is given a filament lamp and connecting wires.

She decides to use a 15V power supply, a variable resistor, an ammeter, a voltmeter and a switch.

- (a) Complete the circuit diagram to show how she should set up the circuit.

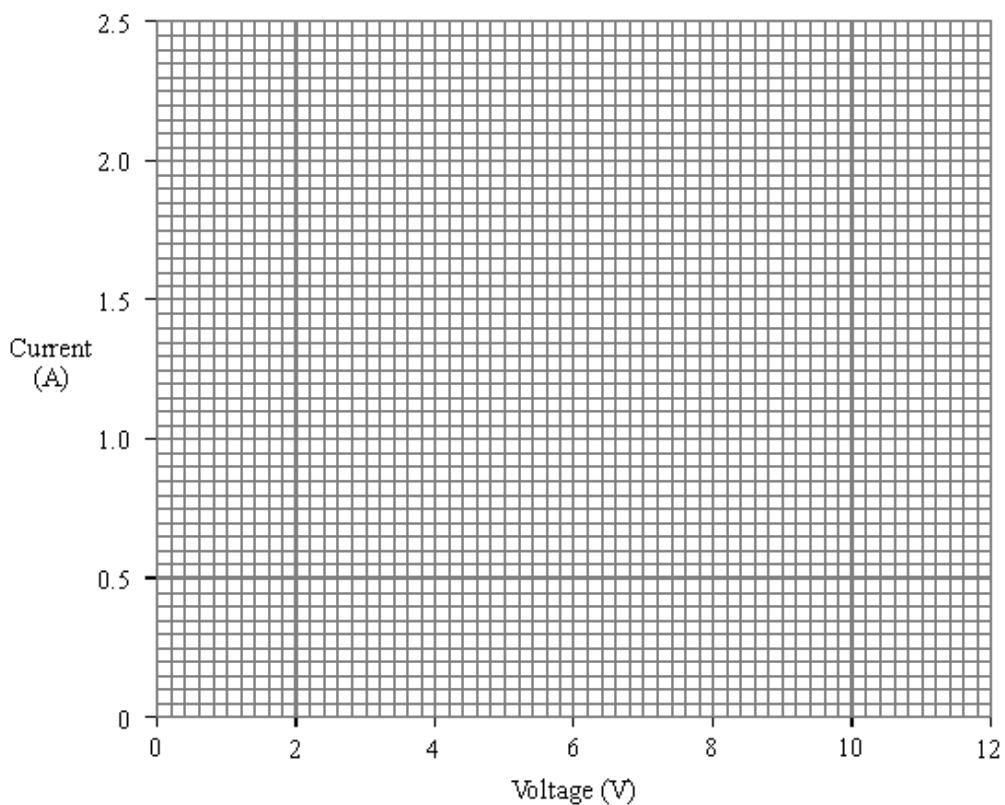


(4)

- (b) The student obtains the following results.

VOLTAGE (V)	0.0	3.0	5.0	7.0	9.0	11.0
CURRENT (A)	0.0	1.0	1.4	1.7	1.9	2.1

- (i) Plot a graph of current against voltage.



(3)

- (ii) Use your graph to find the current when the voltage is 10V.

Current A

(1)

- (iii) Use your answer to (ii) to calculate the resistance of the lamp when the voltage is 10V.

.....
.....
.....

Resistance Ω

(2)

- (c) (i) What happens to the resistance of the lamp as the current through it increases?

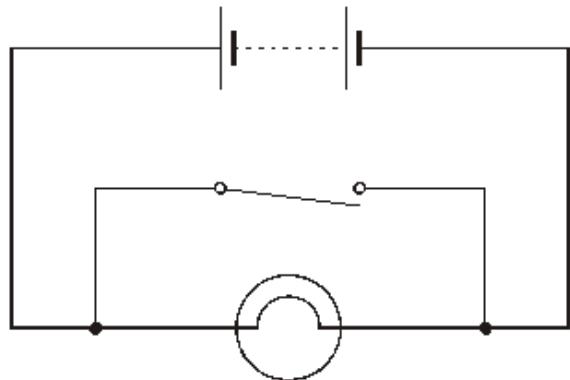
.....

- (ii) Explain your answer.

.....
.....
.....

(2)
(Total 12 marks)

- Q11.** The circuit diagram below shows a battery connected to a lamp and a switch.



- (a) State what happens to the lamp when:

- (i) the switch is open (OFF);

.....

- (ii) the switch is closed (ON).

.....

(2)

- (b) When the switch is closed what problem is caused in the circuit?

