AQA - Internal energy and energy transfer – GCSE Physics

1. May/2020/Paper_1F/No.7

0 7 A student heated water in an electric kettle.

0 7 . 1 Water has a high specific heat capacity.

Complete the sentence.

Choose answers from the box.

[2 marks]

°C	**J**	**kg**	**s**	**W**

The specific heat capacity of a substance is the energy needed to raise the

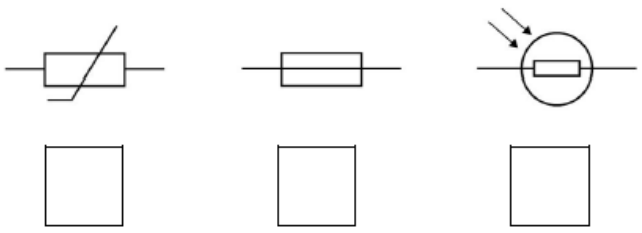
temperature of 1 _____ of the substance by 1 _____.

0 7 . 2 The kettle circuit contains a thermistor which is used to switch the kettle off when the water reaches 100 °C.

What is the correct symbol for a thermistor?

[1 mark]

Tick (✓) **one** box.



0 7 . 3 The resistance of the heating element in the kettle is 15 Ω.

The current in the heating element is 12 A.

Calculate the power of the heating element.

Use the equation:

$$\text{power} = (\text{current})^2 \times \text{resistance}$$

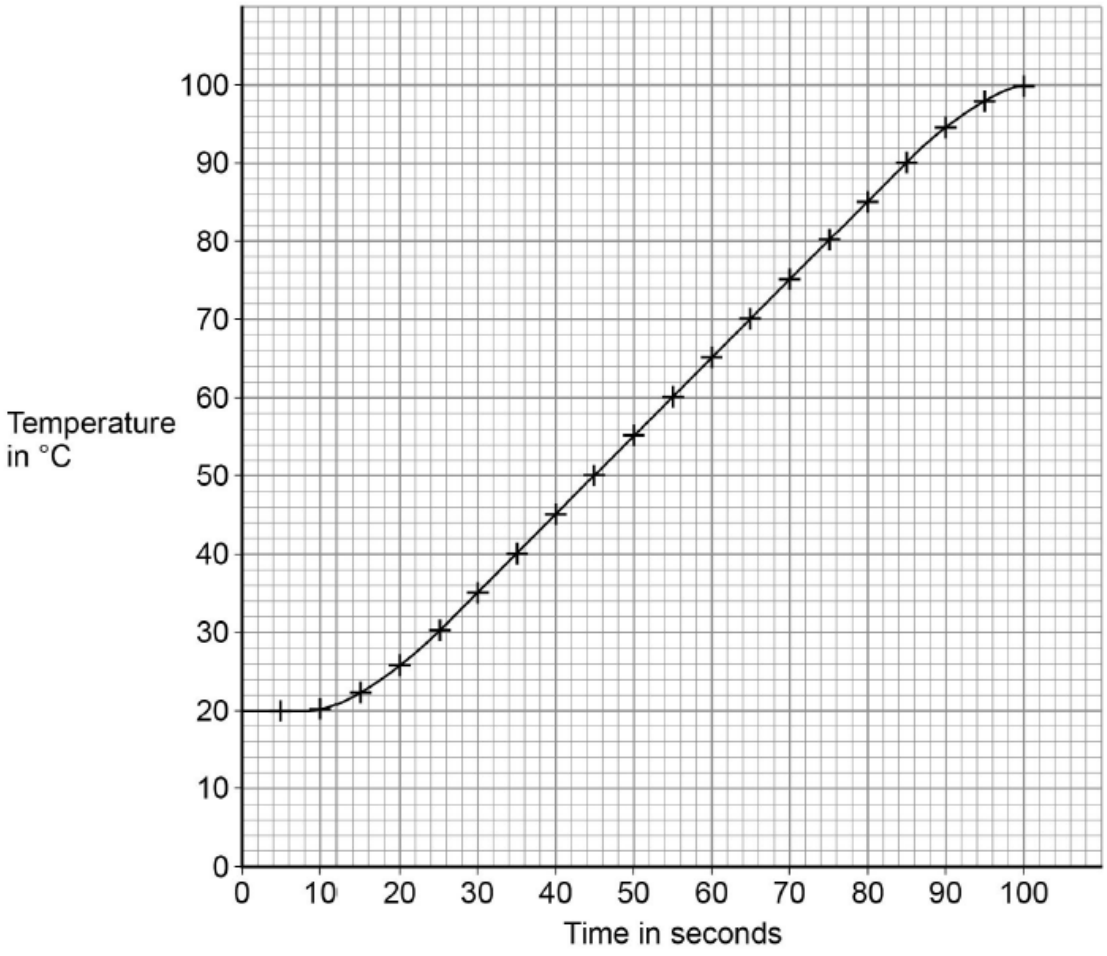
[2 marks]

