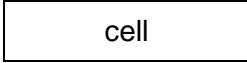
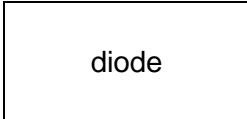
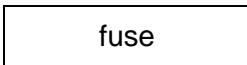
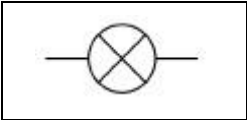
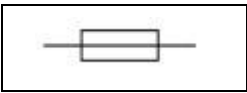


**Q1.**

Components can be connected in electrical circuits in different ways.

(a) Draw **one** line from each circuit symbol to the name of the component it represents.

| Circuit symbol  | Name of component |
|---|-------------------|
|  | cell              |
|  | diode             |
|  | fuse              |
|  | lamp              |
|  | variable resistor |

(2)

(b) Complete the sentence.

Choose the answer from the box.

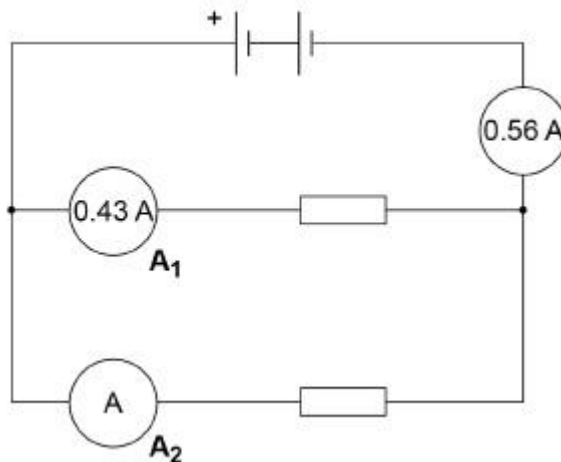
**charge    energy    potential difference    resistance**

Electric current is the rate of flow of \_\_\_\_\_.

(1)

**Figure 1** shows a parallel circuit.

**Figure 1**



- (c) Calculate the current measured by ammeter **A<sub>2</sub>**.

Current = \_\_\_\_\_ A

(1)

- (d) The circuit is connected for 300 s

The total current in the circuit stays at 0.56 A

Calculate the total charge flow.

Use the equation:

$$\text{charge flow} = \text{current} \times \text{time}$$

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Charge flow = \_\_\_\_\_ C

(2)

- (e) The potential difference supplied by the battery is 4.5 V

Calculate the total energy transferred in 300 s

Use the equation:

$$\text{energy transferred} = \text{charge flow} \times \text{potential difference}$$

Use your answer to part (d).

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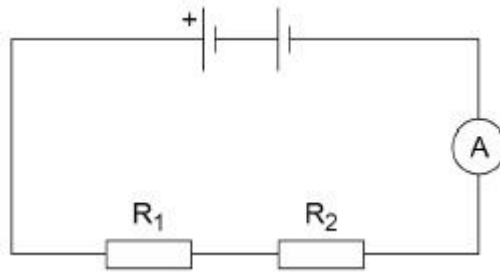
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Energy transferred = \_\_\_\_\_ J

(2)

- (f) **Figure 2** shows a series circuit.

**Figure 2**



Resistor  $R_2$  breaks.

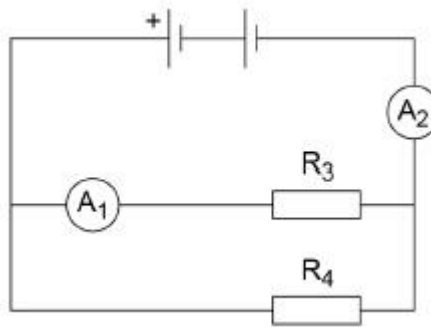
What happens to the reading on the ammeter?

\_\_\_\_\_

(1)

(g) **Figure 3** shows a parallel circuit.

**Figure 3**



Resistor  $R_3$  breaks.

