OCR GCSE GATEWAY PHYSICS A · J249

PHYSICS



EXAM QUESTION PACK

P1.2 CHANGES OF STATE

SCORE	PERCENTAGE
/120	%

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Gateway Physics A (9-1)

Changes of state

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

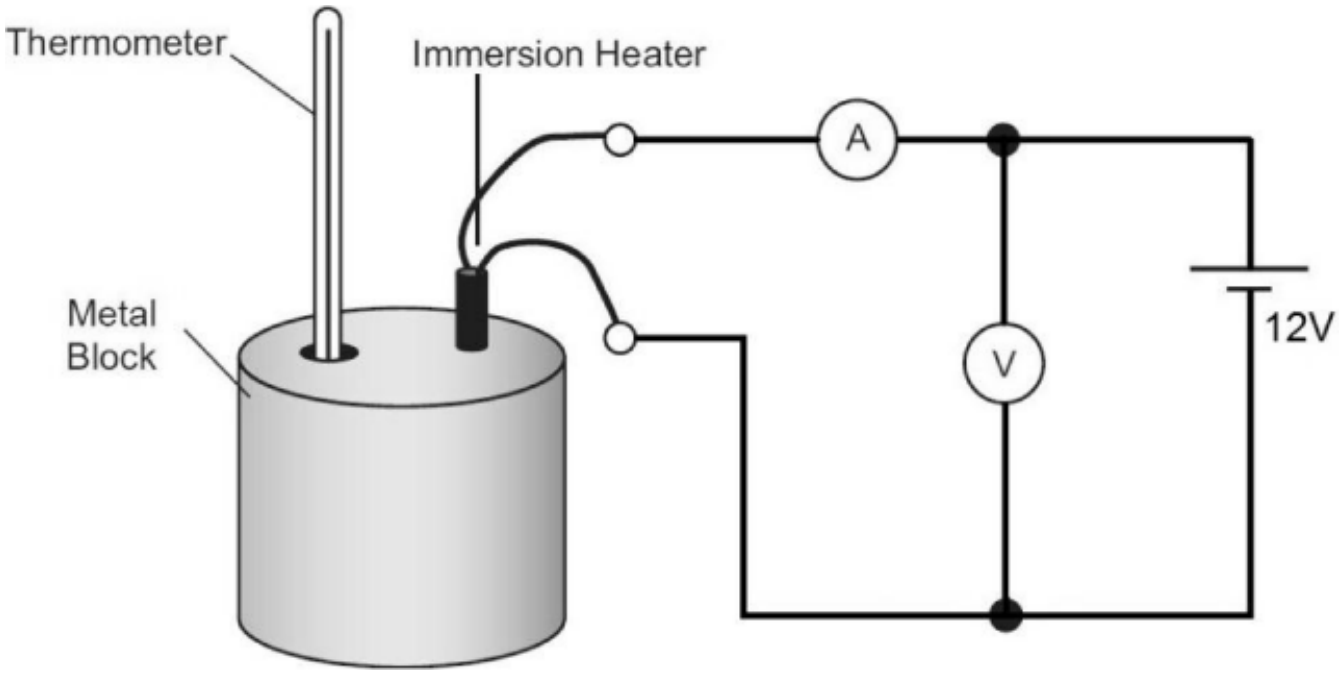
- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **120**.
- The total number of marks may take into account some 'either/or' question choices.

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1(a) A student completes an experiment to find the specific heat capacity of a metal.



(i) The student takes voltage and current measurements.

Suggest **three** other measurements they need to take?

---

[3]

(ii) Describe how these measurements could be used to determine the specific heat capacity of the metal.

---

[2]

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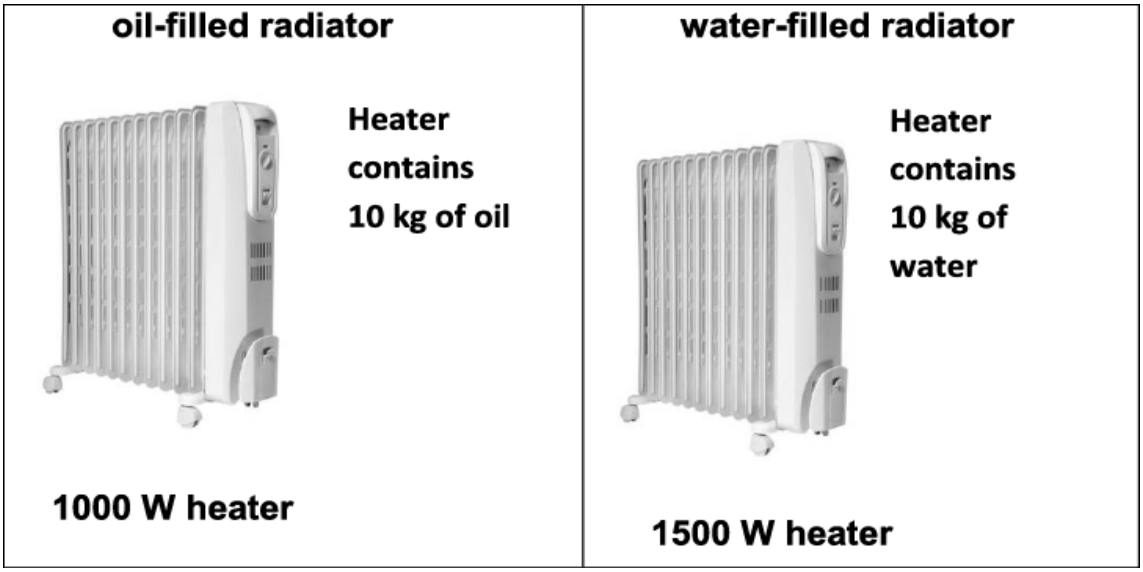
(b) The value obtained from the experiment is much higher than expected.