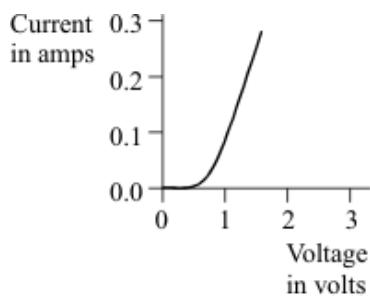
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(1)

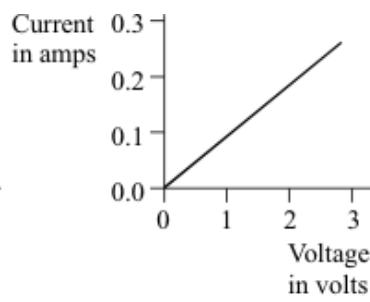
- (c) In the space below draw a circuit diagram to show how the switch should be correctly connected to the lamp and battery.

(1)
(Total 4 marks)

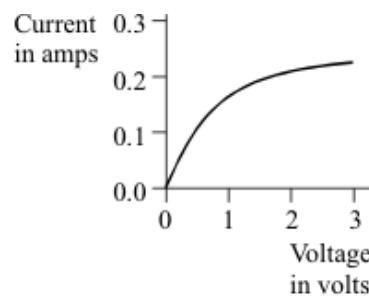
- Q12.** (a) The diagram shows the voltage-current graphs for three different electrical components.



A



B



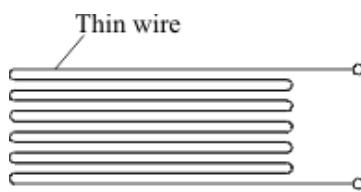
C

Which **one** of the components **A**, **B** or **C** could be a 3 volt filament lamp? Explain the reason for your choice.

.....
.....
.....
.....

(3)

- (b) Using the correct symbols draw a circuit diagram to show how a battery, ammeter and voltmeter can be used to find the resistance of the wire shown.



(3)

- (c) When correctly connected to a 9 volt battery the wire has a current of 0.30 amperes flowing through it.

- (i) Give the equation that links current, resistance and voltage.

.....

(1)

- (ii) Calculate the resistance of the wire. Show clearly how you work out your answer and give the unit.

.....
.....

Resistance =

(3)

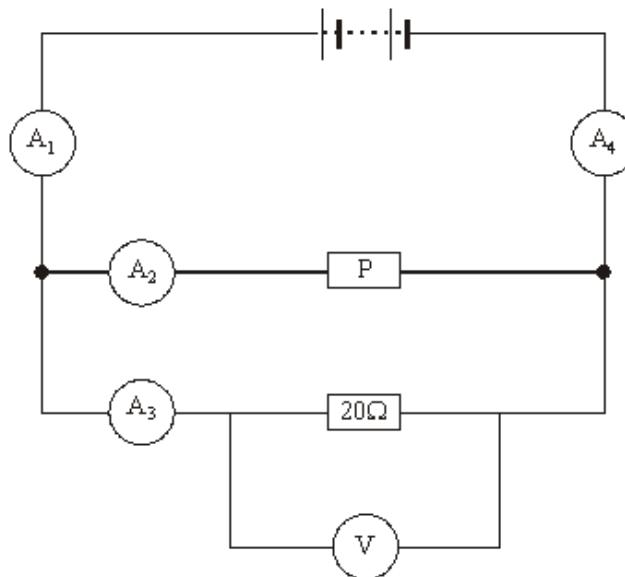
- (iii) When the wire is heated, the current goes down to 0.26 amperes. State how the resistance of the wire has changed.

.....
.....

(1)

(Total 11 marks)

- Q13.** The circuit shown has four identical ammeters.



- (a) The table gives the current through two of the ammeters.
- (i) Complete the table to show the current through the other two ammeters.

Ammeter	Reading on ammeter in amps
A_1	
A_2	0.2
A_3	0.3
A_4	

(2)

- (ii) Which **one** of the following statements is correct. Tick (\checkmark) the box next to your choice.

The resistance of P is more than $20\ \Omega$.

The resistance of P is equal to $20\ \Omega$.

The resistance of P is less than $20\ \Omega$.

Give a reason for your choice.

.....
.....
.....

(2)

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

.....

(1)

- (ii) Calculate the reading on the voltmeter. Show clearly how you work out your answer.

.....
.....

Voltmeter reading = volts.

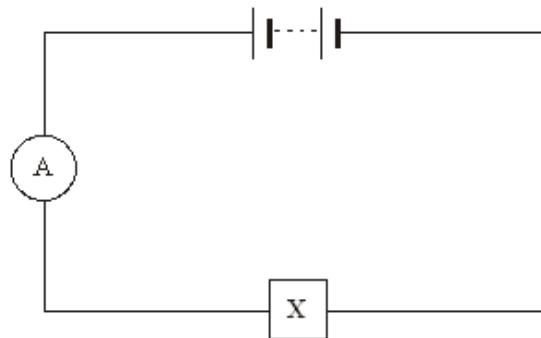
(2)

- (iii) State the potential difference of the power supply.

.....

(1)

- (c) A second circuit contains an unknown component labelled X.



As component X is heated, the reading on the ammeter goes up.

What is component X?

.....

