Physics Higher Paper 1 pack 1

Name: _____

Class: _____

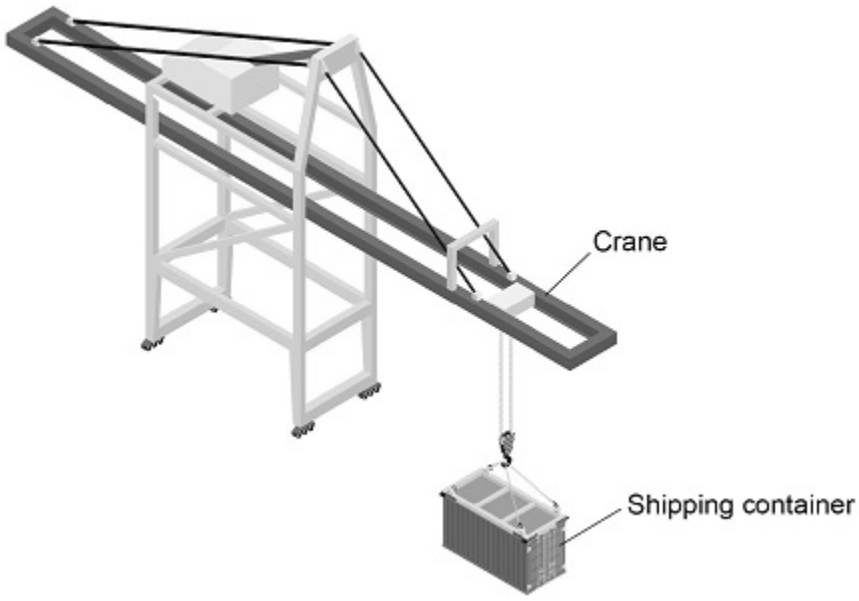
Date: _____

Time: **90 minutes**

Marks: **85 marks**

Comments:

1. The diagram below shows a crane being used to lift a shipping container



(a) Write the equation which links distance, force and work done.

_____

_____

(1)

(b) The container was lifted a height of 14 m

The crane did 3 430 000 J of work on the container.

Calculate the force exerted by the crane on the container.

_____

_____

_____

_____

_____

_____

Force = _____ N

(3)

(c) Write the equation which links power, time and work done.

_____

_____

(1)

(d) The power of the crane was 68 600 W

Calculate the time taken for the crane to do 3 430 000 J of work.

Give the unit.

_____

_____

_____

_____

_____

Time taken = _____ Unit _____

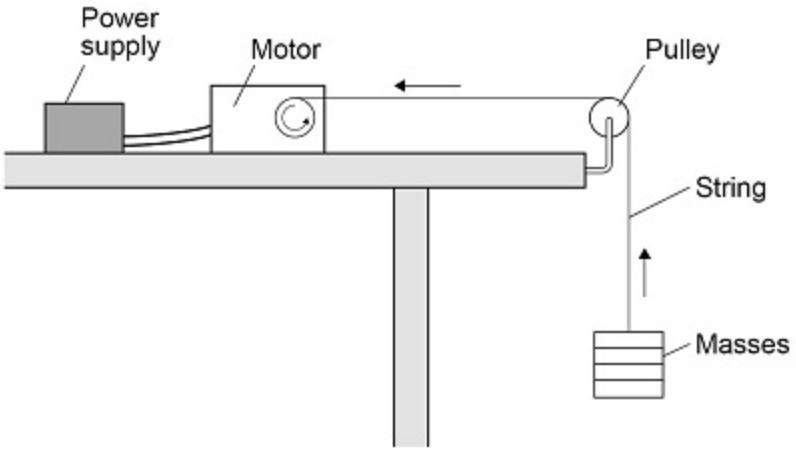
(4)

(Total 9 marks)

2. A student used an electric motor to lift a mass.

He investigated how the efficiency of the motor varied with the mass lifted.

The diagram below shows the apparatus used.



(a) Energy is transferred to the electric motor by the power supply.

Why is the energy transferred to the motor greater than the gravitational potential energy gained by the mass?

Tick (✓) **two** boxes.

Energy is not conserved	☐
Friction in the motor causes energy transfer to the surroundings	☐
The temperature of the motor increases	☐
Thermal energy from the surroundings is transferred to the mass	☐
Wasted energy is destroyed	☐

(2)

(b) The student calculated the gravitational potential energy gained by different masses as they were lifted.