Suggest **two** reasons how this could have occurred and suggest **two** improvements to the experimental procedure.

[4]

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2(a) Alex has two radiators in her home. They are filled with 10 kg of different liquids.



The table below shows information about oil and water.

Material	Specific heat capacity (J/kg°C)	Freezing point (°C)	Boiling point (°C)
Oil	1 700	−24	250
Water	4 200	0	100

Alex's conservatory can be very cold.

Sometimes it can get as low as −6 °C.

Alex thinks that the oil radiator may be better for the conservatory.

Suggest why.

---

[1]

(b) Both radiators in a home have a 'cut-out' which prevents them getting hotter than 60 °C.

Suggest why.

---

[1]

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(c) Alex does a calculation.

She knows that the oil heater produces 800 J of energy each second.

Calculate the energy produced by the oil heater in 10 minutes.

---

answer: _____ J **[2]**

(d)

(i) Alex wants the oil heater to heat up by 40°C.

How much energy is needed? Show your working.

---

answer: _____ J **[2]**

(ii) She supplies enough energy to heat up the oil radiator by 40°C but it only heats up to 32°C.

Suggest two reasons why.

---

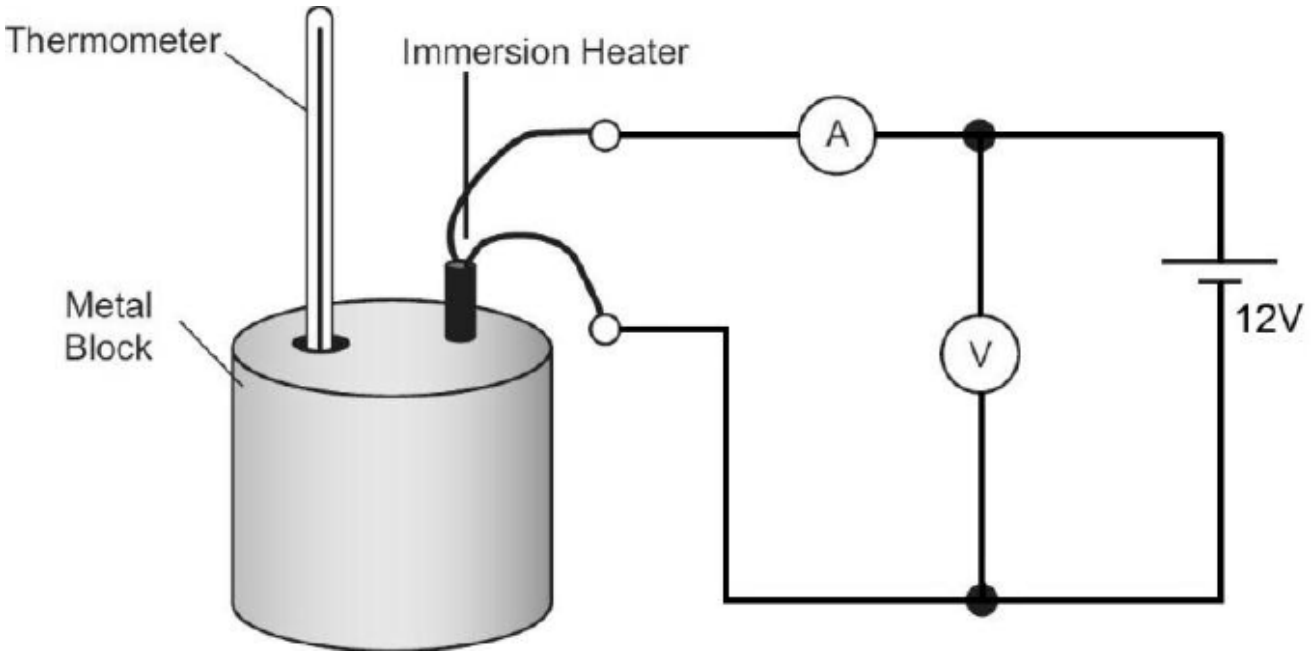
[2]

3(a) A student completes an experiment to find the specific heat capacity of a metal.

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(i) The student takes voltage and current measurements.

Suggest **three** other measurements they need to take?

--- [3]

(ii) Describe how these measurements could be used to determine the specific heat capacity of the metal.