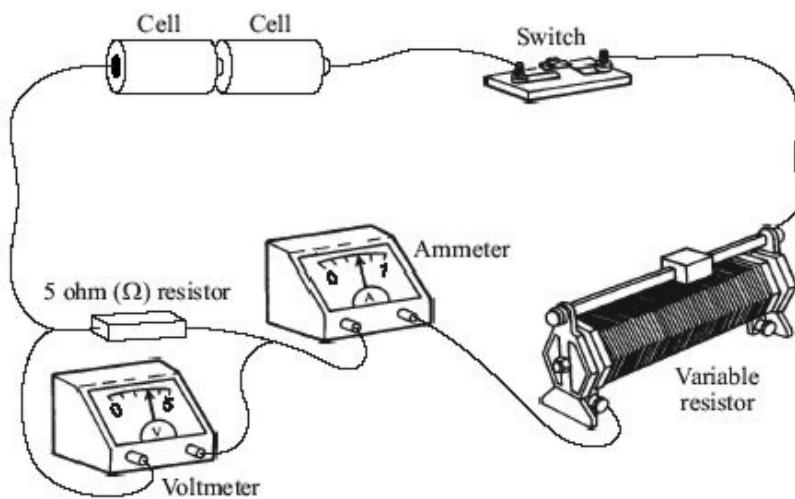
Give a reason for your answer.

.....

.....

(2)
(Total 10 marks)

- Q14.** The drawing shows the circuit used to investigate how the current through a 5 ohm (Ω) resistor changes as the potential difference (voltage) across the resistor changes.



- (a) Draw, in the space below, a circuit diagram of this circuit. Use the correct symbols for each part of the circuit.

(2)

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

.....

(1)

- (ii) Calculate the potential difference across the 5 ohm (Ω) resistor when the current through the resistor equals 0.4 A. Show clearly how you work out your final answer.

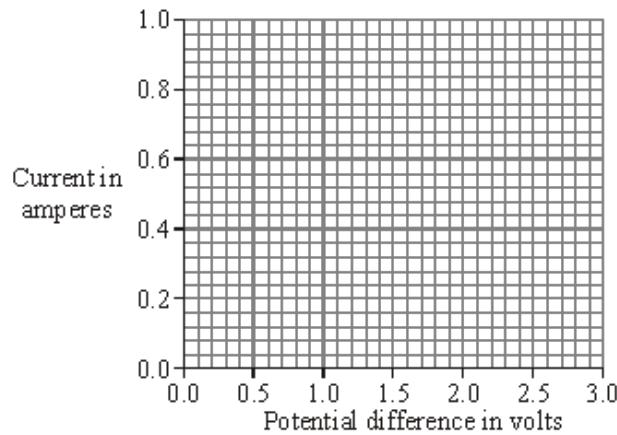
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.....

potential difference = volts

(2)

- (iii) Complete the graph to show how the current through the resistor changes as the potential difference across the resistor increases from 0 V to 3 V. Assume the resistor stays at a constant temperature.

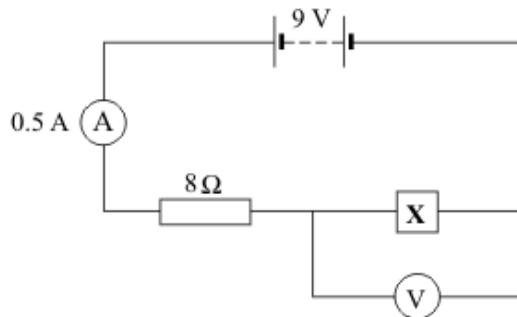


(2)

- (c) The resistor is replaced by a 3 V filament lamp. The resistance of the lamp increases as the potential difference across it increases. Why?
-
.....

(1)
(Total 8 marks)

- Q15.** (a) The circuit diagram drawn below includes a component labelled X.



- (i) Use the equation in the box to calculate the potential difference across the 8 ohm resistor.

potential difference = current \times resistance

Show clearly how you work out your answer.

.....
.....