The student used the equation:

gravitational potential energy = mass × 9.8 × height

Describe how the student could make accurate measurements to use in the calculations.

(4)

(c) Write the equation which links efficiency, total input energy transfer and useful output energy transfer.

(1)

(d) The efficiency of the motor was 15%.

The student calculated that the useful output energy transfer was 1.20 J

Calculate the total input energy transfer.

Total input energy transfer = _____ J

(4)

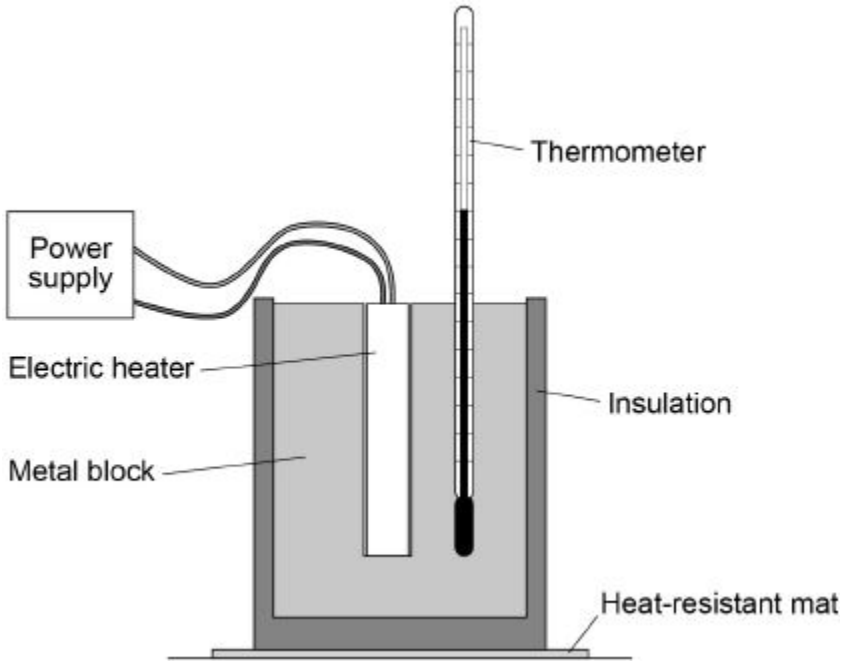
(Total 11 marks)

3. A student investigated how the temperature of a metal block changed with time.

An electric heater was used to increase the temperature of the block.

The heater was placed in a hole drilled in the block as shown in **Figure 1**.

Figure 1



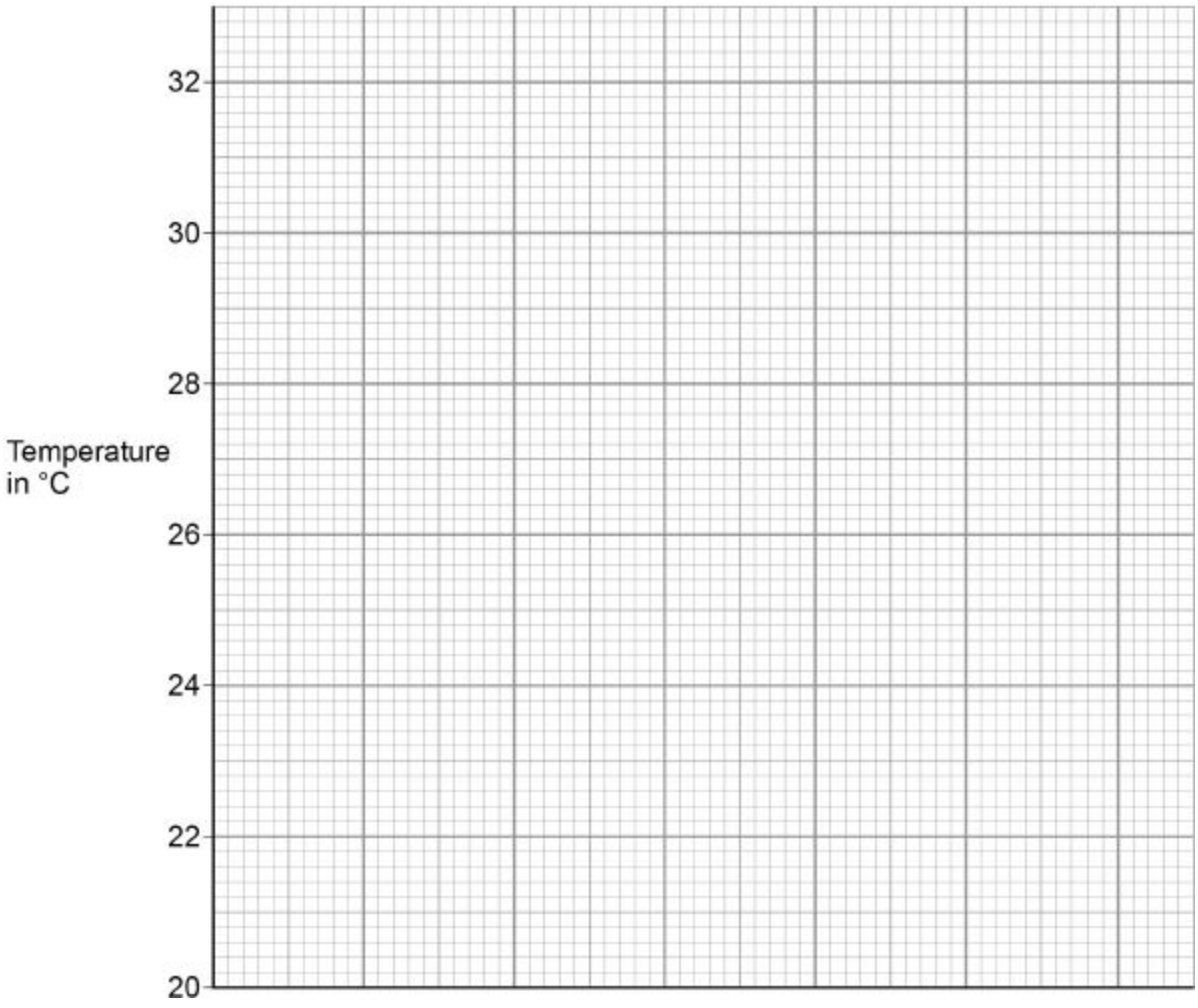
The student measured the temperature of the metal block every 60 seconds.
The table below shows the student's results.

