Questions are for both separate science and combined science students

Q1.

Figure 1 shows a student putting a coin into a vending machine that sells food.

Figure 1

The vending machine is connected to the mains electricity supply.

(a) What is the frequency of the mains electricity supply in the UK?

Tick (✓) **one** box.

50 hertz ☐

60 hertz ☐

100 hertz ☐

(1)

(b) What is the potential difference of the mains electricity supply in the UK?

Tick (✓) **one** box.

12 volts ☐

230 volts ☐

20 000 volts ☐

(1)

The vending machine identifies the value of the coin by measuring the resistance of the coin.

(c) The machine applies a potential difference of 0.45 V across the coin.

The current in the coin is 0.75 A.

Calculate the resistance of the coin.

Use the equation:

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

_____

_____

_____

_____

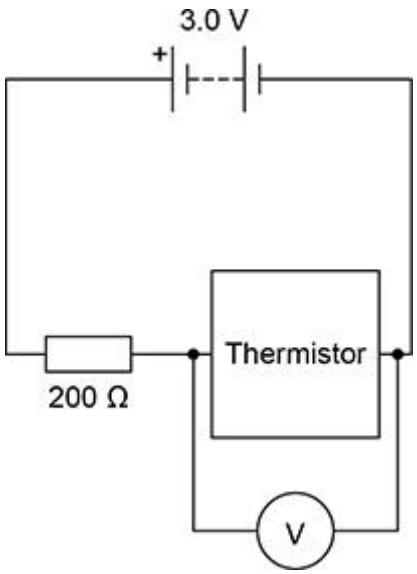
Resistance = _____ Ω

(2)

The temperature inside the vending machine is monitored using an electrical circuit.

Figure 2 shows part of the circuit.

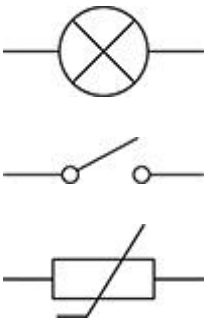
Figure 2



(d) The circuit symbol for the thermistor is wrong.

What is the circuit symbol for a thermistor?

Tick (✓) **one** box.



☐

☐

☐

(1)

(e) How could the potential difference (pd) across the resistor be calculated?

Tick (✓) **one** box.

pd across battery – pd across thermistor ☐

pd across battery + pd across thermistor ☐

pd across battery × pd across thermistor ☐

pd across battery ÷ pd across thermistor ☐

(1)

(f) At one temperature, the thermistor in **Figure 2** has a resistance of 200 Ω.

What is the potential difference across the thermistor at this temperature?

Give a reason for your answer.

Tick (✓) **one** box.