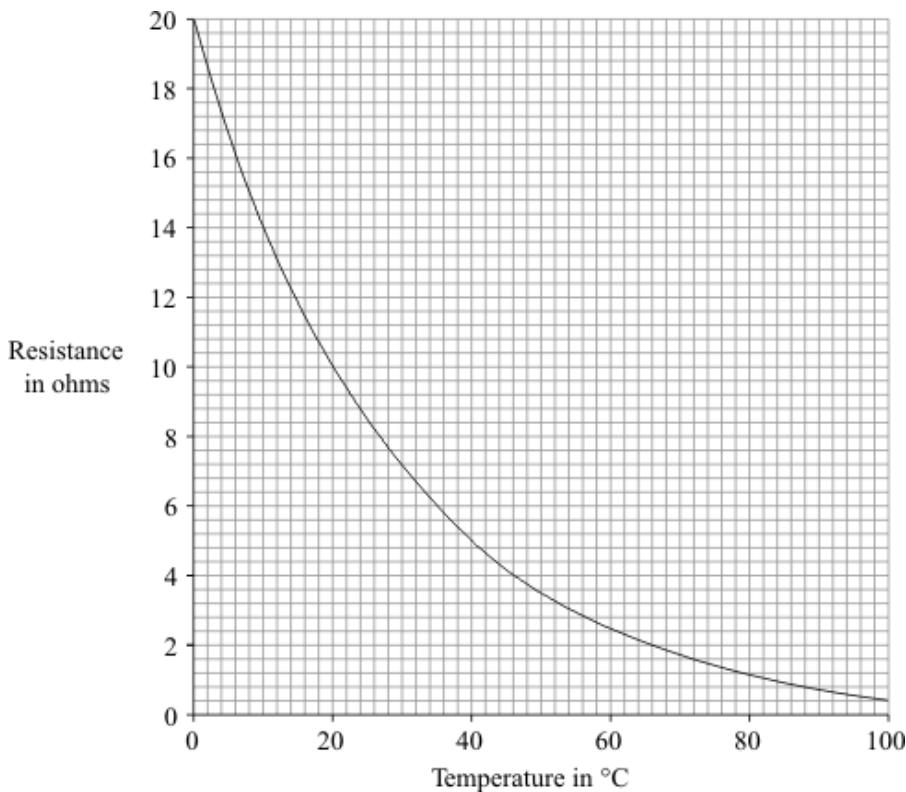
Potential difference = volts

(2)

- (ii) What is the potential difference across component X?
-

(1)

- (b) The graph shows how the resistance of component X changes with temperature.



- (i) What is component X?

.....

(1)

- (ii) Over which range of temperatures does the resistance of component X change the most?

Put a tick (✓) next to your choice.

0 °C to 20 °C

20 °C to 40 °C

40 °C to 60 °C

60 °C to 80 °C

80 °C to 100 °C

(1)

(Total 5 marks)

- Q16.** The picture shows an advert for an electric mobility scooter.



- (a) The batteries are joined in series.

- (i) What is the potential difference provided by the batteries to the motor?

.....

(1)

- (ii) The batteries supply a *direct current (d.c.)*.

What is a *direct current (d.c.)*?

.....

(1)

- (b) At 2.5 m/s on flat ground, the motor takes a current of 3.0 A from the batteries.

- (i) Explain why a bigger current is taken from the batteries when the scooter is going uphill at 2.5 m/s.

.....

.....

.....

(2)

- (ii) What effect does travelling uphill have on the range of the scooter?

.....

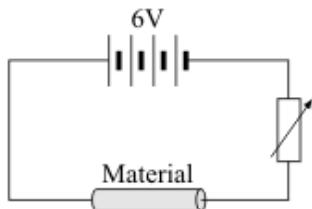
(1)

- (c) The mass of the scooter driver is 80 kg.

Use the equation in the box to calculate the kinetic energy of the scooter **and** driver when they are travelling at maximum speed.

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times \text{speed}^2$$

- Q17.** (a) The diagram shows the circuit used to investigate the resistance of a material. The diagram is incomplete; 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?

.....

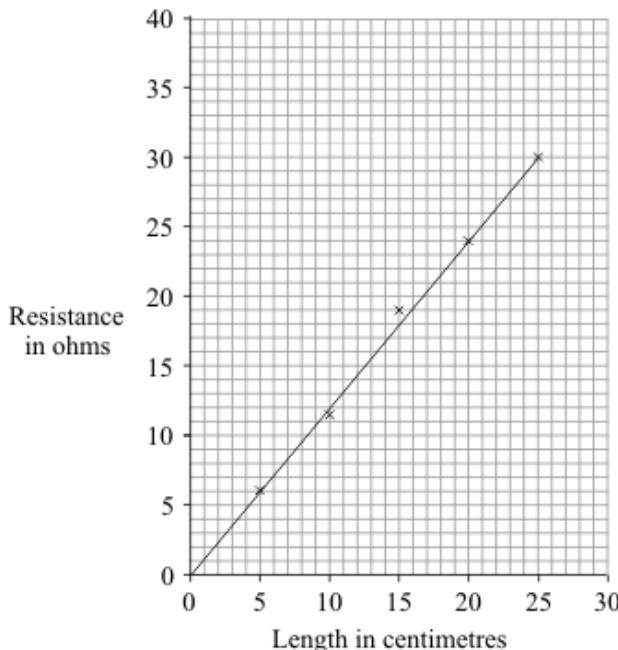
.....

(1)

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

Graph 1 shows how the resistance changes with length.

Graph 1



- (i) Why has the data been shown as a line graph rather than a bar chart?

.....
.....

(1)

- (ii) The current through a 30 cm length of conducting putty was 0.15 A.

Use **Graph 1** to find the resistance of a 30 cm length of conducting putty.

Resistance = ohms

(1)

- (iii) Use your answer to (b)(ii) and the equation in the box to calculate the potential difference across a 30 cm length of conducting putty.

$\text{potential difference} = \text{current} \times \text{resistance}$

Show clearly how you work out your answer.