What happens to the readings on the ammeter?

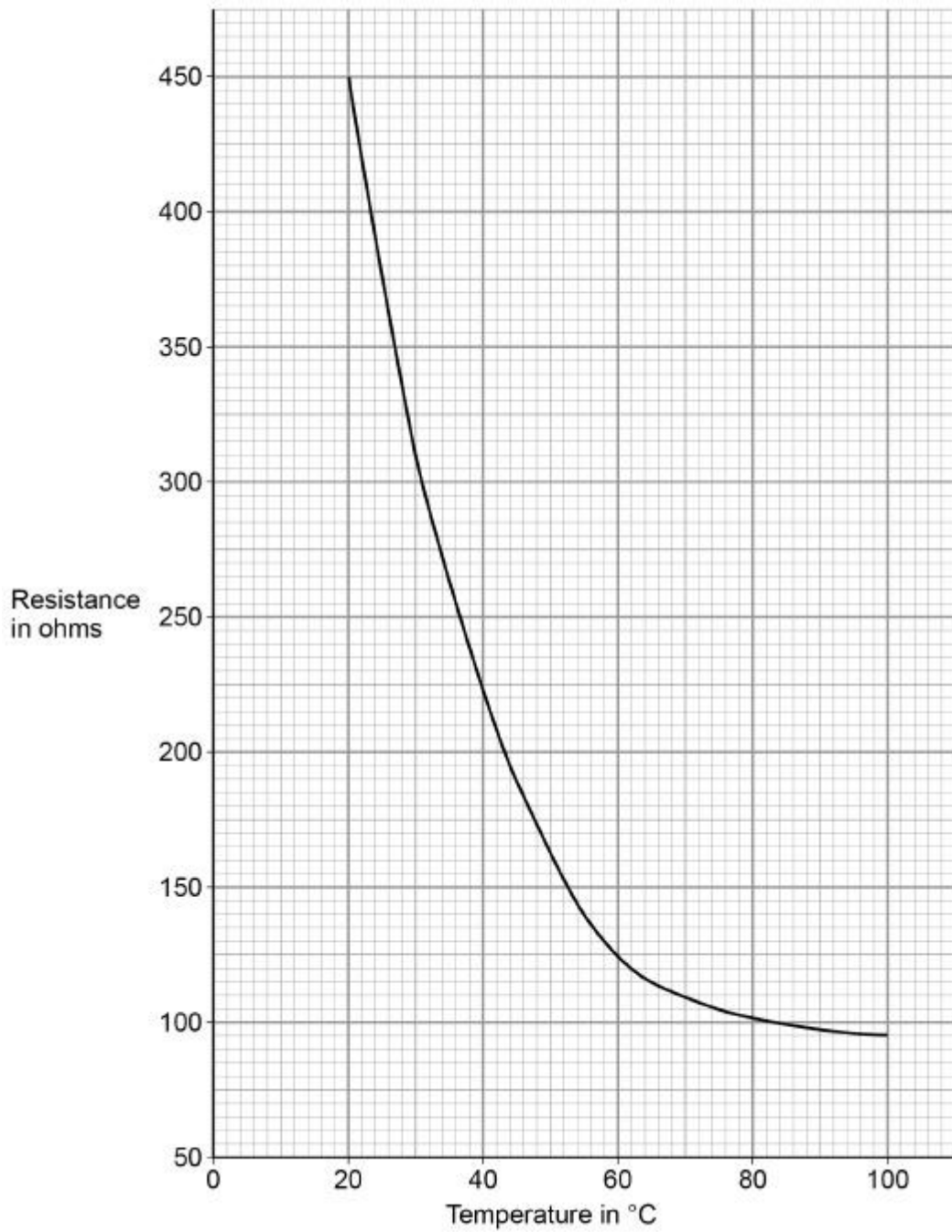
Ammeter  $A_1$  \_\_\_\_\_

Ammeter  $A_2$  \_\_\_\_\_

(2)

**Figure 4** shows how the resistance of a component varies with temperature.

**Figure 4**



(h) What is the name of the component?