--- [2]

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(b) The value obtained from the experiment is much higher than expected.

Suggest **two** reasons how this could have occurred and **two** improvements to the experimental procedure.

---

[4]

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4 The plastic beaker has a mass of 0.2 kg and the specific heat capacity of the plastic is 1680 J / kg °C.

The water has a mass of 0.6 kg and its specific heat capacity is 4200 J / kg °C.

The energy from the microwave is initially absorbed by the water which then heats the plastic beaker.

The plastic beaker and water experience different temperature rises.

The plastic beaker gains 13 440 J and the water gains 151 200 J.

(i) Calculate the temperature rise of the water and the temperature rise of the plastic beaker.

water _____

_____

temperature rise of water _____ °C

plastic beaker _____

_____

temperature rise of plastic beaker _____ °C

[2]

(ii) Heating the plastic beaker in the **microwave oven** results in the plastic having a lower temperature rise than the water.

Suggest a reason why.

_____

_____ **[1]**

5 Sophia wants to buy a new kettle.

She is not sure which one to buy.

The two kettles in the table are identical, apart from the material they are made out of.

		
	Metal alloy kettle	**Stainless steel kettle**
Specific heat capacity	400 J / kg °C	500 J / kg °C
Mass of metal in kettle	1.5 kg	1.2 kg
Mass of water in kettle	1.8 kg	1.8 kg
Power	3 kW	3 kW

Sophia puts 1.8 kg of cold water, at 20 °C, in each kettle.

She thinks that the alloy kettle will take a shorter time to heat the water up to boiling point (100 °C).

She finds that both kettles take the **same** time to reach 100 °C.

Explain why the kettles take the same time to heat the water up to 100 °C.

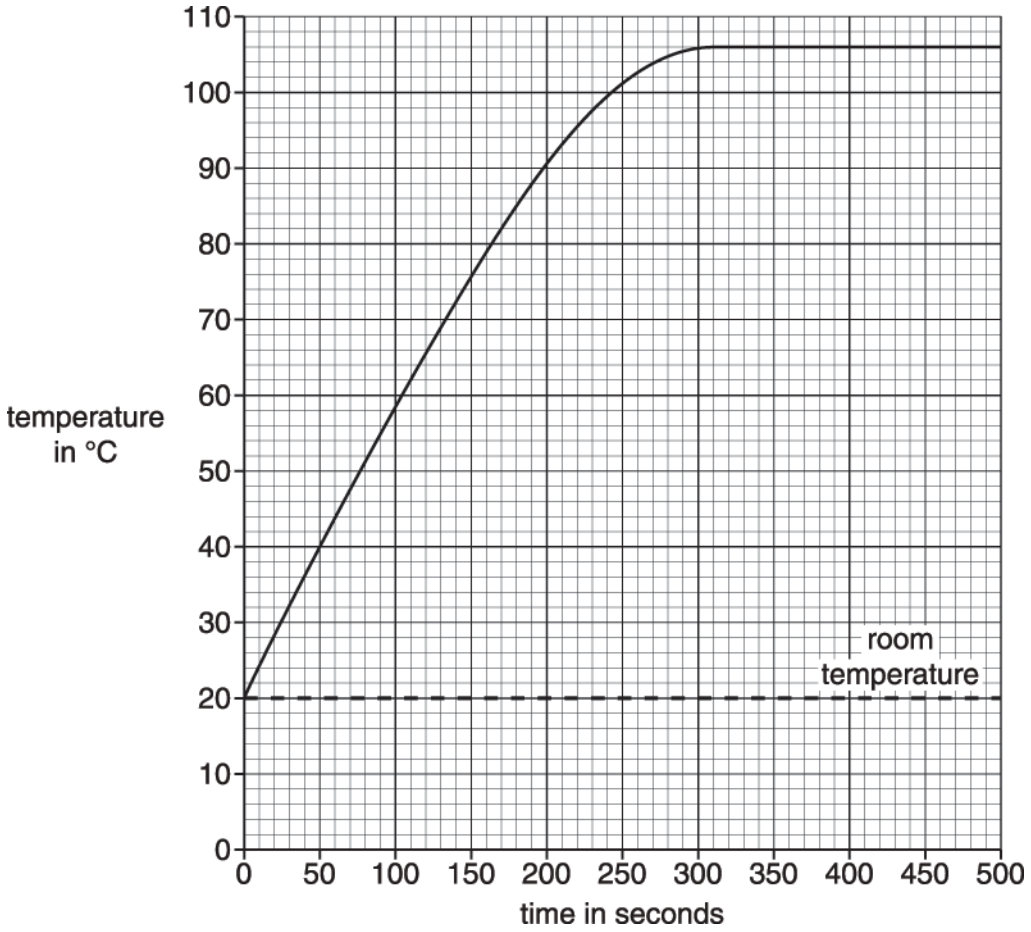
The quality of written communication will be assessed in your answer to this question.

---

[6]

6 Layla heats the liquid in a beaker for 500 seconds and records the temperature.

Look at the graph of her results.