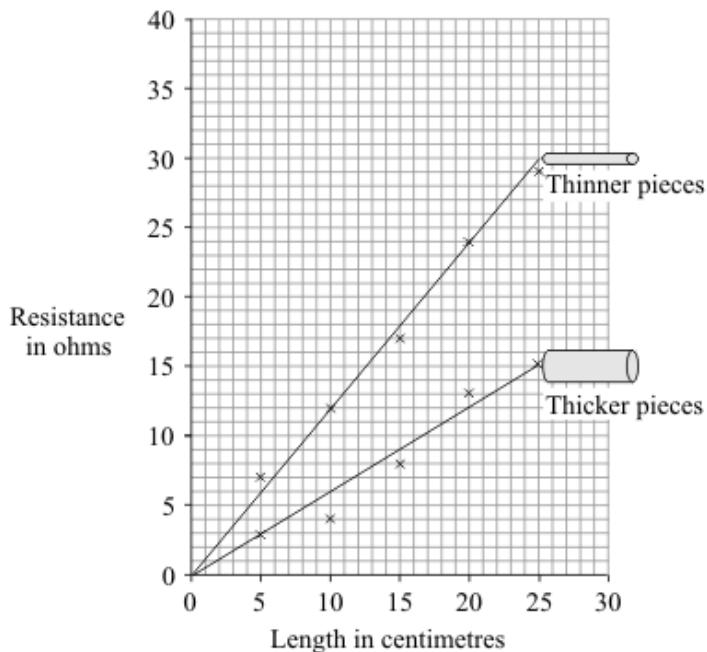
.....
.....
.....

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.

.....

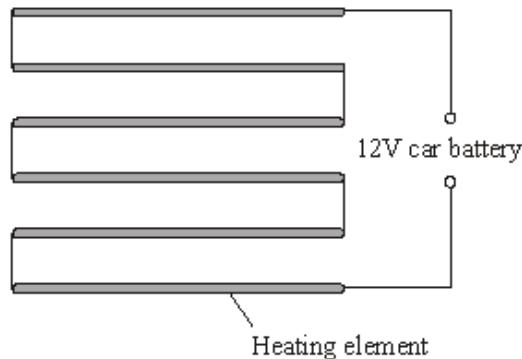
(1)

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

.....
.....

(1)
(Total 10 marks)

- Q18.** The diagram shows a simple type of car rear window heater. The six heating elements are exactly the same.



Each heating element has a resistance of $5\ \Omega$. The current passing through each element is 0.4 A.

- (i) Calculate the total resistance of the six heating elements.

Show clearly how you work out your answer.

.....
.....

$$\text{Total resistance} = \dots \text{ ohms}$$

(2)

- (ii) Why is the current passing through each element the same?

.....
.....

(1)

- (iii) What is the total current passing through the whole circuit?

.....

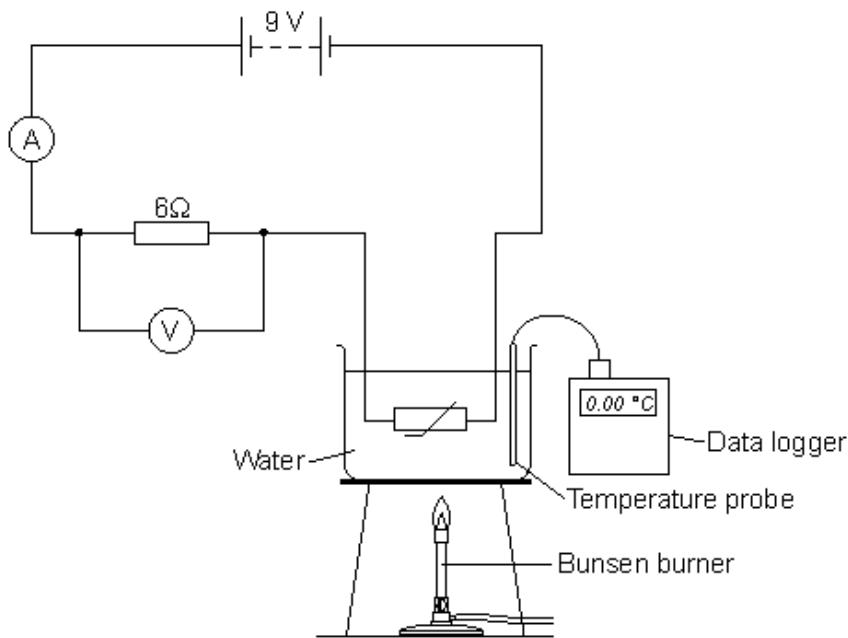
(1)

- (iv) How is the 12 volt potential difference of the car battery shared between the six heating elements?

.....
.....

(1)
(Total 5 marks)

- Q19.** A student designed the circuit below to measure temperature using a thermistor.



To calibrate the thermistor to measure temperature, the student placed the thermistor in a beaker of water at 0 °C and took the voltmeter reading. The student then heated the water slowly with a Bunsen burner. The student recorded the reading on the voltmeter every 10 °C.

