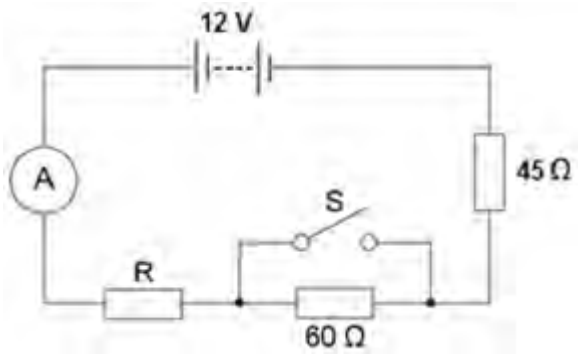
Q1.A student set up the electrical circuit shown in the figure below.



(a) The ammeter displays a reading of 0.10 A.

Calculate the potential difference across the 45 Ω resistor.

.....

.....

Potential difference = ... V

(2)

(b) Calculate the resistance of the resistor labelled **R**.

.....

.....

.....

Resistance = ... Ω

(3)

(c) State what happens to the total resistance of the circuit and the current through the circuit when switch **S** is closed.

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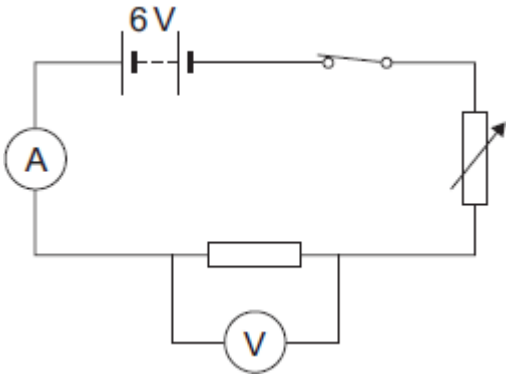
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(2)

(Total 7 marks)

Q2. 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?

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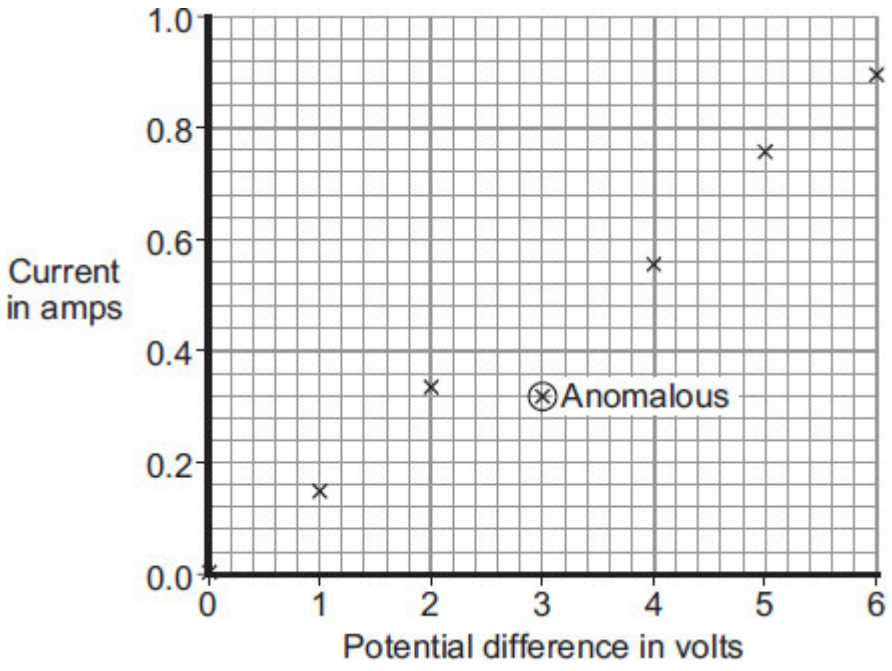
(1)

(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)

Q3. Electrical circuits have resistance.

(a) Draw a ring around the correct answer to complete the sentence.

When the resistance of a circuit increases, the current in the circuit

decreases.

increases.

stays the same.