Time in s	Temperature in °C
0	20.0
60	24.5
120	29.0
180	31.0
240	31.5

(a) Complete the graph of the data from the table above on the graph below.

- Choose a suitable scale for the x-axis.
- Label the x-axis.
- Plot the student's results.
- Draw a line of best fit.

Figure 2



(4)

(b) The rate of change of temperature of the block is given by the gradient of the graph.

Determine the gradient of the graph over the first 60 seconds.

Gradient = _____

(2)

(c) The metal block had a mass of 1.50 kg

The specific heat capacity of the metal was 900 J/kg °C

Calculate the change in thermal energy of the metal during 240 seconds.

Use the Physics Equations Sheet.

Give your answer in kilojoules.

Change in thermal energy = _____ kJ

(4)

(d) Another student repeated the investigation.

Give **two** variables this student would need to control to be able to compare their results with the results in the table above.

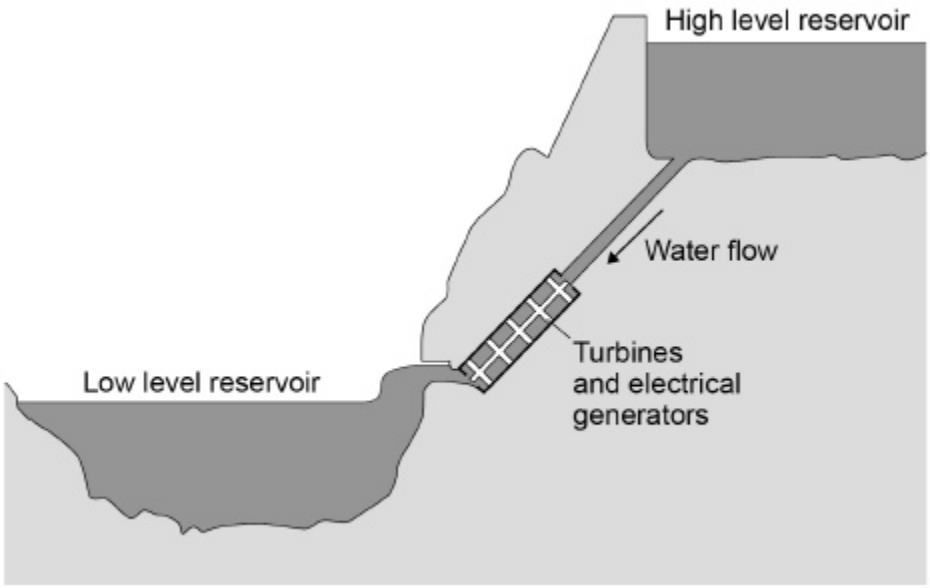
1. _____

2. _____

(2)

(Total 12 marks)

4. The diagram shows the flow of water through a hydroelectric power station.



The falling water turns the turbines.