Power = _____ W

The student investigated how quickly the kettle could increase the temperature of 0.50 kg of water.

Figure 10 shows the results of the investigation.

Figure 10



0 7 . 4 The temperature of the water did **not** start to increase until 10 seconds after the kettle was switched on.

What is the reason for this?

[1 mark]

Tick (✓) **one** box.

Energy is transferred from the surroundings to the kettle. ☐

The charge flows slowly through the kettle circuit. ☐

The heating element in the kettle takes time to heat up. ☐

The power output of the kettle increases slowly. ☐

0 7 . 5 Describe a method the student could have used to obtain the results shown in **Figure 10**.

[6 marks]

0 7 . 6 The mass of water in the kettle was 0.50 kg.

The temperature of the water increased from 20 °C to 100 °C.

specific heat capacity of water = 4200 J/kg °C

Calculate the energy transferred to the water.

Use the Physics Equations Sheet.

[3 marks]

Energy = _____ J

0 7 . 7 The water in the kettle boiled for a short time before the kettle switched off.

During this time 5.0 g of water changed to steam.

specific latent heat of vaporisation of water = 2 260 000 J/kg

Calculate the energy transferred to change the water to steam.

Use the Physics Equations Sheet.

[3 marks]

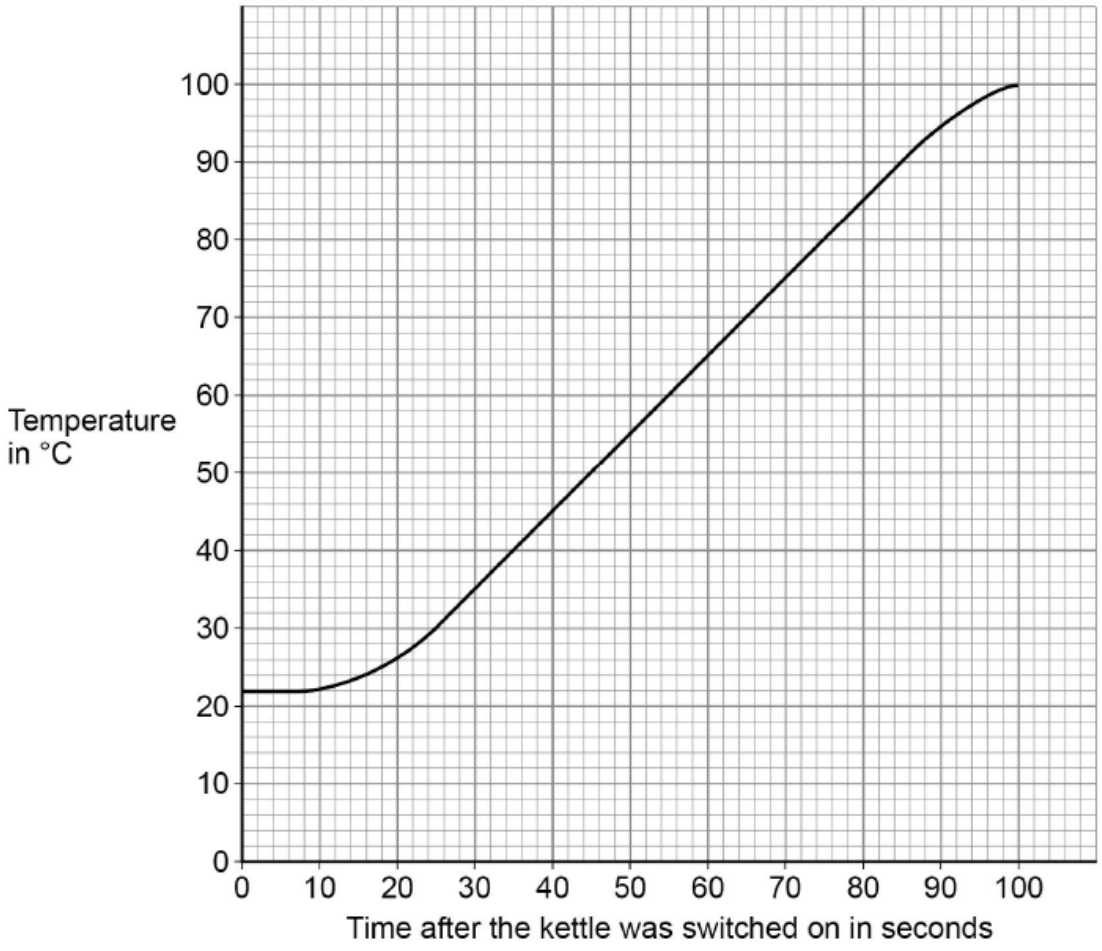
Energy = _____ J