Write down the time interval during which all of the energy supplied was used to change the state of the liquid, and explain how the energy supplied causes this change of state.

time interval is from _____ seconds to _____ seconds

explanation _____

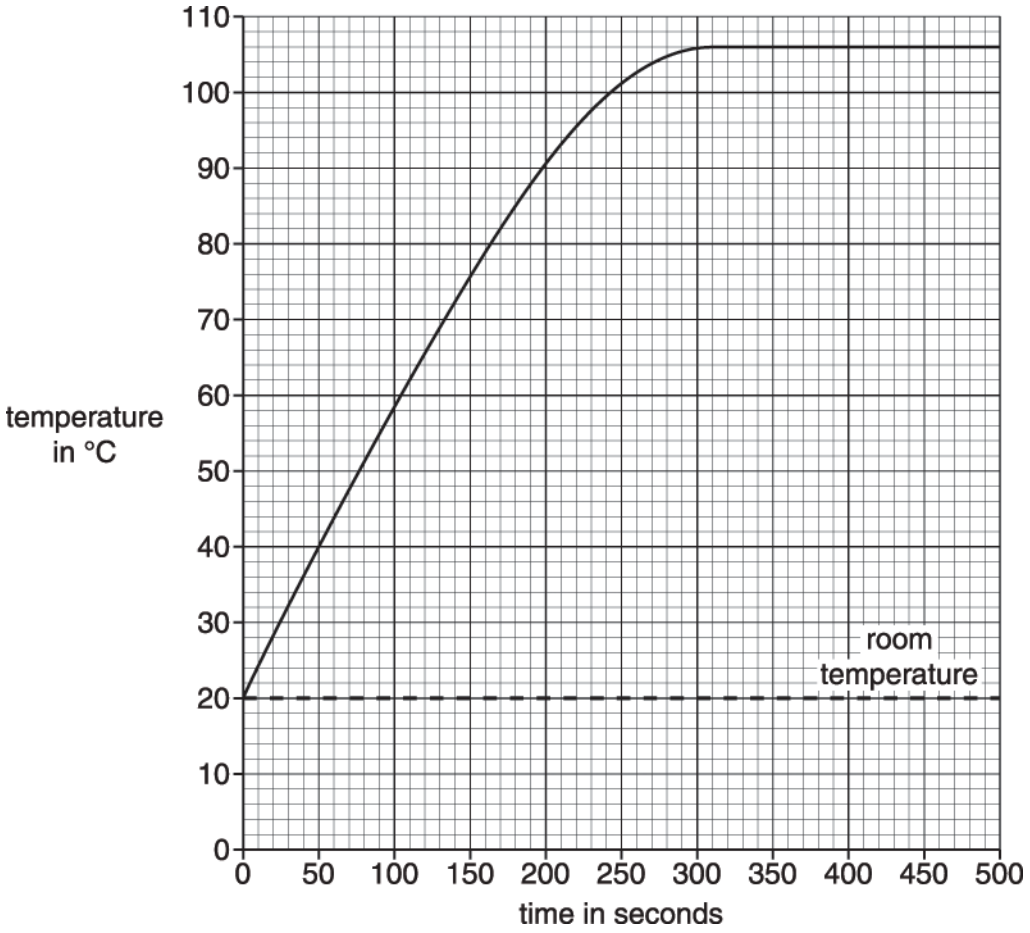
_____

_____

_____ [2]

7(a) Layla heats a beaker containing a liquid and records its temperature.

Look at the graph of her results.



Layla concludes that the liquid boiled during the experiment.

How does the graph show this?

---

[1]

(b) What is the boiling point of the liquid?

answer _____ °C.

[1]

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8(a) Dave experiments heating different materials.

He needs to choose a heater to warm some water.

The table shows how much energy different heaters supply in 600 seconds.

Heater	Energy supplied in joules
A	5000
B	10 000
C	20 000
D	25 000
E	35 000

Dave needs to increase the temperature of 0.6 kg of water by 12°C in 600 seconds.

Water has a specific heat capacity of 4200 J / kg°C.

Do a calculation to find out which heater Dave needs. Show your working.

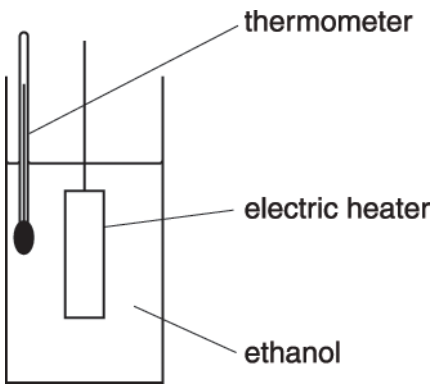
_____ J

The heater Dave needs for this is _____

[2]

(b) Dave needs to boil some ethanol. He uses an electrical heater.

Look at the diagram.



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(i) The ethanol is at its boiling point.

Dave measures the temperature of the ethanol as it boils.

What happens to the temperature of ethanol when it is boiling?

---

[1]

(ii) The specific latent heat of ethanol is 850 J / g.

Calculate the energy needed to boil 12 g of ethanol.