The movement of the turbines causes the electrical generators to generate electricity.

(a) Write the equation which links kinetic energy, mass and speed.

_____

(1)

(b) In 1 minute, a mass of 9 000 kg of water flows through the turbines.

The speed of the water is 30 m/s

Calculate the total kinetic energy of the water passing through the turbines in 1 minute.

Give your answer in kilojoules (kJ).

_____

_____

_____

_____

Kinetic energy = _____ kJ

(3)

(c) Write the equation which links efficiency, total input energy transfer and useful output energy transfer.

_____

_____

(1)

(d) The efficiency of the turbines and generators is 80%

Calculate the useful output energy transfer from the hydroelectric power station in 1 minute.

Use your answer to part (b).

_____

_____

_____

_____

_____

Useful output energy transfer = _____ kJ

(3)

(e) A small group of people live in an area in the mountains.

The people plan to buy an electricity generating system that uses either the wind or the flowing water in a nearby river.

- The wind turbine costs £50 000 to buy and install.
- The hydroelectric generator costs £20 000 to buy and install.
- The average power output from the wind turbine is 10 kW
- The hydroelectric generator will produce a constant power output of 8 kW

Compare the advantages and disadvantages of the two methods of generating electricity.

Use your knowledge of energy resources and information given.

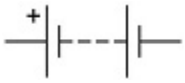
(4)

(Total 12 marks)

5. A student investigated how the resistance of a thermistor varies with temperature.

(a) The student made measurements to determine the resistance of the thermistor at room temperature. He used an ammeter and a voltmeter.

Complete the circuit diagram to show a circuit the student could use.



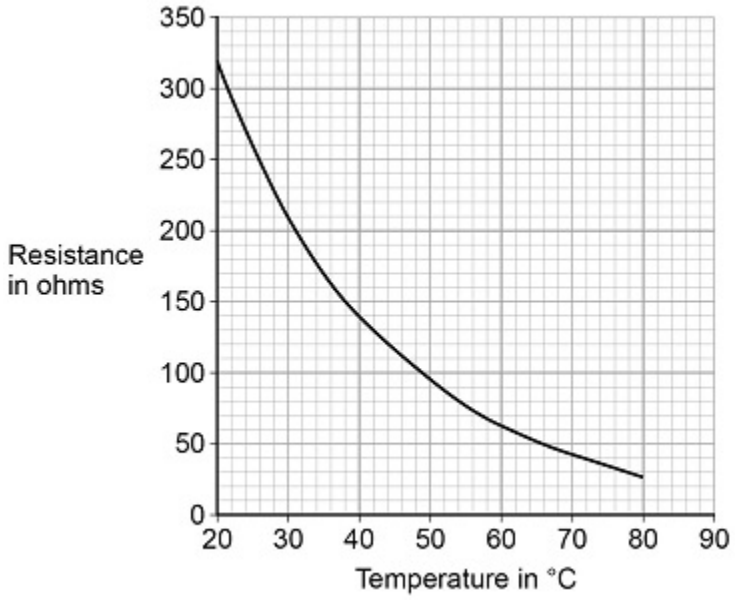
(3)

The student repeated the measurements with the thermistor at different temperatures.

He plotted a graph of resistance against temperature.

Figure 1 shows the graph.

Figure 1



(b) One set of readings was:

- potential difference = 5.60 V
- current = 0.04 A

Determine the temperature of the thermistor.

Temperature = _____ °C

(4)

(c) Explain how the graph shows that the thermistor is most sensitive to changes in temperature between 20 °C and 25 °C

_____

_____

_____

_____

(2)

(Total 9 marks)

6. Ice cream is made by cooling a mixture of liquid ingredients until they freeze.

(a) Which statement describes the motion of the particles in solid ice cream?

Tick (✓) **one** box.

They are stationary. ☐

They move freely. ☐

They vibrate about fixed positions. ☐

(1)

(b) How do the kinetic energy and the potential energy of the particles change as a liquid is cooled and frozen?

Tick (✓) **one** box.