2. May/2020/Paper_1H/No.7

0 7 An electric kettle was switched on.

Figure 10 shows how the temperature of the water inside the kettle changed.

Figure 10



0 7 . 1 When the kettle was switched on the temperature of the water did **not** immediately start to increase.

Suggest **one** reason why.

[1 mark]

0 7 . 2 The energy transferred to the water in 100 seconds was 155 000 J.

specific heat capacity of water = 4200 J/kg °C

Determine the mass of water in the kettle.

Use **Figure 10**.

Give your answer to 2 significant figures.

[5 marks]

Mass of water (2 significant figures) = _____ kg

0 7 . 3 The straight section of the line in **Figure 10** can be used to calculate the useful power output of the kettle.

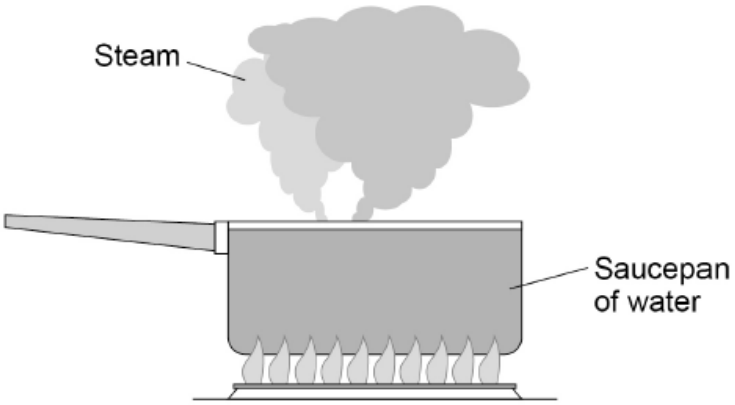
Explain how.

[3 marks]

3. May/2019/Paper_1F/No.1

0 1 **Figure 1** shows water being heated. Eventually the water changed into steam.

Figure 1



0 1 . 1 Complete the sentences.

Choose answers from the box.

Each answer may be used once, more than once or not at all.

[2 marks]

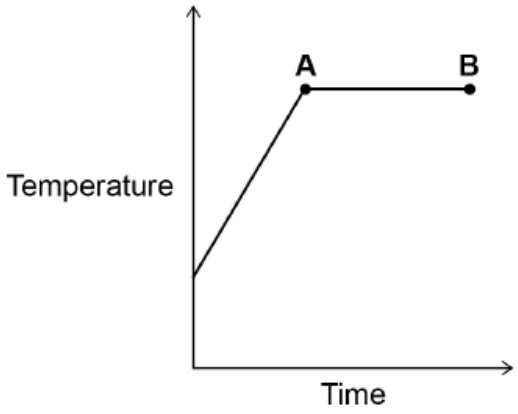
greater than	**less than**	**the same as**

The distance between the particles in steam is _____ the distance between the particles in liquid water.

The density of steam is _____ the density of liquid water.

Figure 2 shows how the temperature of the water varied with time.