Tick **one** box.

LED

LDR

Resistor

Thermistor

(1)

- (i) What is the resistance of the component at a temperature of 50 °C?

Resistance = \_\_\_\_\_  $\Omega$

(1)

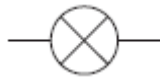
(Total 13 marks)

**Q2.**

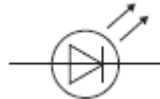
- (a) Draw **one** line from each circuit symbol to its correct name.

**Circuit symbol**

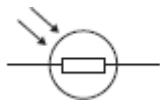
**Name**



Diode



Light-dependent resistor (LDR)



Lamp

Light-emitting diode (LED)

(3)

- (b) **Figure 1** shows three circuits.

The resistors in the circuits are identical.

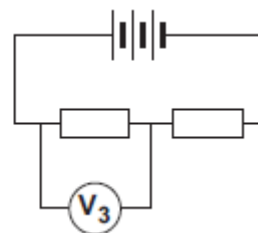
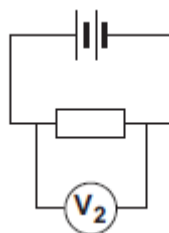
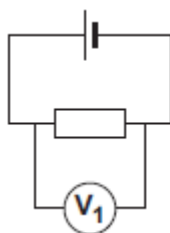
Each of the cells has a potential difference of 1.5 volts.

**Figure 1**

**Circuit 1**

**Circuit 2**

**Circuit 3**



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

|             |              |                    |
|-------------|--------------|--------------------|
| <b>half</b> | <b>twice</b> | <b>the same as</b> |
|-------------|--------------|--------------------|

The resistance of **circuit 1** is \_\_\_\_\_ the resistance of **circuit 3**.

(1)

- (ii) Calculate the reading on voltmeter  $V_2$ .

\_\_\_\_\_

Voltmeter reading  $V_2 =$  \_\_\_\_\_ V

(1)

- (iii) Which voltmeter,  $V_1$ ,  $V_2$  or  $V_3$ , will give the lowest reading?

Draw a ring around the correct answer.

$V_1$

$V_2$

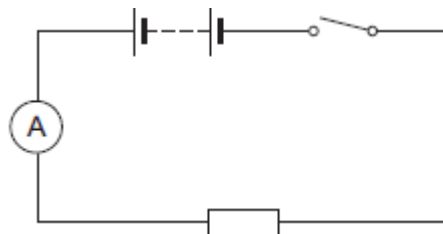
$V_3$

(1)

- (c) A student wanted to find out how the number of resistors affects the current in a series circuit.

**Figure 2** shows the circuit used by the student.

**Figure 2**



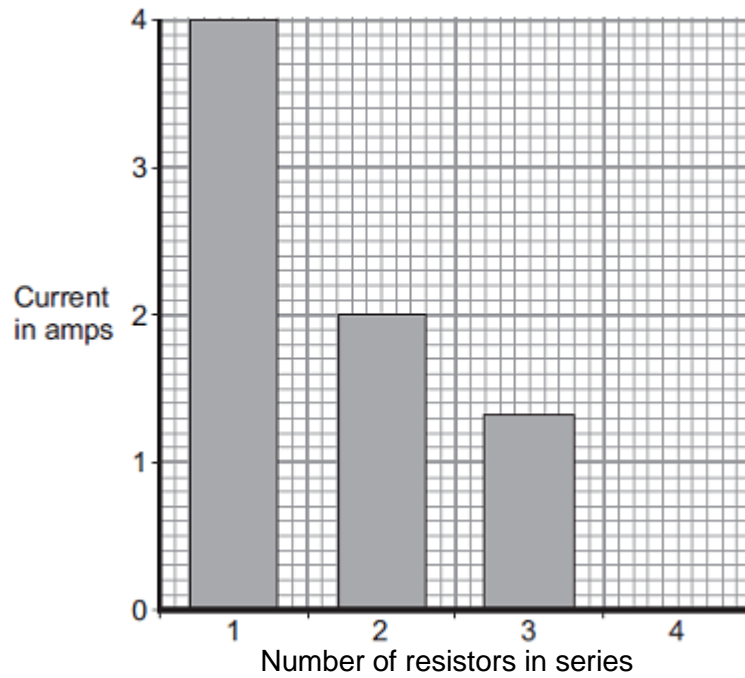
The student started with one resistor and then added more identical resistors to the circuit.

