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

(a) The vending machine is connected to the mains electricity supply.

What is the frequency and the potential difference of the mains electricity supply in the UK?

Frequency = _____ Hz

Potential difference = _____ V

(2)

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

(b) The power dissipated by the coin is 340 mW when the current in the coin is 0.75 A.

Calculate the resistance of the coin.

Use the Physics Equations Sheet.

_____

_____

_____

_____

_____

_____

Resistance = _____ Ω

(4)

(c) Coins that are dirty are **not** recognised by the vending machine.

Suggest **one** reason why.

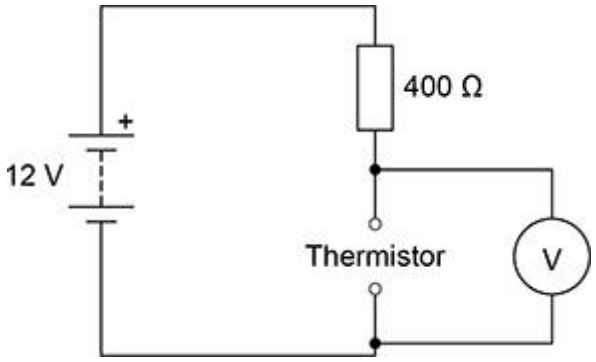
_____

_____

(1)

Figure 2 shows part of a different circuit that is used to monitor the temperature inside the vending machine.

Figure 2



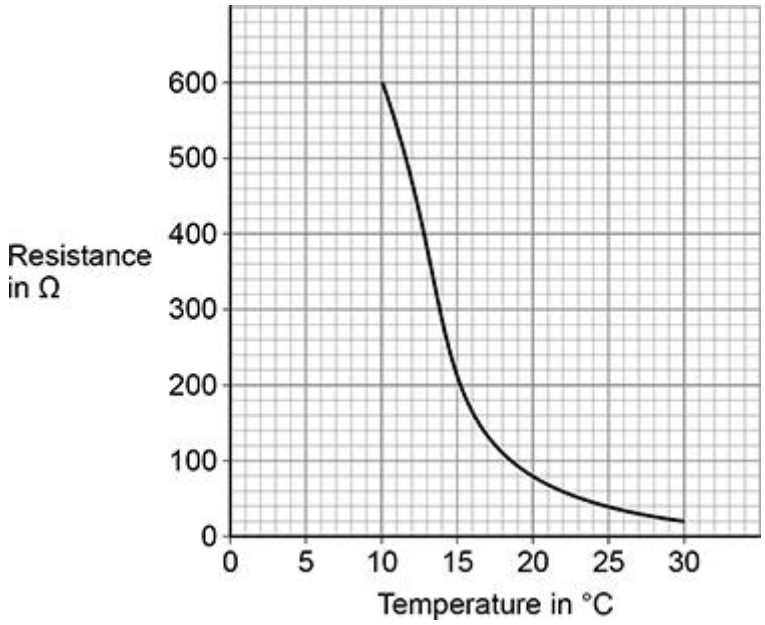
(d) The circuit symbol for a thermistor has not been included.

Draw the circuit symbol for a thermistor in the box below.

(1)

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

Figure 3



(e) The cooling system inside the vending machine turns on when the temperature of the thermistor is above 20 °C.

Determine the potential difference across the thermistor when the temperature is 20 °C.

Use the Physics Equations Sheet.

Potential difference = _____ V

(5)

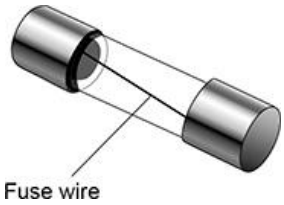
(Total 13 marks)

Q2.

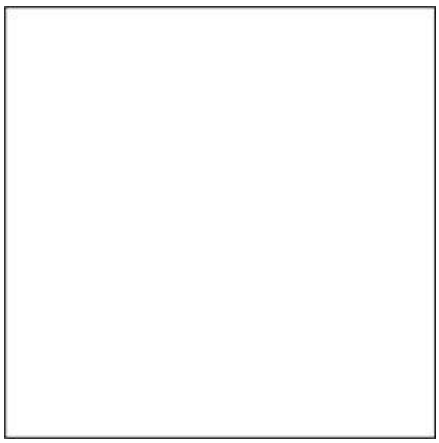
The live wire in a three-core cable is connected to a fuse inside a plug.

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

The figure below shows a fuse.



(a) Draw the circuit symbol for a fuse in the box below.