0.0 V ☐

1.0 V ☐

1.5 V ☐

2.0 V ☐

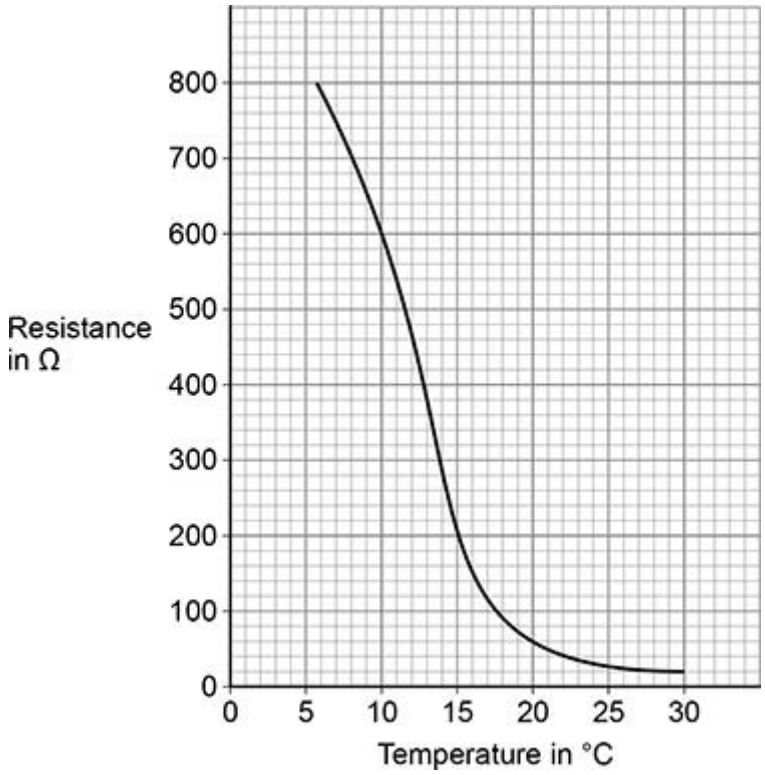
Reason _____

_____

(2)

Figure 3 shows how the resistance of the thermistor varies with temperature.

Figure 3



(g) When the temperature of the thermistor is 10 °C, the resistance of the thermistor is 600 Ω.

Calculate the change in resistance when the temperature increased from 10 °C to 15 °C.

_____

_____

_____

Change in resistance = _____ Ω

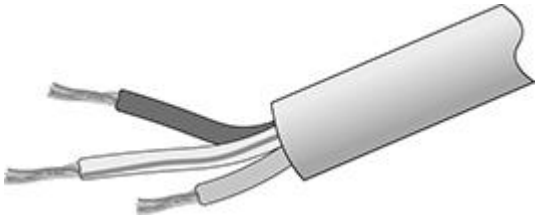
(2)

(Total 10 marks)

Q2.

An electrical appliance is connected to the mains electricity supply using a three-core cable.

The figure below shows a three-core cable.



The plug connected to the cable contains a fuse.

A fuse contains a wire that is designed to melt when the current is too great.

(a) The wire in the fuse melts when there is a charge flow of 2.0 C in a time of 0.40 s.

Calculate the current in the wire when it melts.

Use the equation:

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

_____

_____

_____

_____

Current = _____ A

(2)

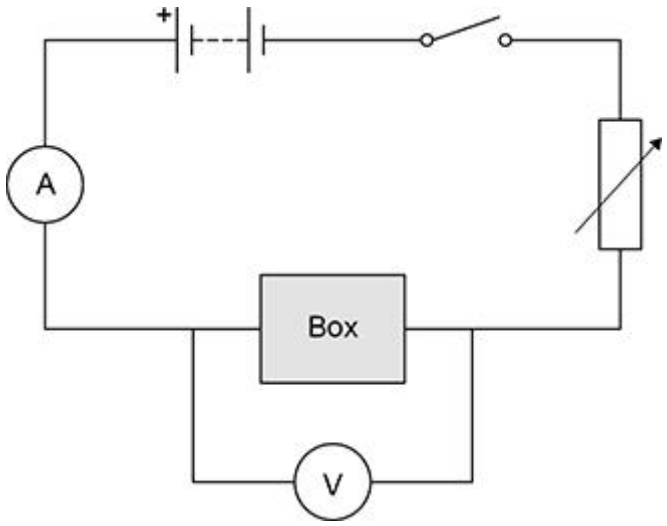
(Total 2 marks)

Q3.

A student had an unknown electrical component inside a sealed box.

Figure 1 shows the circuit the student used to identify the component.

Figure 1



The student varied the potential difference across the component and measured the current in the component.

The table below shows the results when the potential difference across the component was 6.0 V.

Potential difference in volts	**Current in amps**			
	1st reading	2nd reading	3rd reading	**Mean**
6.0	0.26	0.21	0.25	**X**

(a) Calculate value **X** in above table.