(1)

(b) Use the correct answer from the box to complete each sentence.

a filament bulb	**an LED**	**an LDR**

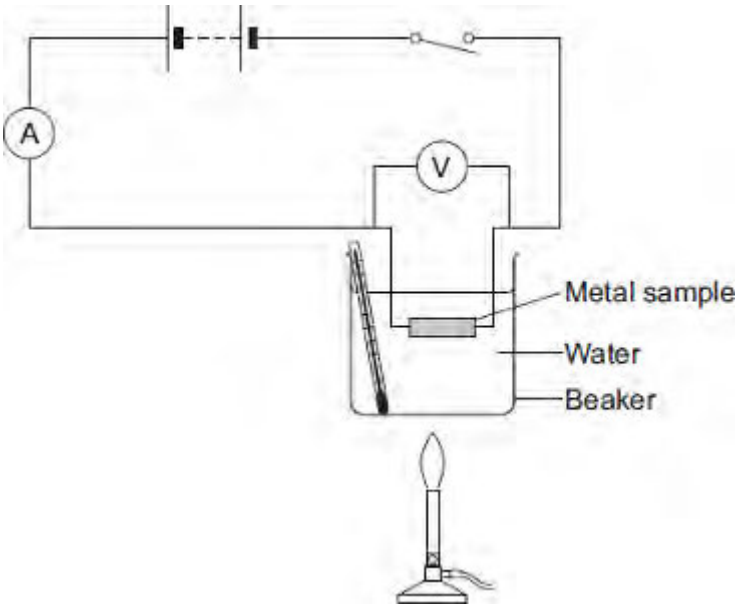
An electrical component which has a resistance that increases as the temperature increases is ..... .

An electrical component which emits light only when a current flows through it in the forward direction is ..... .

(2)

(c) When some metals are heated the resistance of the metal changes.

The equipment for investigating how the resistance of a metal changes when it is heated is shown in the diagram.



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

Describe an investigation a student could do to find how the resistance of a metal sample varies with temperature. The student uses the equipment shown.

Include in your answer:

- how the student should use the equipment
- the measurements the student should make
- how the student should use these measurements to determine the resistance
- how to make sure the results are valid.

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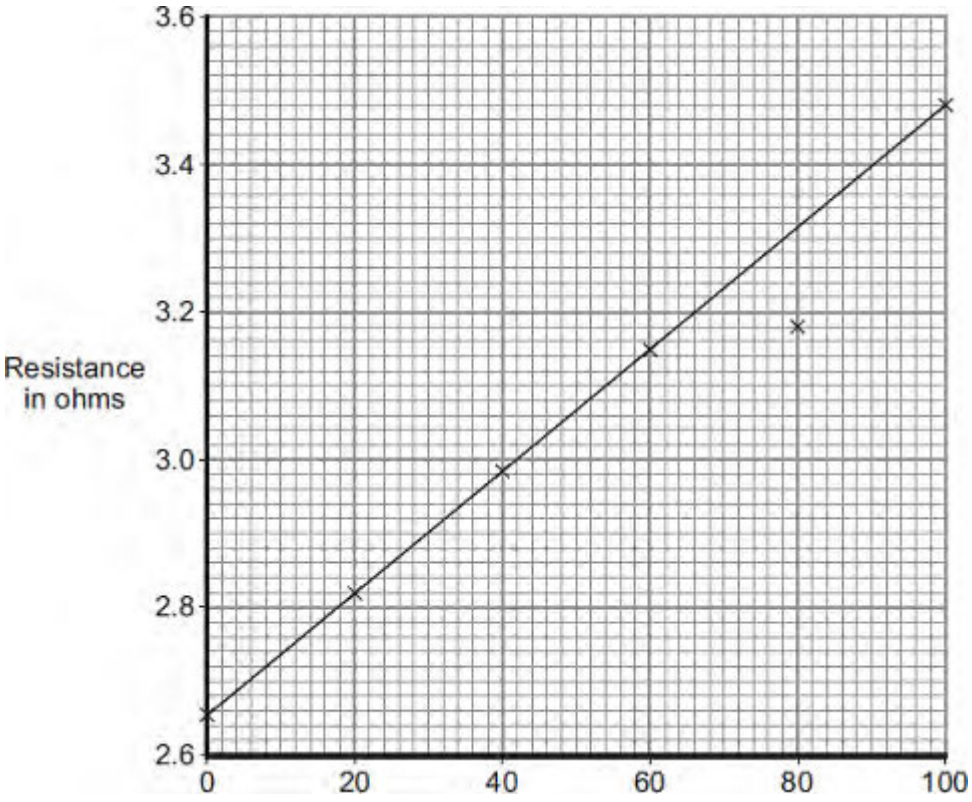
(6)