Figure 2



0 1 . 2 What is the name of the process that is taking place between points **A** and **B**?

Give a reason for your answer.

[2 marks]

Process _____

Reason _____

_____

0 1 . 3 A mass of 0.063 kg of water was turned into steam.

The specific latent heat of vaporisation of water is 2 260 000 J/kg

Calculate the thermal energy transferred to the water to turn it into steam.

Use the equation:

thermal energy for a change of state = mass × specific latent heat

[2 marks]

Energy = _____ J

0 1 . 4 The mass of the steam was 0.063 kg

The volume of the steam was 0.105 m^3

Calculate the density of steam.

Use the equation:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Choose the unit from the box.

[3 marks]

kg	**m^3 / kg**	**kg / m^3**

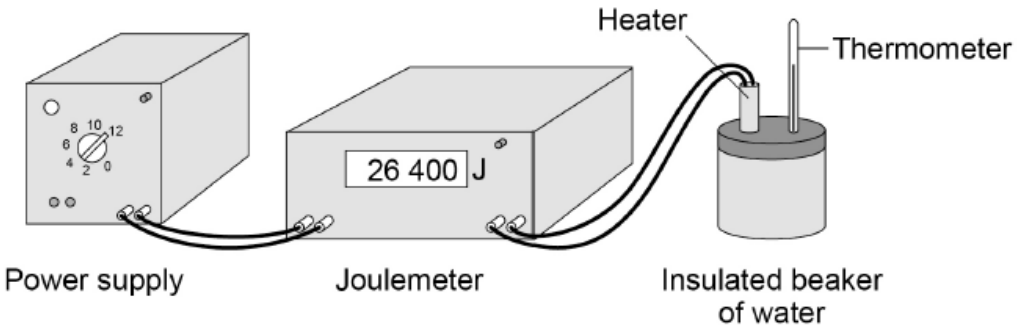
Density = _____ Unit _____

4. May/2019/Paper_1F/No.8

0 8 A student carried out an experiment to determine the specific heat capacity of water.

Figure 12 shows the equipment the student used to heat the water.

Figure 12



0 8 . 1 Why did the student insulate the beaker of water?

[1 mark]

Tick (✓) **one** box.

To increase energy transfer to the surroundings. ☐

To reduce energy transfer to the surroundings. ☐

To stop energy transfer to the surroundings. ☐

0 8 . 2 One hazard in this experiment is the hot water.

Give **one** risk to the student caused by this hazard.

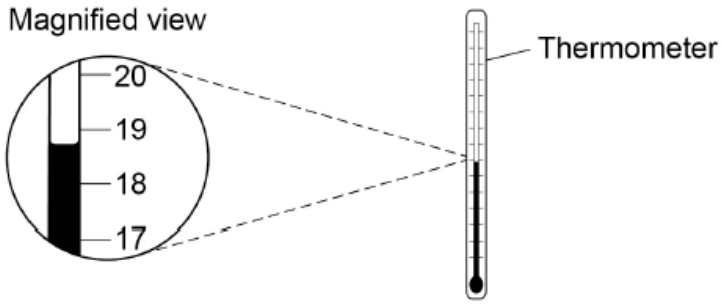
[1 mark]

_____

_____

0 8 . 3 **Figure 13** shows the thermometer that the student used.

Figure 13



What is the resolution of the thermometer?

[1 mark]

Tick (✓) **one** box.

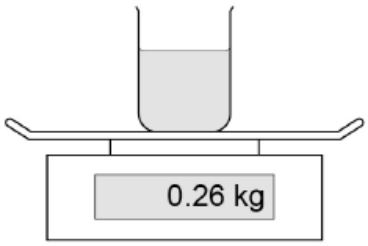
1 °C ☐

3 °C ☐

19 °C ☐

0 8 . 4 **Figure 14** shows the beaker of water on a balance.

Figure 14



The mass of the water was 0.20 kg

What was the mass of the beaker?

[1 mark]

Tick (✓) **one** box.

0.06 kg ☐

0.20 kg ☐

0.26 kg ☐

0.46 kg ☐

0 8 . 5 The energy transferred to the water was 26 400 J

The mass of water was 0.20 kg

The temperature increase of the water was 30 °C

Calculate the specific heat capacity of water using the data from this experiment.