Each time a resistor was added, the student closed the switch and took the ammeter reading.

The student used a total of 4 resistors.

**Figure 3** shows three of the results obtained by the student.

**Figure 3**



- (i) To get valid results, the student kept one variable the same throughout the experiment.

Which variable did the student keep the same?

\_\_\_\_\_

(1)

- (ii) The bar chart in **Figure 3** is not complete. The result using 4 resistors is not shown.

Complete the bar chart to show the current in the circuit when 4 resistors were used.

\_\_\_\_\_

\_\_\_\_\_

(1)

(Total 10 marks)

**Q3.**

A student is investigating some electrical components.

- (a) Describe how the student could set up a circuit to find the resistance of a lamp.

You should include a circuit diagram in your answer.

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**(4)**

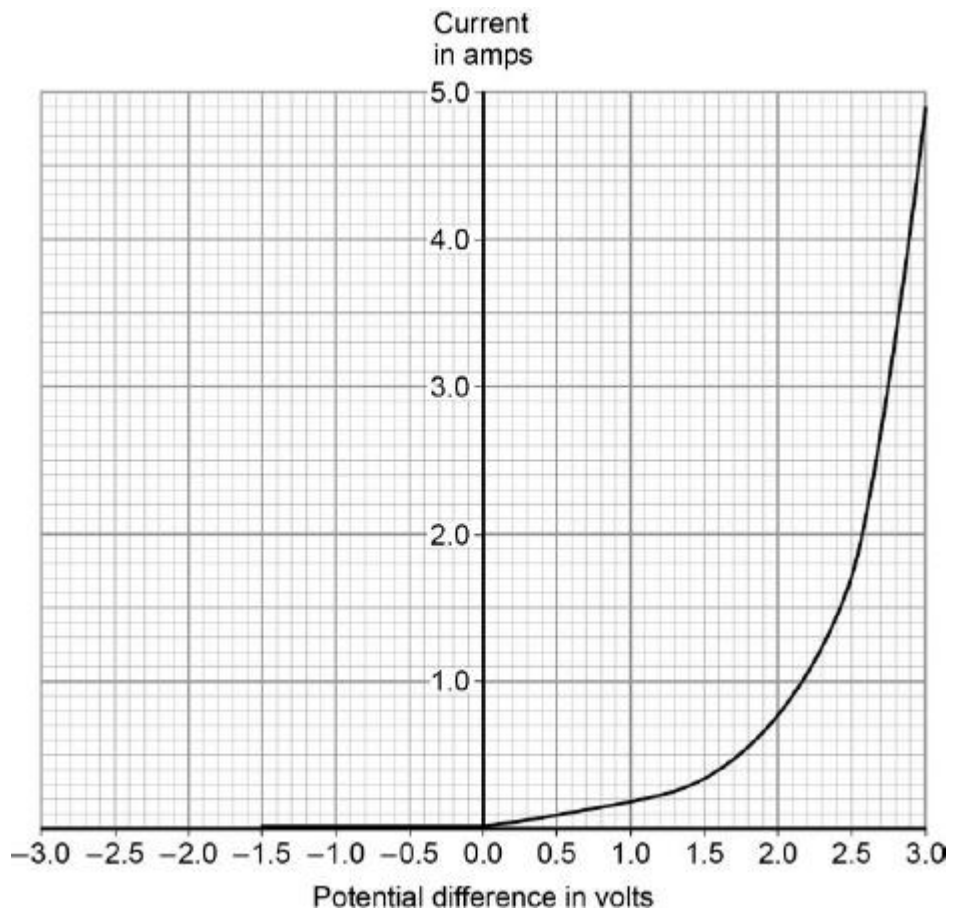
- (b) The student is given an electrical component in a sealed box.