---

answer _____ J

[2]

(iii) When Dave does this experiment he finds that he needs more energy to boil the ethanol than he expected.

Suggest reasons why.

---

[2]

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9(a) Dave experiments heating different materials.

He needs to choose a heater to warm some water.

The table shows how much energy different heaters supply in 600 seconds.

Heater	Energy supplied in joules
A	5000
B	10000
C	20000
D	25000
E	35000

Dave needs to increase the temperature of 0.6 kg of water by 12 °C in 600 seconds.

Water has a specific heat capacity of 4200 J/kg °C.

Do a calculation to find out which heater Dave needs. Show your working.

_____

_____

_____ J

The heater Dave needs for this is _____ **[2]**

(b) Dave's teacher gives him two different liquids to boil.

They have different specific latent heats.

Specific latent heat of **water** = 2260 J/g Specific latent heat of **ethanol** = 850 J/g

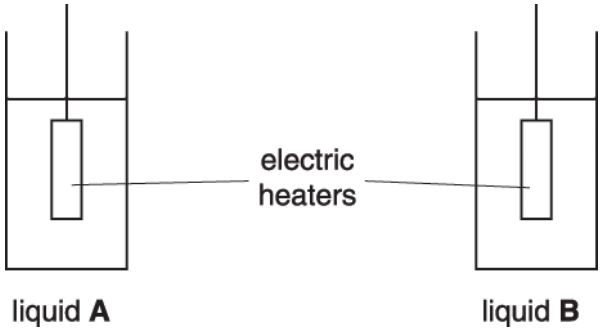
Unfortunately, he gets the two liquids confused. He cannot tell which liquid is which.

He heats up both liquids until they start to boil.

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Dave then measures how much mass is lost from each liquid when he heats them for the same time.

Look at his results.

Liquid	Energy supplied for boiling in J	Mass of liquid lost in g
A	48000	20
B	48000	53

(i) Use a calculation to show which liquid is water.

---

[2]

(ii) When liquids boil, energy is transferred but there is no temperature change.

Write down the name of **another** process in which this happens.

---

[1]

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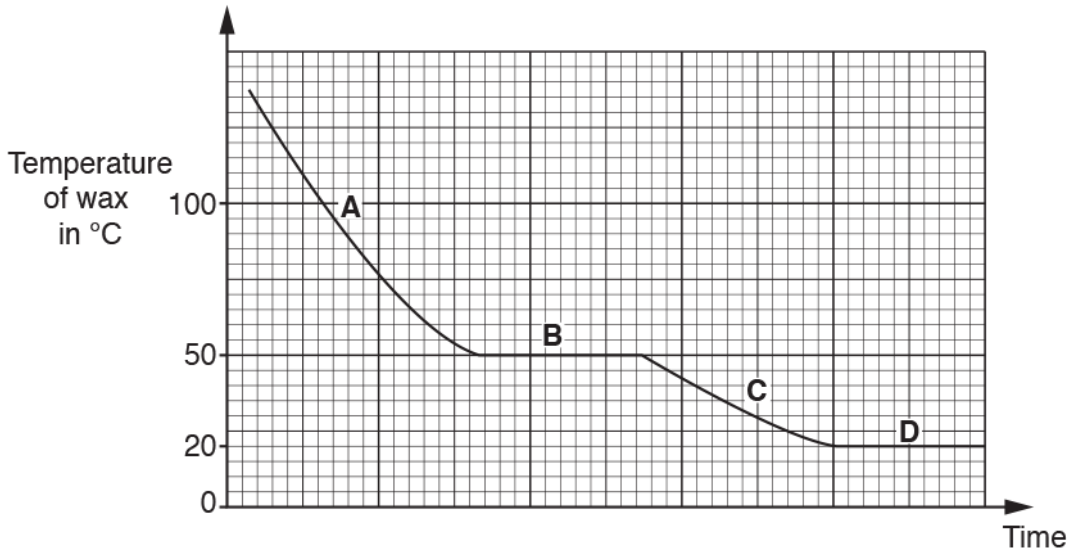
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10(a) Fin lets some **liquid** wax cool until it reaches room temperature at 20°C.

He measures the temperature of the wax as it cools.

Look at the graph of his results.



Explain what happens at **B** on the graph.

---

[2]

(b) Explain why the graph is constant at **D**.

---

[2]

11(a) Calculate the energy needed to change the state of 3.5 kg of water into steam.

The specific latent heat for boiling water is 2 260 000 J/kg.

Answer ..... J [2]

(b) This change of state from water into steam can be sketched on a temperature / time graph.

Sketch the line and describe what it shows.