- (a) (i) Before calibrating the thermistor the student completed a risk assessment.

Write down **one** possible hazard that the student should have written in the risk assessment and what the student should do to reduce the risk of the hazard causing an injury.

.....
.....
.....
.....
.....

(2)

- (ii) At 0 °C the reading on the ammeter is 0.5 A.

Calculate the reading on the voltmeter at 0 °C.

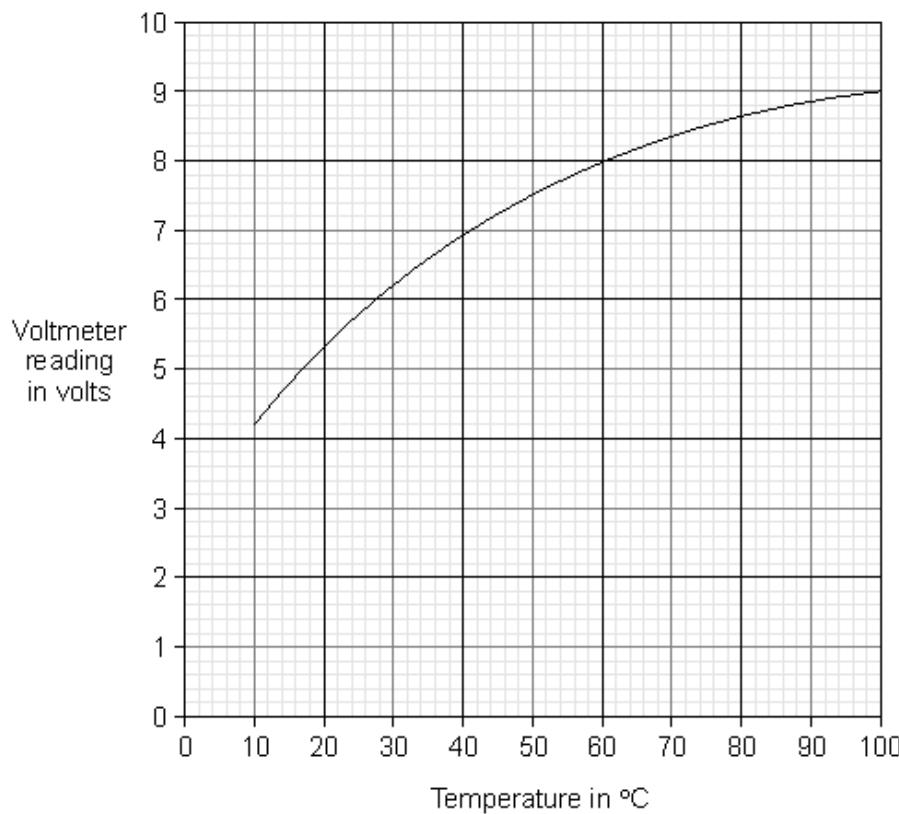
Write down the equation you use, and then show clearly how you work out your answer.

.....
.....
.....

Voltmeter reading = V

(2)

- (b) Most of the readings taken by the student are displayed in the graph.



- (i) Explain why the reading on the voltmeter changes when the temperature of the water increases.

.....
.....
.....
.....
.....

(3)

- (ii) What is the temperature interval that can be measured with this circuit?

.....
.....

(1)

- (iii) Once calibrated, between which temperatures would this circuit give the greatest resolution for temperature readings?

Tick (\checkmark) **one** box.

20 °C to 40 °C

40 °C to 60 °C

60 °C to 80 °C

Give a reason for your answer.

.....
.....

(2)

- (c) Thermistors have many practical uses, including being used as a thermometer to measure temperature.

Give **one** other practical use for a thermistor.

.....
.....

(1)
(Total 11 marks)

Q20. **Diagram 1** shows a hairdryer.

Diagram 2 shows how the heaters and fan of the hairdryer are connected to a 3-pin plug.
The hairdryer does not have an earth wire.

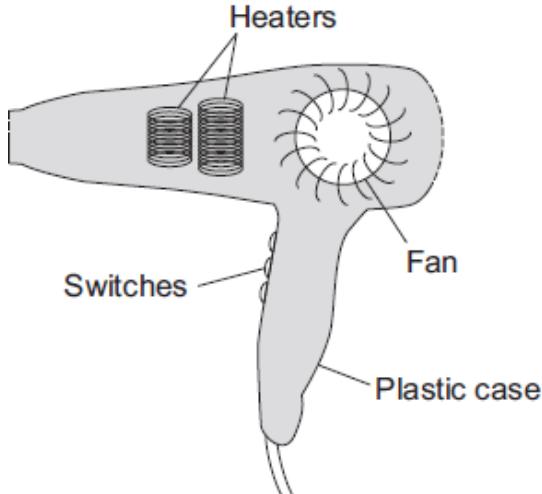


Diagram 1

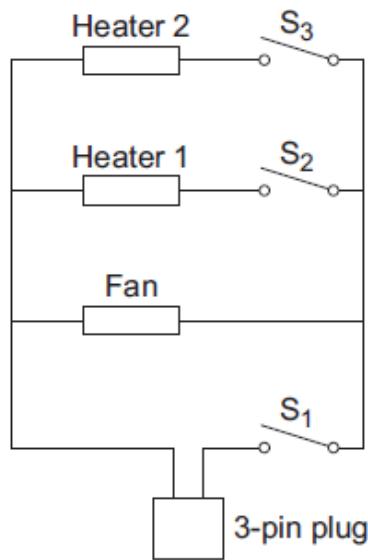


Diagram 2

- (a) What colour is the insulation around the wire connected to the live pin inside the plug?