She has to find out what the electrical component is by experiment.

The student records the current and the potential difference for the component.

Her results are shown in the figure below.





Explain how the student could know that the electrical component in the sealed box is **not** an ohmic conductor.

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(2)

(c) What is the electrical component in the sealed box?

Explain your answer.

Component \_\_\_\_\_

Explanation \_\_\_\_\_

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(3)

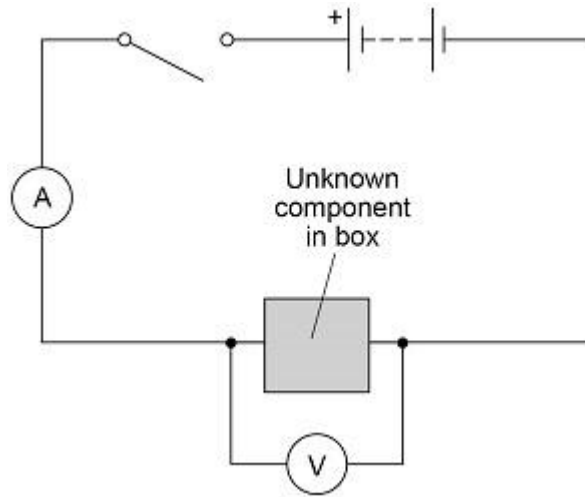
(Total 9 marks)

**Q4.**

A teacher gave a student an unknown electrical component hidden in a box.

The student connected the box in the circuit shown in **Figure 1**.

**Figure 1**



- (a) The student measured the potential difference across the component and the current in the component.

She repeated this for several values of potential difference.

Give **one** way the circuit could be altered so that the potential difference across the component could be varied.

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(1)

- (b) Explain why the student needed to switch the circuit off between readings.

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(2)

The following table shows the student's results.

| Potential difference in volts | Current in amps |
|-------------------------------|-----------------|
| 0.00                          | 0.00            |
| 0.20                          | 0.00            |

|      |      |
|------|------|
| 0.40 | 0.00 |
| 0.60 | 0.13 |
| 0.80 | 0.68 |
| 1.00 | 1.50 |

(c) What was the resolution of the ammeter?

Tick (✓) **one** box.

- 0.01 A
- 0.05 A
- 0.10 A
- 1.50 A

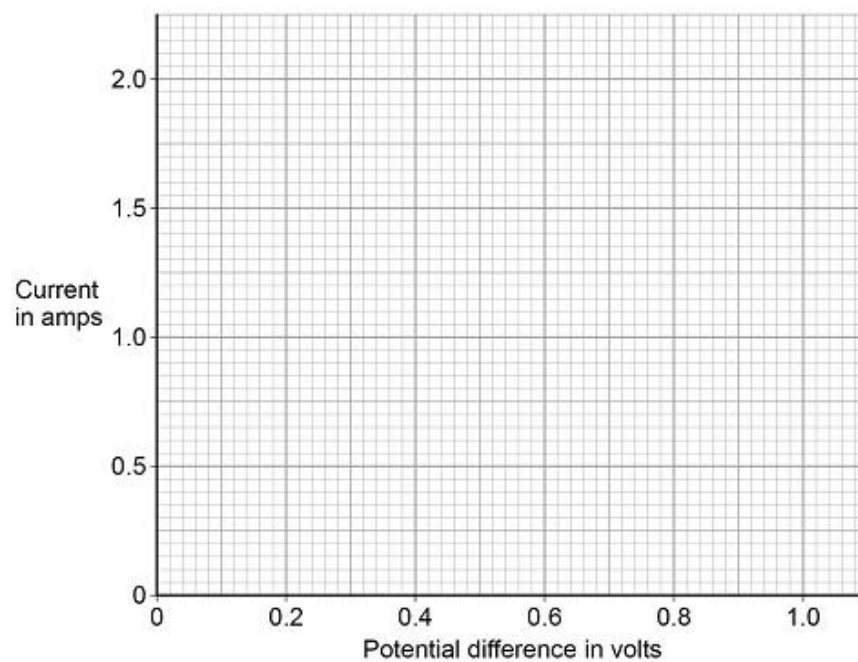
(1)