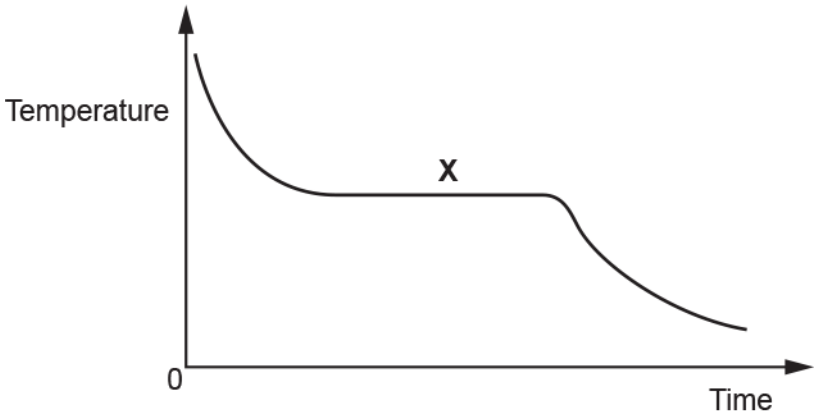
[1]

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12 A student studies how the temperature falls when a liquid cools.



What is happening at point **X** on the graph?

A Boiling

B Freezing

C Melting

D Subliming

Your answer ☐ **[1]**

13(a) The students find that 250 g of ice takes 95 kJ of energy to change state.

Calculate the specific latent heat.

Answer = ... J/kg **[3]**

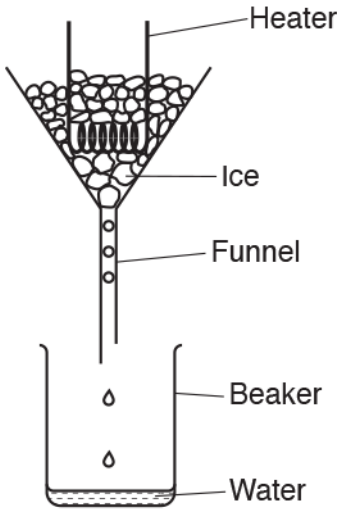
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(b) Two students design an experiment to find the specific latent heat of water.

They set up their equipment as shown in the diagram.



The students also have access to a power supply, a voltmeter, an ammeter, a stop-clock and a top-pan balance.

* Explain how the students could use this equipment to determine an accurate value for the specific latent heat of water.

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[6]

14 A wooden block has a mass of 2 kg and a specific heat capacity of 2000 J/kg °C.

Calculate the energy needed to raise its temperature by 6 °C.

Use the equation:

Change in thermal energy = Mass × Specific Heat Capacity × Change in Temperature

A 1 200 J

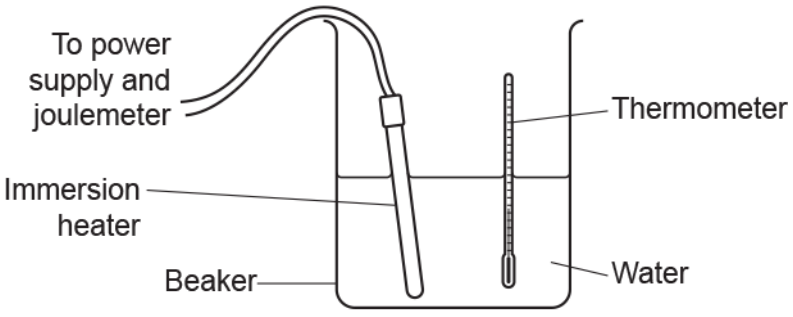
B 2 400 J

C 12 000 J

D 24 000 J

Your answer ☐ [1]

15(a) A student completes an experiment to find the specific heat capacity of water.



He heats up 1 kg of water, using an immersion heater. He measures the temperature rise and calculates the specific heat capacity of the water.

Attempt	Energy supplied	Temperature rise	Specific heat capacity

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	(J)	(°C)	(J/kg °C)
1	10 000	2	5000
2	21 000	4	5250
3	44 000	8	5500

(i) Calculate the **mean** specific heat capacity.

Answer = ... J/kg °C **[1]**

(ii) Describe the conclusions that can be drawn from the data.

---**[3]**

(b) The actual value for the specific heat capacity of water is 4200 J/kg °C.

(i) Explain why the mean specific heat capacity calculated in **(a)(i)** is higher than the actual value.

---

[2]

(ii) Write down **two** problems with this experiment **and** suggest how they could be solved.

Use the diagram and results table to help you.

Problem 1 ---

Solution ---

Problem 2 ---

Solution ---

---

[4]

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16(a) A student puts an ice cube into a beaker. The mass of the ice cube is 40 g.

The ice cube melts.

(i) Write down the mass of the water produced.

Mass = ... g **[1]**

(ii) Explain your answer to **(i)**.