Use the Physics Equations Sheet.

Choose the unit from the box.

[4 marks]

J/kg	J/kg°C	J/°C

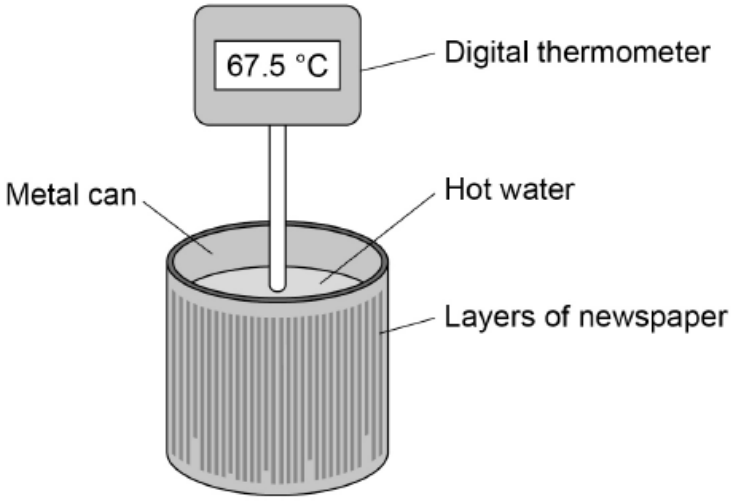
Specific heat capacity = _____ Unit _____

5. May/2019/Paper_1F/No.10

1 0 A student investigated the insulating properties of newspaper.

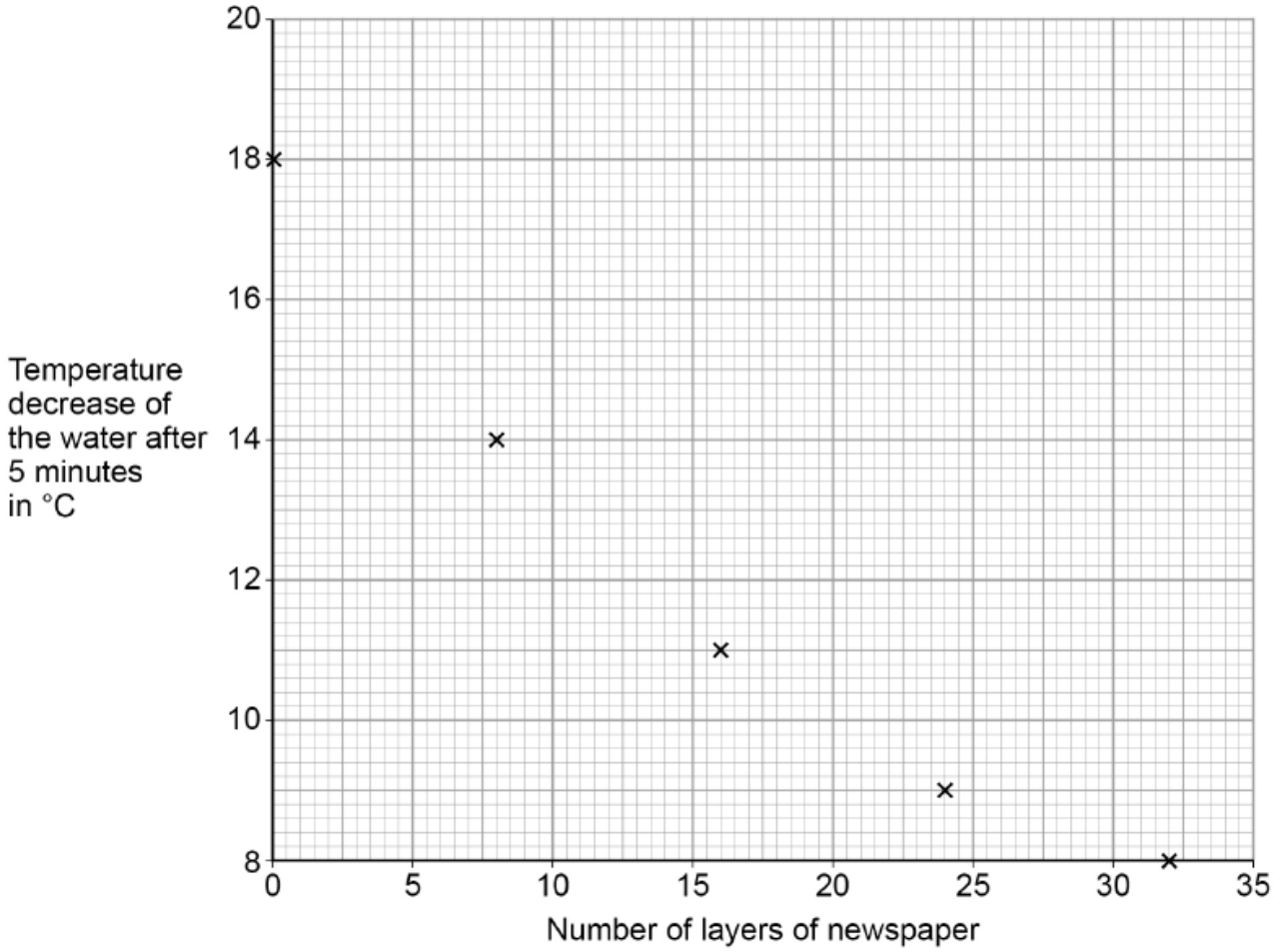
Figure 15 shows the apparatus the student used.