(d) Complete **Figure 2**.

You should:

- plot the data from the table above
- draw a line of best fit.

**Figure 2**



(3)

- (e) What was the unknown electrical component given to the student?

Tick (✓) **one** box.

Diode

Filament lamp

Resistor

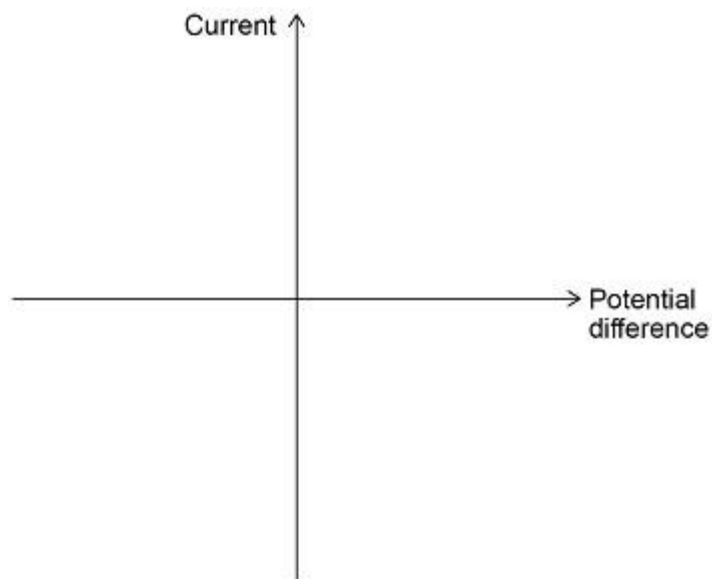
Thermistor

(1)

- (f) An ohmic conductor has constant resistance when its temperature is constant.

Sketch a current-potential difference graph for an ohmic conductor at constant temperature on **Figure 3**.

**Figure 3**



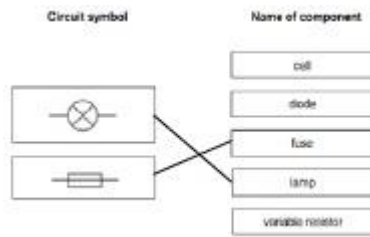
(2)

(Total 10 marks)

Mark schemes

**Q1.**

(a)



*extra lines from circuit symbols negate the mark*

(b) charge

1  
1

(c) 0.13 (A)

1

(d)  $0.56 \times 300$

1

168 (C)

*an answer of 168 (C) scores 2 marks*

1

(e)  $168 \times 4.5$

1

756 (J)

*an answer of 756 (J) scores 2 marks  
allow ecf from part (d)*

1

(f) decreases to zero

*allow reads zero*

1

(g) (A1) decreases to zero

*allow reads zero*

1

(A2) decreases

*do not accept 'to zero' for A2*

1

(h) thermistor

1

(i) answer in range 160–165 ( $\Omega$ )