---

[2]

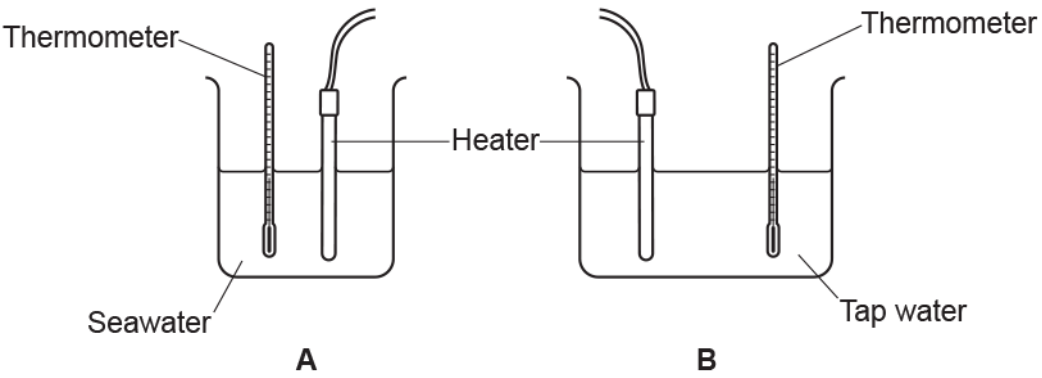
(b) Describe **one** difference between a **physical change** and a **chemical change**.

---

[1]

(c) A student does an experiment to find the difference between the specific heat capacities of seawater and tap water.

The student places a heater and a thermometer into two beakers, **A** and **B**. Look at the diagram.



(i) There are 5 steps to the method for this experiment.

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Complete the missing steps for this method.

Step 1 – Put seawater into beaker and tap water into beaker .

Step 2 – _____

Step 3 – _____

Step 4 – _____

Step 5 – Calculate the temperature change of beaker and beaker .

[3]

(ii) Suggest **one** mistake the student made when choosing their equipment.

_____

[1]

(iii) Suggest **two** improvements to the method followed.

1 _____

2 _____

[2]

17(a) A student puts an ice cube into a beaker. The mass of the ice cube is 40 g.

The ice cube melts.

(i) Write down the mass of the water produced.

Mass = ... g **[1]**

(ii) Explain your answer to **(i)**.

---

[2]

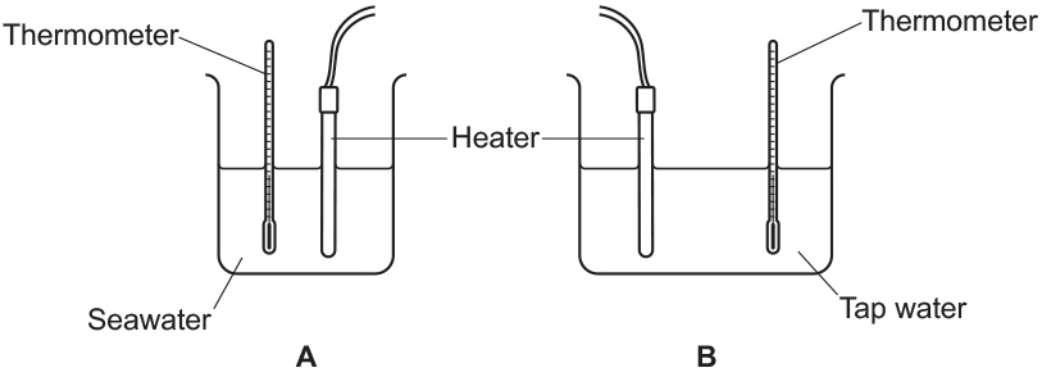
(b) Describe **one** difference between a **physical change** and a **chemical change**.

---

[1]

(c) A student does an experiment to find the difference between the specific heat capacities of seawater and tap water.

The student places a heater and a thermometer into two beakers, **A** and **B**. Look at the diagram.



(i) There are 5 steps to the method for this experiment.

Complete the missing steps for this method.

Step 1 – Put seawater into beaker **A** and tap water into beaker **B**.

Step 2 – ---

Step 3 – ---

Step 4 – ---

Step 5 – Calculate the temperature change of beaker **A** and beaker **B**.

[3]

(ii) Suggest one mistake the student made when choosing their equipment.

---

[1]

(iii) Suggest **two** improvements to the method followed.

1 ---

2 ---

[2]

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18 *A student does an experiment using 0.2 kg of water.

Here is some information from the experiment:

The aim is to find the energy needed to raise the temperature of the water by 20 °C. An electrical heater is used to heat the water. The temperature of the water increases by 20 °C. The **specific heat capacity** of water is 4 200 J / kg °C.

Describe how the student should carry out the experiment, including the equipment used.

In your answer calculate the change in internal energy for the water.

You may include a diagram in your answer.

[6]

19 A student investigates what happens when she heats a beaker of water.

	The temperature increases	The state changes	The energy stored in the water changes
A	✓	✓	✓
B	✓	*x*	*x*
C	*x*	✓	*x*
D	*x*	*x*	✓

Which row in the table describes what **could** happen when the water is heated?