Kinetic energy	**Potential energy**	
Decreases	Decreases	☐
Decreases	Does not change	☐
Does not change	Decreases	☐
Does not change	Does not change	☐

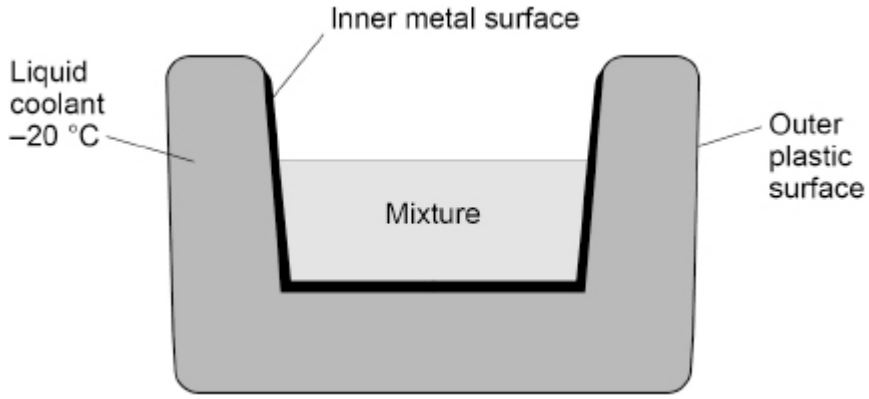
(1)

The diagram below shows a bowl used for making ice cream.

The walls of the bowl contain a liquid coolant.

The bowl is cooled to –20 °C before the mixture is put in the bowl.

The bowl causes the mixture to cool down and freeze.



(c) Explain why the different thermal conductivities of metal and plastic are important in the design of the bowl.

Metal _____

_____

_____

_____

Plastic _____

_____

_____

_____

(4)

(d) The liquid coolant has a freezing point below –20 °C

Explain **one** other property that the liquid coolant should have.

_____

_____

_____

_____

(2)

(e) The initial temperature of the mixture was +20 °C. The mixture froze at –1.5 °C.

A total of 165 kJ of internal energy was transferred from the mixture to cool and freeze it.

specific heat capacity of the mixture = 3500 J/kg °C

specific latent heat of fusion of the mixture = 255 000 J/kg

Calculate the mass of the mixture.

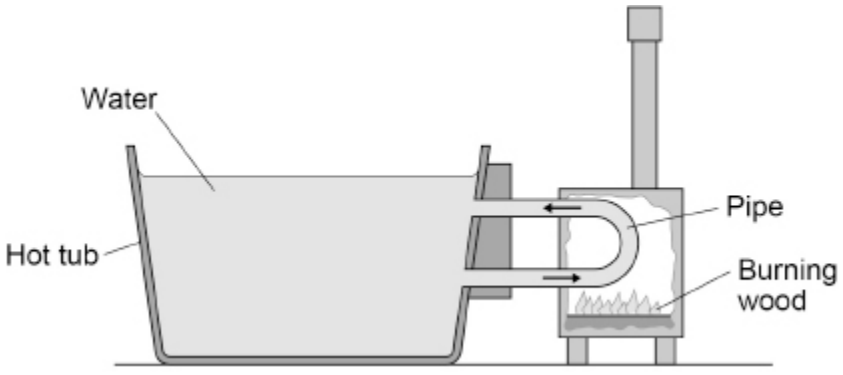
Give your answer to 2 significant figures.

Mass (2 significant figures) = _____ kg

(6)

(Total 14 marks)

7. The diagram below shows a wood-fired hot tub.



(a) What type of fuel is wood?

Tick (✓) **one** box.

A non-renewable biofuel ☐

A non-renewable fossil fuel ☐

A renewable biofuel ☐

A renewable fossil fuel ☐

(1)

(b) Give **two** environmental effects of using wood as an energy resource.

1. _____

_____

2. _____

_____

(2)

(c) Describe the change to the stores of energy of the wood, pipe and water as the water is heated.

Wood _____

_____

Pipe _____

_____

Water _____

_____

(3)

(d) The temperature of the water reaches 42 °C

The temperature then stays constant even though the fire continues to burn.

Explain why the temperature of the water stays constant.