.....

(1)

- (b) Why does the hairdryer **not** need an earth wire?

.....

(1)

- (c) All the switches are shown in the OFF position.

- (i) Which switch or switches have to be ON to make:

(1) only the fan work;

(2) heater 2 work?

(2)

- (ii) The heaters can only be switched on when the fan is also switched on.

Explain why.

.....

.....

.....

.....

(2)

- (d) The table shows the current drawn from the 230 volt mains electricity supply when different parts of the hairdryer are switched on.

	Current in amps
Fan only	1.0
Fan and heater 1	4.4
Fan and both heaters	6.5

Use the equation in the box to calculate the maximum power of the hairdryer.

$$\text{power} = \text{current} \times \text{potential difference}$$

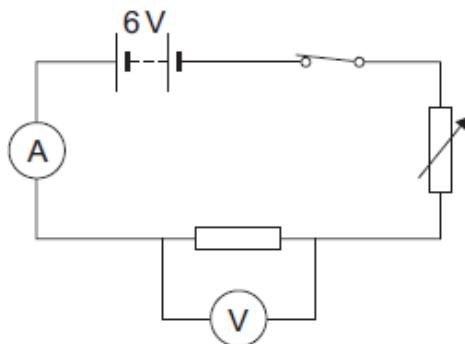
Show clearly how you work out your answer and give the unit.

.....
.....

Maximum power =

(3)
(Total 9 marks)

- Q21.** The diagram shows the circuit set up by a student.



- (a) The student uses the circuit to test the following hypothesis:

'The current through a resistor is directly proportional to the potential difference across the resistor.'

- (i) If the hypothesis is correct, what should the student predict will happen to the current through the resistor when the potential difference across the resistor is doubled?
-
.....

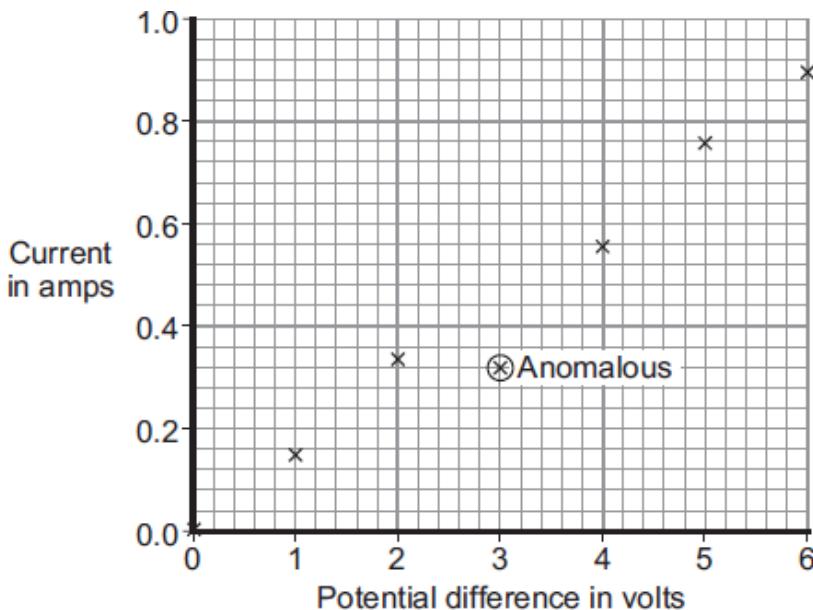
(1)

- (ii) Name the component in the circuit used to change the potential difference across the resistor.

.....

(1)

- (b) The student used the data obtained to plot the points for a graph of current against potential difference.



- (i) Why has the student plotted the points for a line graph and not drawn a bar chart?

.....

(1)

- (ii) One of the points has been identified by the student as being anomalous.

What is the most likely cause for this anomalous point?

.....

(1)

- (iii) Draw a line of best fit for these points.

(1)

- (iv) Does the data the student obtained support the hypothesis?

Give a reason for your answer.

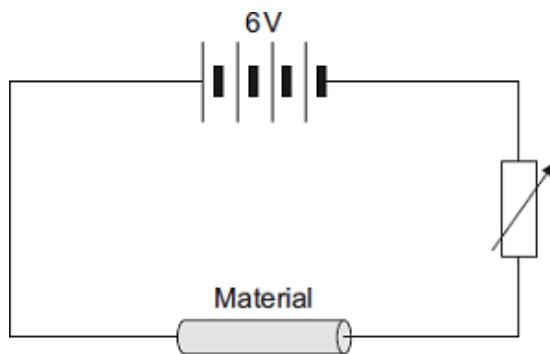
.....
.....