_____

_____

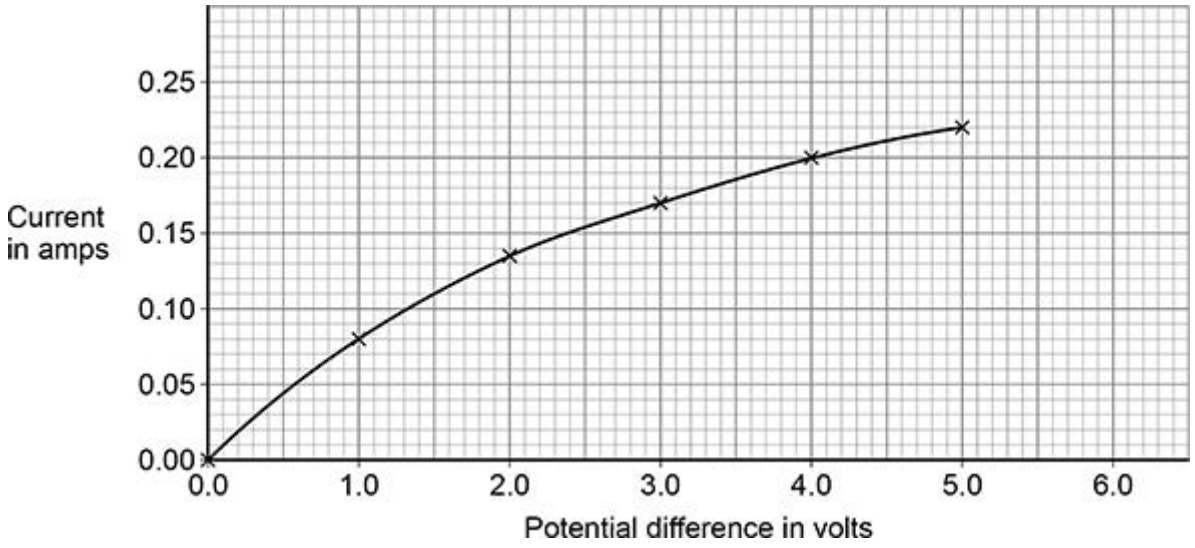
_____

X = _____ A

(2)

Figure 2 shows the results.

Figure 2



(b) Calculate the power of the component when the potential difference across the component is 3.0 V.

Use **Figure 2** and the equation:

power = potential difference × current

_____

_____

_____

_____

_____

Power = _____ W

(3)

(c) Complete the sentence.

Choose the answer from the box.

decreases	**stays the same**	**increases**

As the potential difference across the component increases, the gradient of the graph _____.

(1)

(d) What is the component in the sealed box?

Tick (✓) **one** box.

Diode ☐

Filament lamp ☐

Resistor at constant temperature ☐

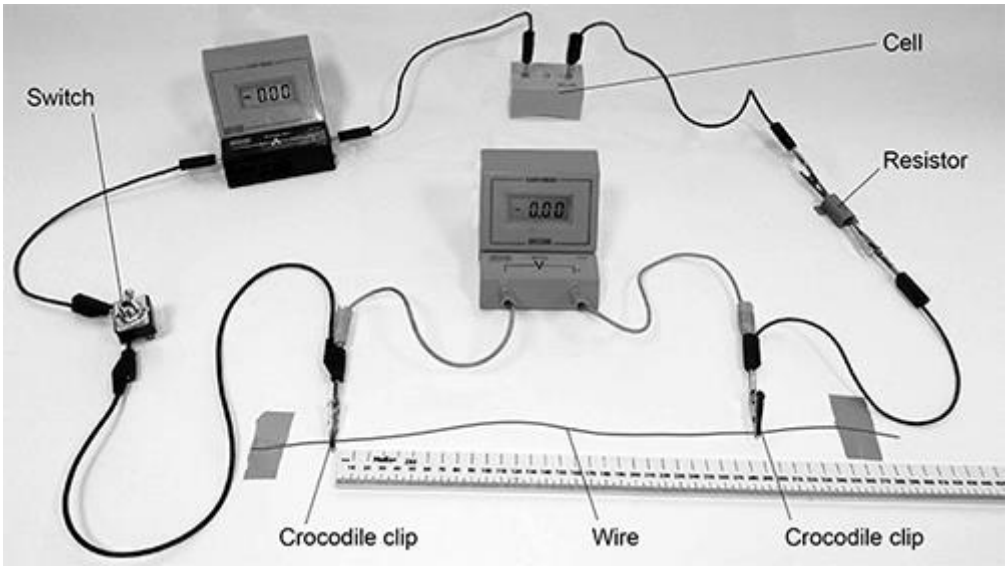
(1)