_____

_____

_____

_____

_____

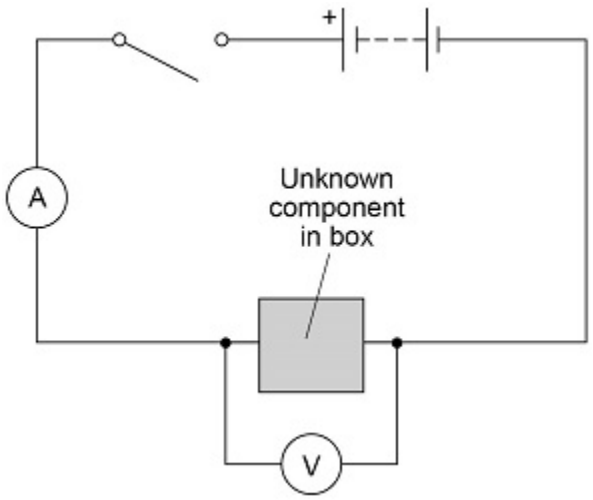
(2)

(Total 8 marks)

8. 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.

_____

_____

(1)

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

_____

_____

_____

_____

(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 ☐

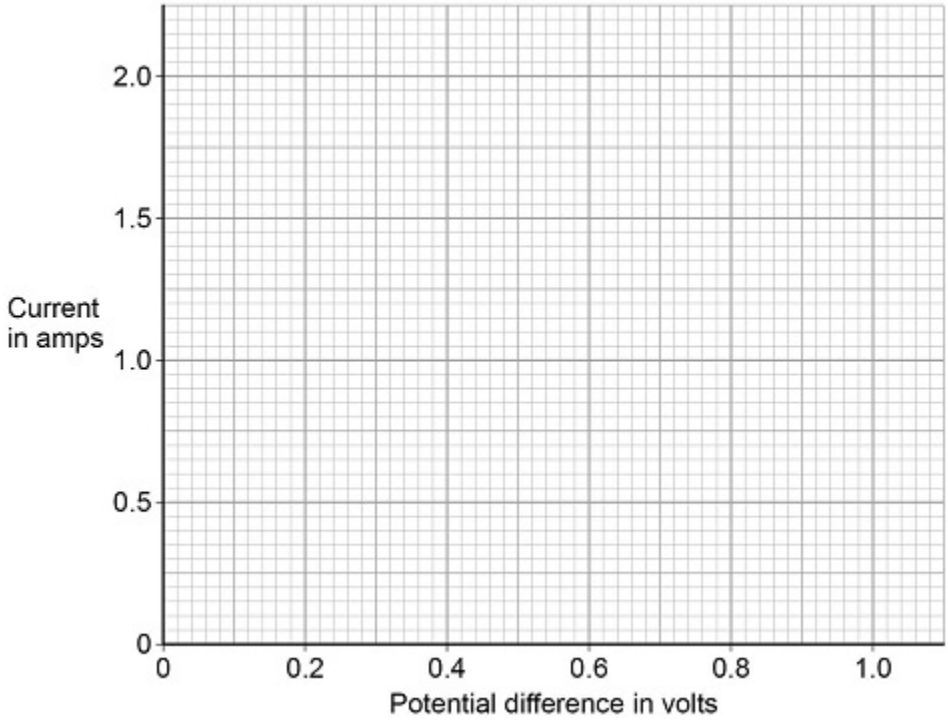
(1)

(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 ☐

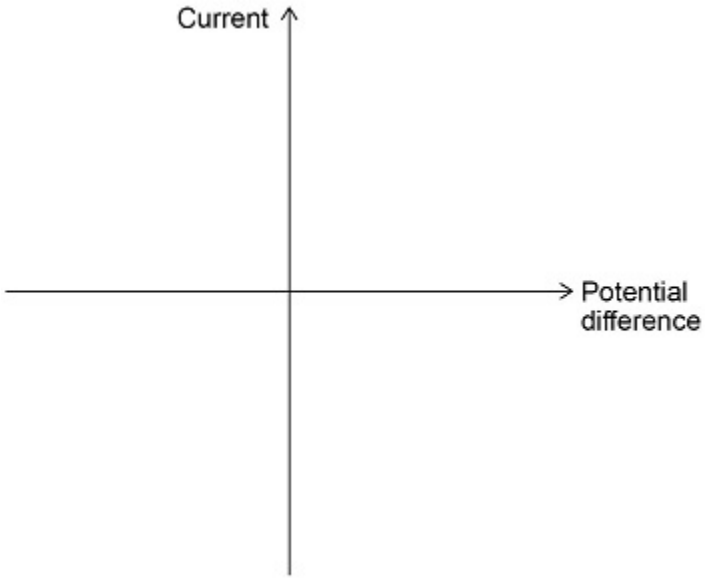
Thermistor ☐

(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)