(d) The table shows some data for samples of four metals **P**, **Q**, **R** and **S**.

The metal samples all had the same cross-sectional area and were the same length.

Metal sample	Resistance at 0°C in ohms	Resistance at 100°C in ohms
P	4.05	5.67
Q	2.65	3.48
R	6.0	9.17
S	1.70	2.23

A graph of the results for one of the metal samples is shown.



(i) Which metal sample, **P**, **Q**, **R** or **S**, has the data shown in the graph?

(1)

(ii) One of the results is anomalous. Circle this result on the graph.

(1)

(iii) Suggest a reason for the anomalous result.

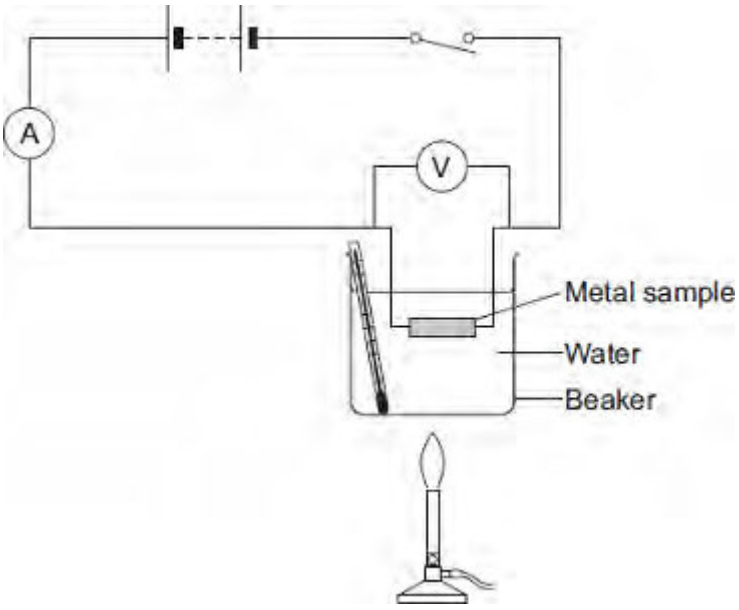
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(1)

(iv) The same equipment used in the investigation could be used as a

thermometer known as a ‘resistance thermometer.’



Suggest **two** disadvantages of using this equipment as a thermometer compared to a liquid-in-glass thermometer.

1 .....

.....

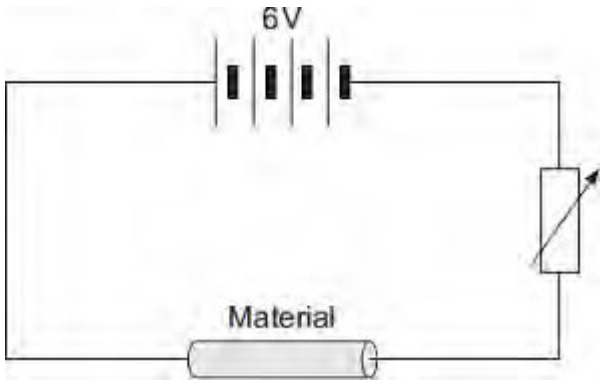
2 .....