Figure 15



The student's results are shown in **Figure 16**.

Figure 16


Temperature decrease of the water after 5 minutes in °C
20
18
16
14
12
10
8
0
5
10
15
20
25
30
35
Number of layers of newspaper

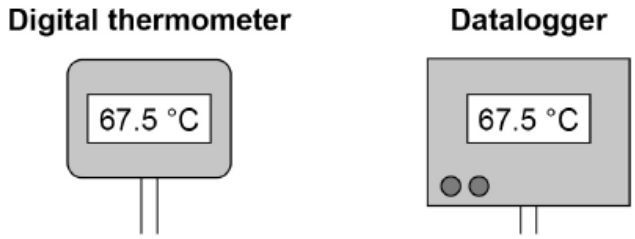
1 0 . 1 Describe a method the student could have used to obtain the results shown in **Figure 16**.

[6 marks]

1 0 . 2 The student could have used a datalogger with a temperature probe instead of the digital thermometer.

Figure 17 shows the readings on the digital thermometer and the datalogger.

Figure 17



The datalogger records 10 readings every second.

The student considered using a temperature probe and datalogger.

Explain why it was **not** necessary to use a temperature probe and datalogger for this investigation.

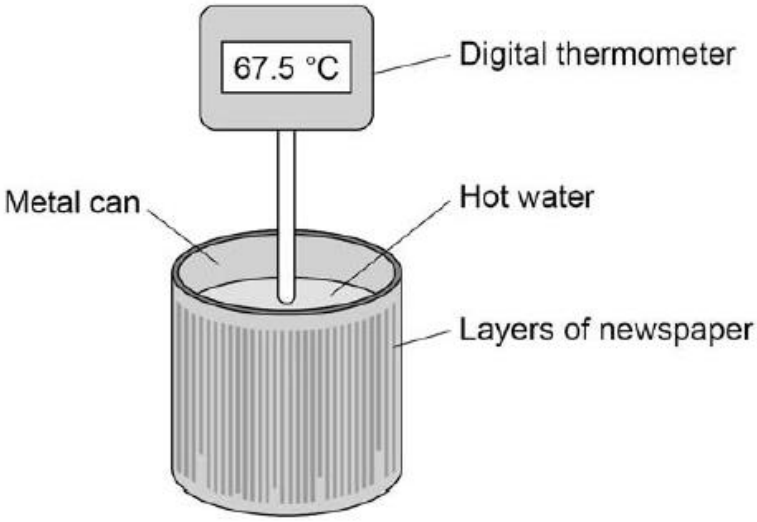
[2 marks]

6. May/2019/Paper_1H/No.2

0 2 A student investigated the insulating properties of newspaper.