Your answer [ ] [1]

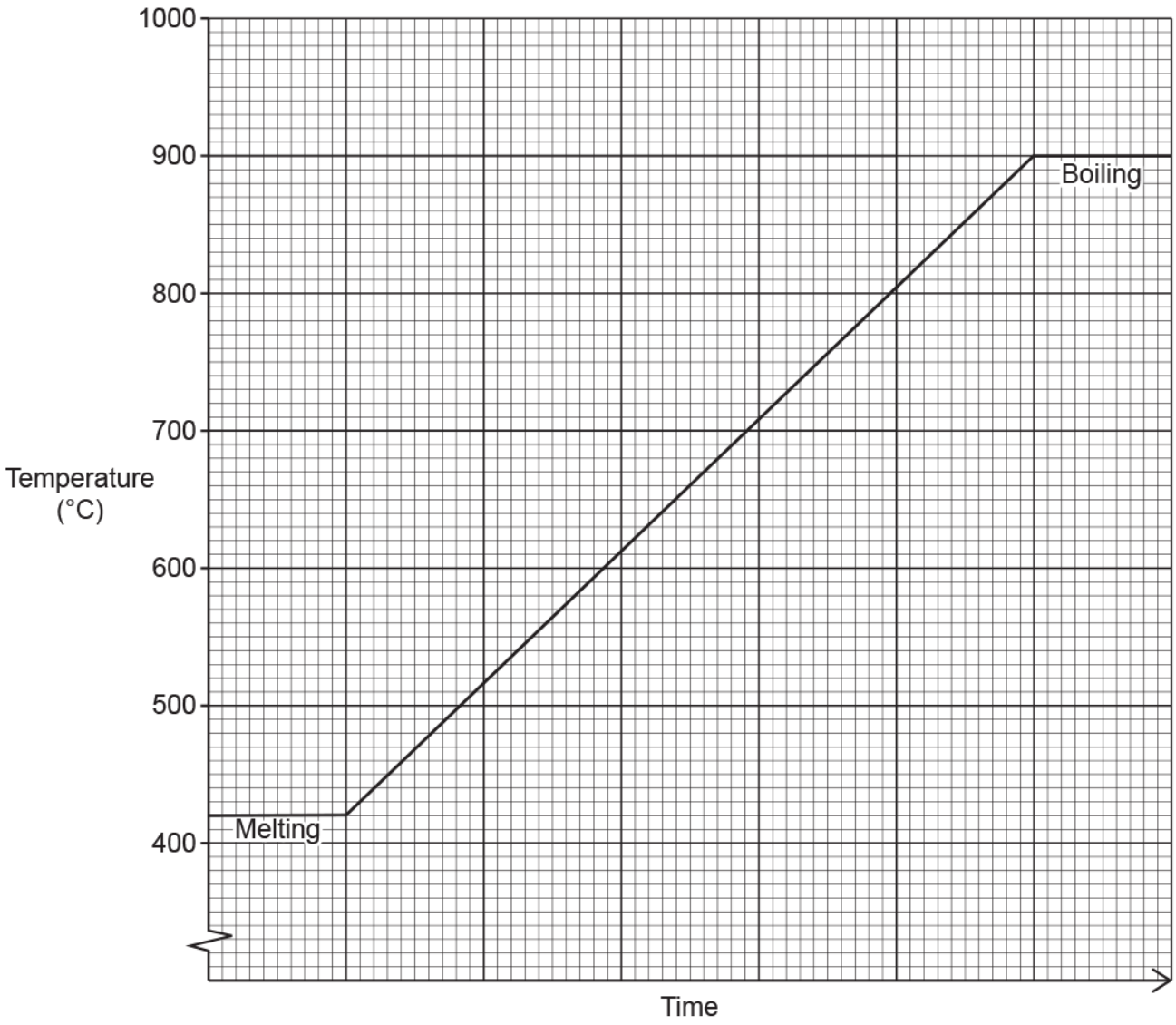
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20(a) The table shows the specific heat capacities of different materials.

Material	Specific heat capacity (J / kg °C)
Copper	330
Brass	380
Zinc	385
Nickel	440
Concrete	880
Concrete	913

A scientist heats an unknown substance from a solid to a liquid.

The graph shows how the temperature of the substance varies with time.



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The scientist has 2.5 kg of the substance and records that it takes 462 kJ of energy to increase it from the lowest to the highest temperature in the liquid state.

Use the graph to calculate the specific heat capacity of the substance.

Suggest what material it could be from the table.

Specific heat capacity = ... J / kg °C

Material = ...

[5]

(b) Suggest **two** reasons why the scientist cannot be certain that the substance has been identified correctly.

1 ----------

---

2 ----------

---

[2]

21

(i) **Table 21.1** gives some information about a kettle.

Energy transferred to the kettle	525 000 J
Mass of water	1.2 kg
Starting temperature of water	25 °C
Final temperature of water	100 °C
Specific heat capacity of water	4200 J / kg °C

Table 21.1

Calculate the efficiency of the kettle described in **Table 21.1**.

Give your answer as a percentage.

Use an equation from the data sheet.

Efficiency = ... % **[5]**

(ii) Explain why the efficiency of the kettle is less than 100%.

---

[1]

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22 Energy is needed to change ice into water.

Calculate the energy needed to change 5 kg of ice into water.

Use an equation from the data sheet to help you.

Specific latent heat of melting = 3.34×10^5 J / kg.

A 16.7 J
B 1670 J
C 1 670 000 J
D 1 670 000 000 J

Your answer ☐ [1]

END OF QUESTION PAPER

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