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(2)

(Total 14 marks)

Q4.(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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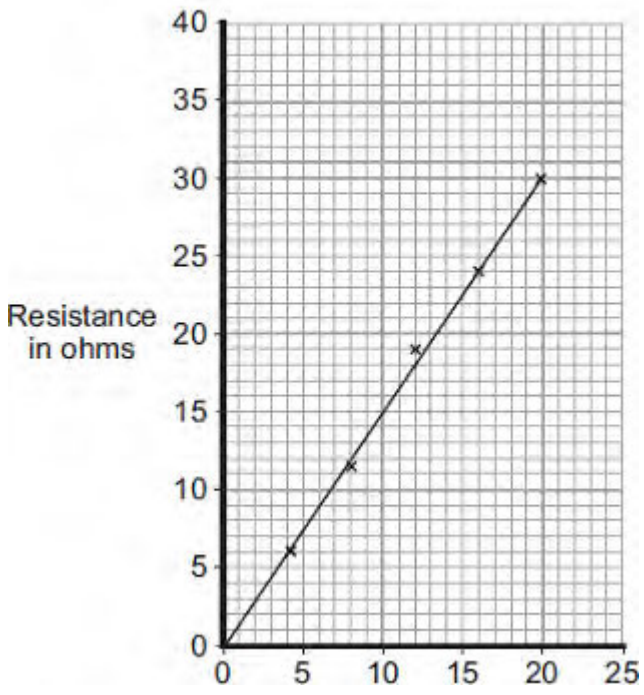
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(1)

(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.

Resistance = ... ohms

(1)

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

Show clearly how you work out your answer.

.....

.....

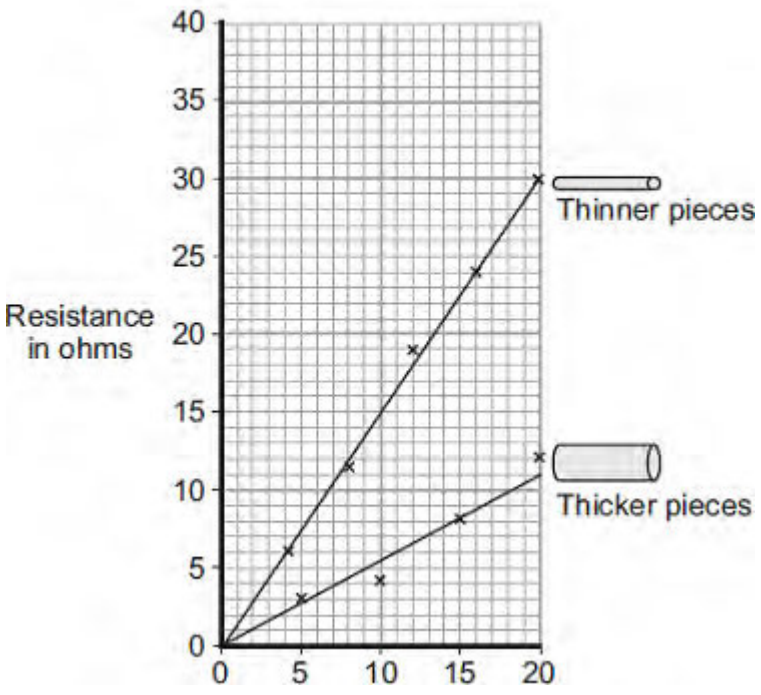
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Potential difference = ... volts

(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)

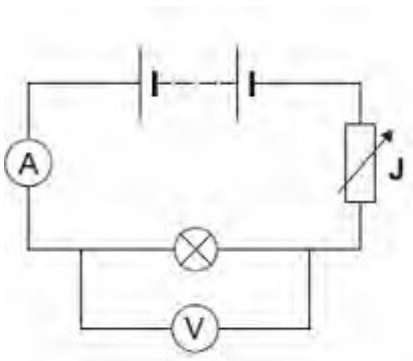
(ii) Name **one** error that may have reduced the accuracy of the results.