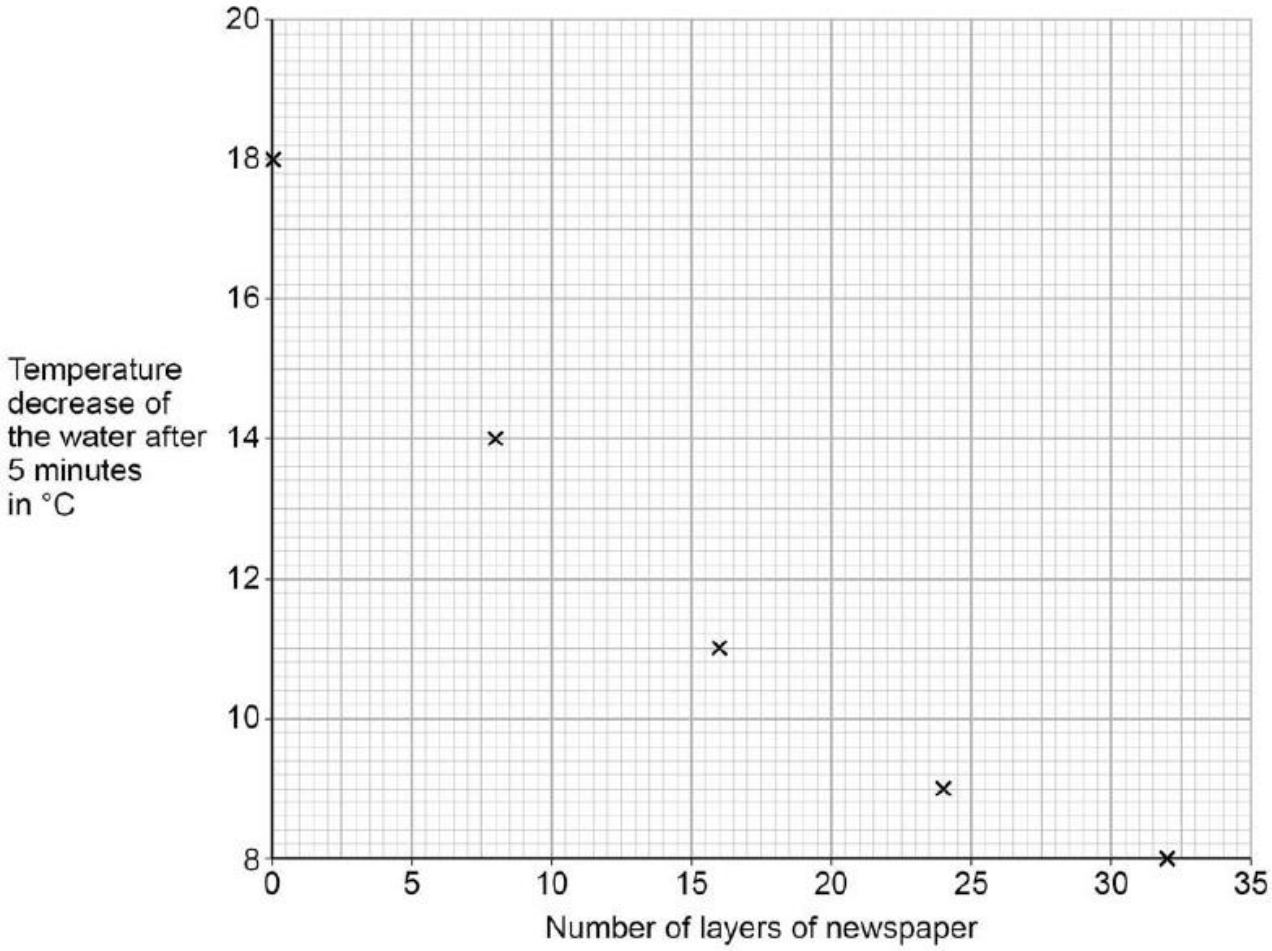
Figure 1 shows the apparatus the student used.

Figure 1



The student's results are shown in **Figure 2**.