(Total 7 marks)

Q4.

A student investigated how the length of a wire affects the resistance of the wire at constant temperature.

The figure below shows the circuit used.



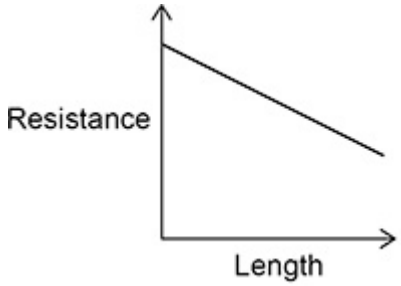
(a) The student plotted a graph of resistance against the length of wire.

Describe a method the student could have used to collect the data needed to plot the graph.

(6)

(b) Which graph shows the relationship between the resistance of a wire at constant temperature and its length?

Tick (✓) **one** box.



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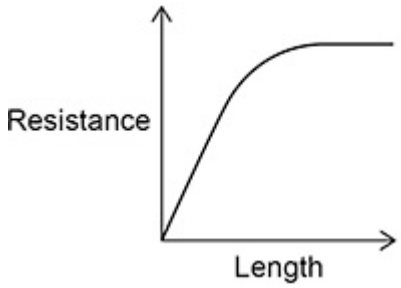

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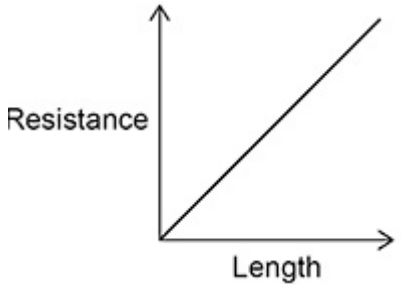

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(1)

(c) The student used a cell that had a potential difference of 1.50 V.

Explain why the cell was **not** an electrical hazard to the student in the investigation.

_____

_____

_____

_____

(2)

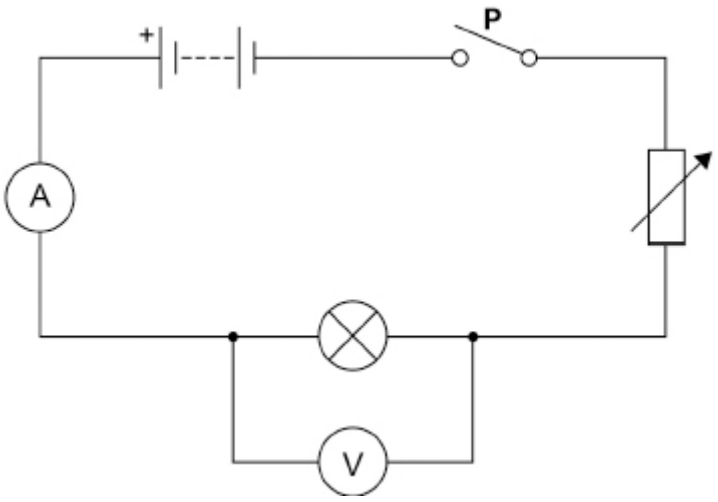
(Total 9 marks)

Q5.

A student investigated how the current in a filament lamp varies with the potential difference across the lamp.

Figure 1 shows the circuit used.

Figure 1



(a) What is component **P**?

_____

(1)

(b) Complete the sentences.