(1)

(Total 6 marks)

- Q22.** (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?

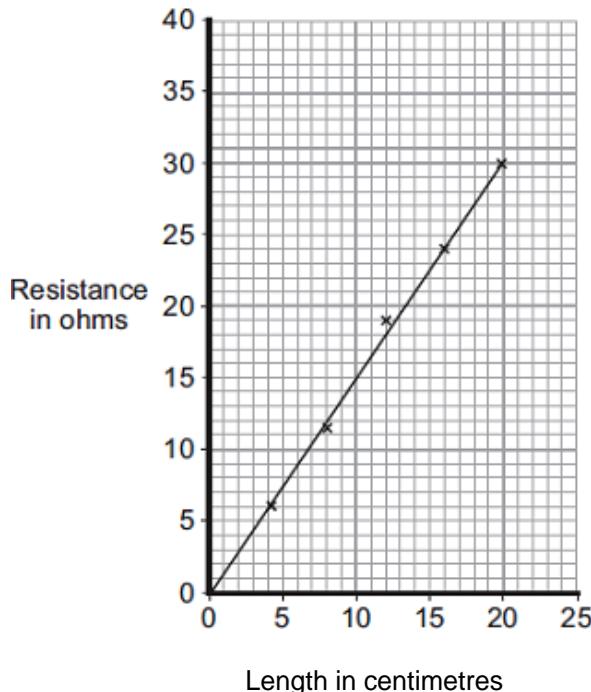
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.....

(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.

$$\text{Resistance} = \dots \text{ ohms}$$

(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.

$$\boxed{\text{potential difference} = \text{current} \times \text{resistance}}$$

Show clearly how you work out your answer.

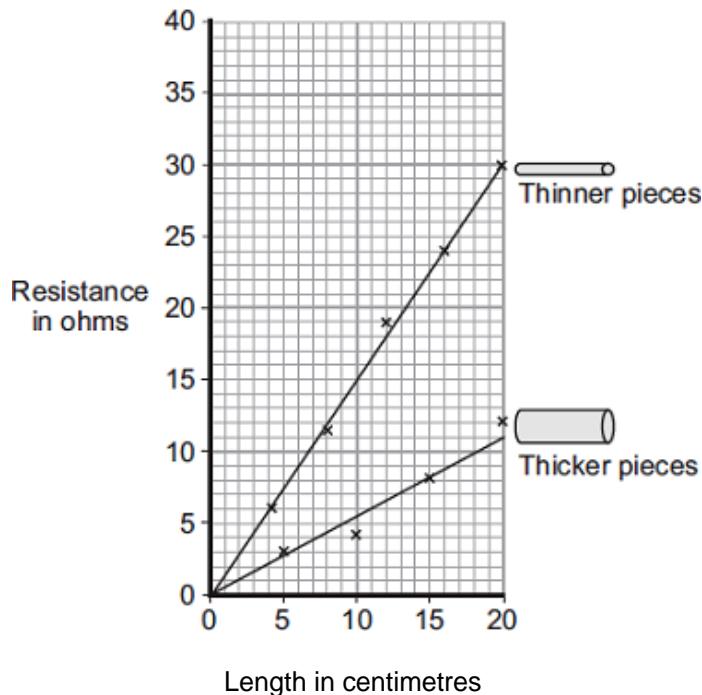
.....
.....
.....

$$\text{Potential difference} = \dots \text{ volts}$$

(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.

.....

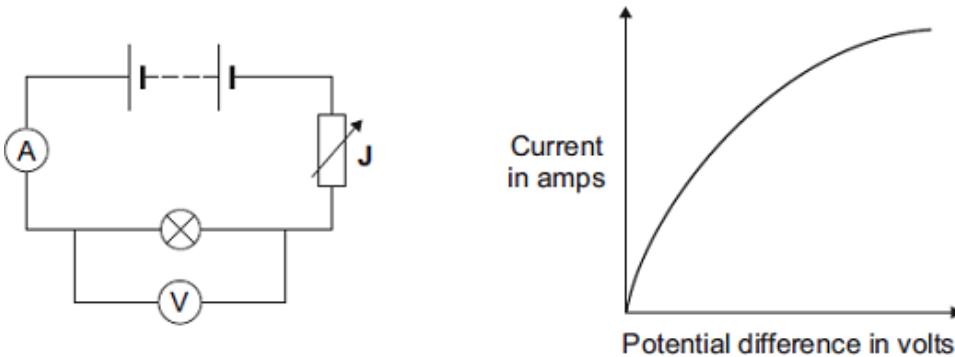
(1)

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

.....
.....

(1)
(Total 9 marks)

- Q23.** (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.

(6)
(Total 11 marks)