Figure 2


Temperature decrease of the water after 5 minutes in °C
20
18
16
14
12
10
8
0
5
10
15
20
25
30
35
Number of layers of newspaper

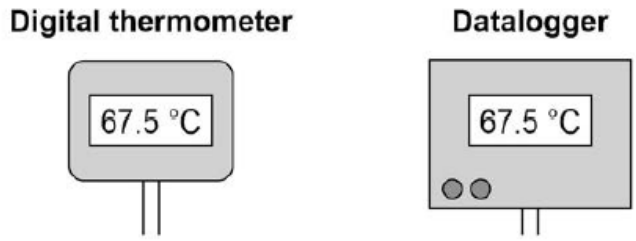
0 2 . 1 Describe a method the student could have used to obtain the results shown in **Figure 2**.

[6 marks]

0 2 . 2 The student could have used a datalogger with a temperature probe instead of the digital thermometer.

Figure 3 shows the readings on the digital thermometer and the datalogger.

Figure 3



The datalogger records 10 readings every second.

The student considered using a temperature probe and datalogger.

Explain why it was **not** necessary to use a temperature probe and datalogger for this investigation.

[2 marks]

7. May/2019/Paper_1H/No.8

0 8 A student investigated the thermal conductivity of different metals.

This is the method used:

1. Measure the mass of an ice cube.
2. Put the ice cube on a metal block which is at room temperature.
3. Measure the mass of the ice cube after one minute.
4. Repeat with other blocks of the same mass made from different metals.

Figure 10

Table 3 shows the student's results.

Table 3

Metal	Initial mass of ice cube in grams	Final mass of ice cube in grams	Change in mass of ice cube in grams
Aluminium	25.85	21.14	4.71
Copper	26.20	20.27	5.93
Lead	25.53	21.97	3.56
Steel	24.95	19.45	5.50

0 8 . 1 The initial temperature of each ice cube was –15 °C

Why was it important that the initial temperature of each ice cube was the same?

[1 mark]

Tick (✓) **one** box.

Initial temperature was a continuous variable. ☐

Initial temperature was a control variable. ☐

Initial temperature was the dependent variable. ☐

Initial temperature was the independent variable. ☐

0 8 . 2 Which metal had the highest thermal conductivity?

Give a reason for your answer.

[2 marks]

Metal: _____

Reason: _____

_____

_____

0 8 . 3 Suggest **one** source of random error in the student's investigation.

[1 mark]

_____

_____

_____

_____

0 8 . 4 An ice cube has a temperature of –15.0 °C

The total thermal energy needed to raise the temperature of this ice cube to 0.0 °C and completely melt the ice cube is 5848 J

specific heat capacity of ice = 2100 J/kg °C
specific latent heat of fusion of ice = 334 000 J/kg

Calculate the mass of the ice cube.

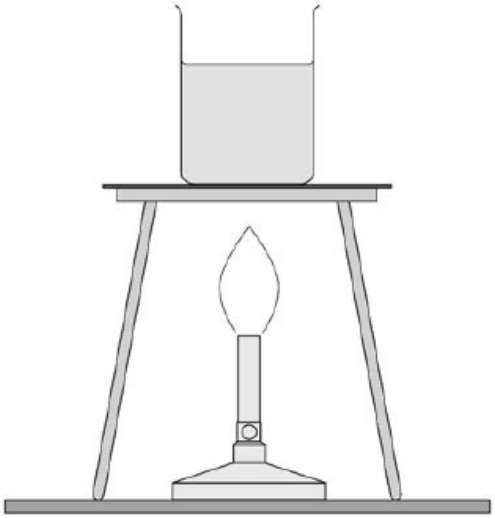
[5 marks]

Mass of ice cube = _____ kg

8. May/2019/Paper_1H/No.11

1 1 **Figure 14** shows a Bunsen burner heating some water in a beaker.
Eventually the water changes into steam.

Figure 14



1 1 . 1 Explain how the internal energy of the water changes as it is heated from 20 °C to 25 °C

[2 marks]

1 1 . 2 How is the particle model used to explain the difference in density between a liquid and a gas?

[1 mark]

Tick (✓) **one** box.

Particles in a gas have less kinetic energy than particles in a liquid. ☐

Particles in a gas have more potential energy than particles in a liquid. ☐

Particles in a liquid are further apart than particles in a gas. ☐

Particles in a liquid are larger than particles in a gas. ☐

1 1 . 3 A student measured the mass of boiling water that was turned into steam in five minutes.

Explain how the student could use this information to estimate the power output of the Bunsen burner in watts.

[4 marks]