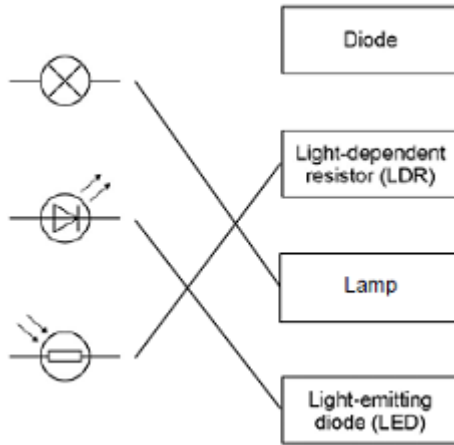
1

1

[13]

**Q2.**

(a)



*allow 1 mark for each correct line if more than one line is drawn from any symbol then all of those lines are wrong*

3

(b) (i) half

1

(ii) 3(V)

1

(iii)  $V_1$

1

(c) (i) potential difference / voltage of the power supply  
*accept the power supply*  
*accept the voltage / volts*  
*accept number of cells / batteries*  
*accept (same) cells / batteries*  
*do not accept same ammeter / switch / wires*

1

(ii) bar drawn – height 1.(00)A  
*ignore width of bar*  
*allow 1 mark for bar shorter than 3<sup>rd</sup> bar*

2

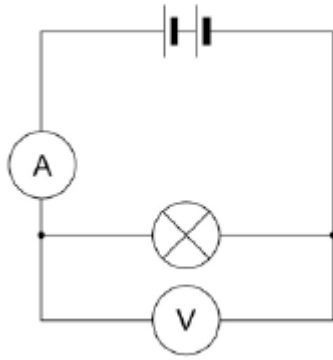
(iii) as the number of resistors increases the current decreases

1

**[10]**

**Q3.**

(a)



*ammeter connected in series*

1

*voltmeter connected in parallel*

1

measure the potential difference across the lamp at known current

1

calculate resistance from measured values using  $V = IR$

1

- (b) for ohmic conductors the current is directly proportional to the potential difference applied across it

1

this graph is curved so it is not an ohmic conductor

1

- (c) diode

1

because it has a high resistance with negative potential differences

1

and a low resistance for positive potential differences.

1

*allow answers in terms of current*

[9]

**Q4.**

- (a) add a variable resistor to the circuit (in series)

**or**

use a different number of cells in the battery

*allow use a variable power supply*

1

- (b) to keep the temperature constant

*allow to stop the components heating up*

*references to overheating alone are insufficient*

*ignore references to variation in output from the battery*

1

(as) temperature may affect the current / resistance / potential difference

*allow temperature may affect the readings*

(c) 0.01 A

1

(d) all points plotted correctly

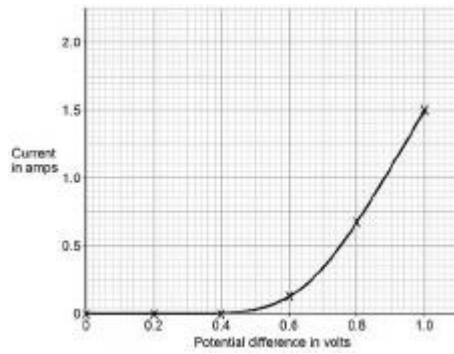
1

*allow  $\pm \frac{1}{2}$  a small square*

*allow 1 mark for 4 or 5 points plotted correctly*

2

line of best fit drawn through points



1

(e) diode

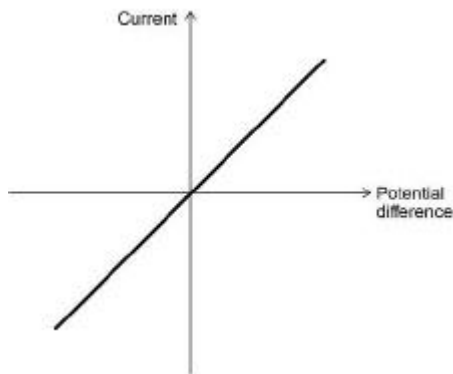
1

(f) straight line from the origin in positive quadrant

1

continued into negative quadrant with constant gradient

1



[10]