Choose answers from the box.

charge	**current**	**energy**	**potential difference**	**power**

The ammeter in the circuit measures _____.

The voltmeter in the circuit measures _____.

(2)

(c) How will **increasing** the resistance of the variable resistor in **Figure 1** affect each of the following quantities?

Tick (✓) **one** box in **each** row.

Quantity	Decreases	Stays the same	Increases
Current in the circuit			
Potential difference across the lamp			
Total resistance of the circuit			

(3)

(d) A charge flow of 15 coulombs passed through the filament lamp in a time of 60 seconds.

Calculate the current in the lamp.

Use the equation:

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

Current = _____ A

(2)

(e) When the current in the filament lamp is 0.12 A, the potential difference across the lamp is 6.0 V.

Calculate the resistance of the filament lamp.

Use the equation:

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

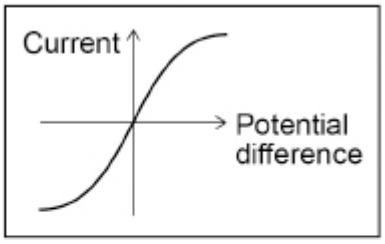
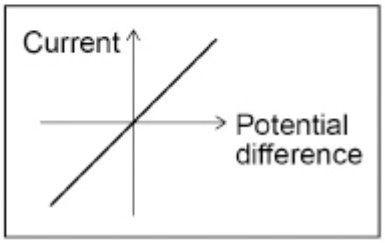
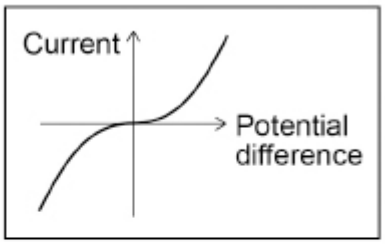
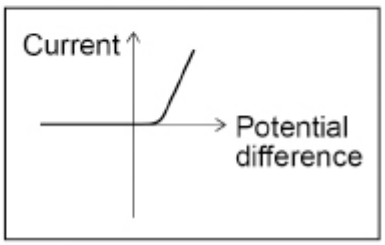
Resistance = _____ Ω

(2)

(f) The student repeated the investigation after replacing the lamp with a resistor at constant temperature and then a diode.

The student plotted a graph for each component.

Draw **one** line from each component to its graph.

Component	Graph
Diode	
Filament lamp	
Resistor	
	

(2)

(g) **Figure 2** shows an ammeter.

The ammeter is **not** connected to a circuit.

Figure 2

What type of error does the ammeter display?

Tick (✓) **one** box.

A positive error ☐

A random error ☐

A zero error ☐

(1)

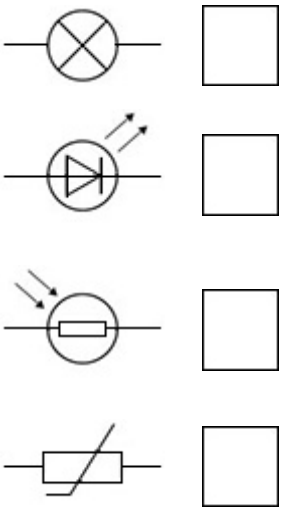
(Total 13 marks)

Q6.

(a) A hair dryer has LEDs to indicate the power setting.

What is the circuit symbol for an LED?

Tick (✓) **one** box.



(1)

(Total 1 marks)

Q7.

Use the Physics Equations Sheet to answer parts (c) and (d).

(a) Write down the equation which links charge flow (Q), current (I) and time (t).

_____

(1)

(b) The town of Hornsdale in Australia has electricity supplied by a huge battery.

The battery supplies a current of 130 000 A.

Calculate the charge flow from the battery in 5 minutes.

Choose the unit from the box.

coulombs	**newtons**	**watts**

_____

_____

_____

_____

Charge flow = _____ Unit _____

(4)

(Total 5 marks)