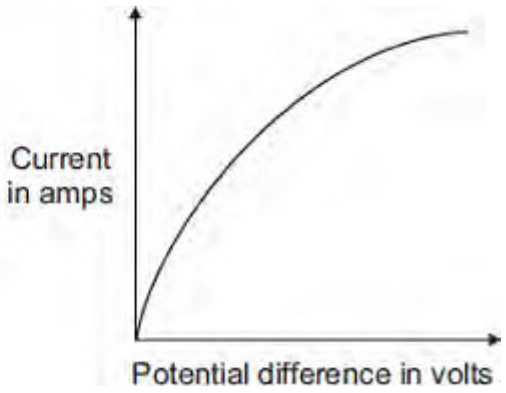
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(1)

(Total 8 marks)

Q5.(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.

.....

.....

.....

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)

Q6. If a fault develops in an electrical circuit, the current may become too great. The circuit needs to be protected by being disconnected.

A fuse or a circuit breaker may be used to protect the circuit.
One type of circuit breaker is a Residual Current Circuit Breaker (RCCB).

(a) (i) Use the correct answer from the box to complete the sentence.

earth	live	neutral

A fuse is connected in the ..... wire.

(1)

(ii) Use the correct answer from the box to complete the sentence.

are bigger	are cheaper	react faster

RCCBs are sometimes preferred to fuses because they
..... .

(1)

(iii) RCCBs operate by detecting a difference in the current between two wires.

Use the correct answer from the box to complete the sentence.

earth and live	earth and neutral	live and neutral

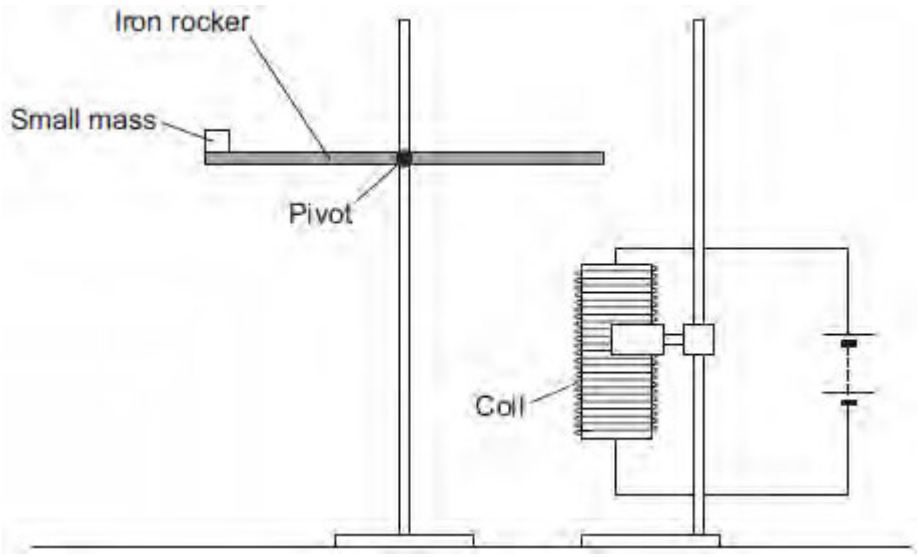
The two wires are the ..... wires.

(1)

(b) An RCCB contains an iron rocker and a coil.

A student investigated how the force of attraction, between a coil and an iron rocker, varies with the current in the coil.

She supported a coil vertically and connected it in an electrical circuit, part of which is shown in the figure below .



She put a small mass on the end of the rocker and increased the current in the coil until the rocker balanced. She repeated the procedure for different masses.

Some of her results are shown in the table below.

Mass in grams	**Current needed for the rocker to balance in amps**
5	0.5
10	1.0
15	1.5
20	2.0

(i) State **two** extra components that must have been included in the circuit in the figure above to allow the data in the above table to be collected.

Give reasons for your answers.

.....

.....

.....

.....

.....

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.....

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(4)

(ii) A teacher said that the values of current were too high to be safe.

Suggest **two** changes that would allow lower values of current to be used in this investigation.

Change 1 .....

.....

Change 2 .....

.....

(2)
(Total 9 marks)