(1)

(b) The fuse wire melts when there is a charge flow of 2.0 C for 400 ms.

Calculate the current in the fuse wire.

Use the Physics Equations Sheet.

Current = _____ A

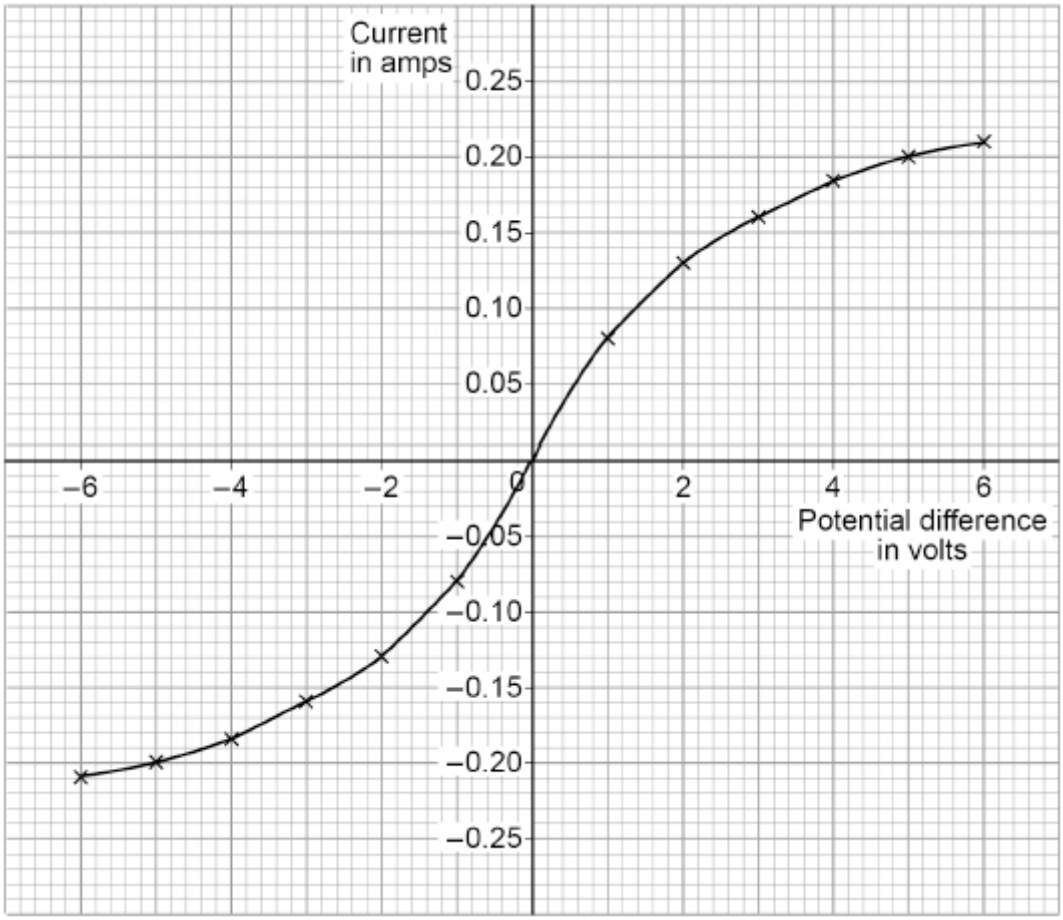
(4)

(Total 5 marks)

Q3.

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

The figure below shows the results.



(a) Describe a method the student could use to obtain these results.

You should include a circuit diagram.

(6)

(b) Determine the resistance of the filament lamp when the potential difference across it is +3.0 V.

Use the Physics Equations Sheet.

Use the figure above.

Resistance = _____ Ω

(3)

(c) The current in the lamp is 0.21 A when the potential difference across the lamp is 6.0 V.

Calculate the energy transferred by the filament lamp in 30 minutes.

Use the Physics Equations Sheet.

Energy transferred = _____ J

(5)

(d) The power output of the lamp is 1.0 W when the potential difference across the lamp is 5.0 V.

A student predicts that the power output would be 4.0 W if the potential difference was doubled.

Explain why the student is **not** correct.

(2)

(Total 16 marks)

Q4.

Figure 1 shows some hair straighteners.

Hair straighteners contain heating elements.

Figure 1

(a) When the hair straighteners reach normal operating temperature, an LED turns on.

Draw the circuit symbol for an LED in the box.

(1)

(Total 1 marks)