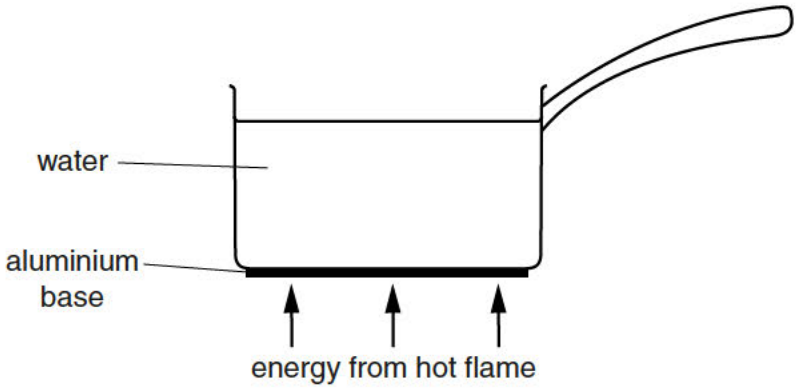
1 This question is about energy transfer and how it is used in cooking.

(a) Steve heats a pan of water on his cooker.
Look at the diagram.



(i) Explain how the particles in the aluminium base conduct energy through the bottom of the pan.

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..... **[3]**

(ii) There is a convection current in the water in the pan.
Steve starts to describe the convection current.
Look at his description.

The water is heated and it contracts.

This makes the water more dense so it rises.

His description is wrong.
Rewrite his description correctly.

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..... **[2]**

(b) Steve has a combination microwave oven.
It can cook food using microwaves or infrared waves.

Microwaves and infrared waves cook food in different ways.

(i) What is **different** about the way microwaves and infrared waves heat food?

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..... **[2]**

(ii) What is **similar** about the way microwaves and infrared waves heat food?

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..... **[2]**

2 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.

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..... **[6]**

[Total: 6]

3 Roxanne investigates the density of different materials.

She calculates the density using this equation:

$$\textbf{density (in g/cm}^3\textbf{)} = \frac{\textbf{mass}}{\textbf{volume}}$$

Look at her results.

Material	State	Volume in cm^3	Mass in g	Density in g/cm^3
Water	liquid	1.0	1.0	1.0
Glass	solid	3.0	5.8	
Liquid X	liquid	1.0	1.2	1.2
Oil	liquid	3.0		0.9
Liquid Y	liquid	1.0	0.7	0.7
Liquid Z	liquid	1.0	0.8	0.8

(a) Calculate the density of glass.

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answer ..... g/cm^3 **[1]**

(b) Roxanne has lost the measurement for the mass of oil.

Calculate the mass of oil.

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answer ..... g **[2]**

(c) Roxanne experiments with different liquids from the table.

She has two identical beakers and puts one litre of water into each of them.

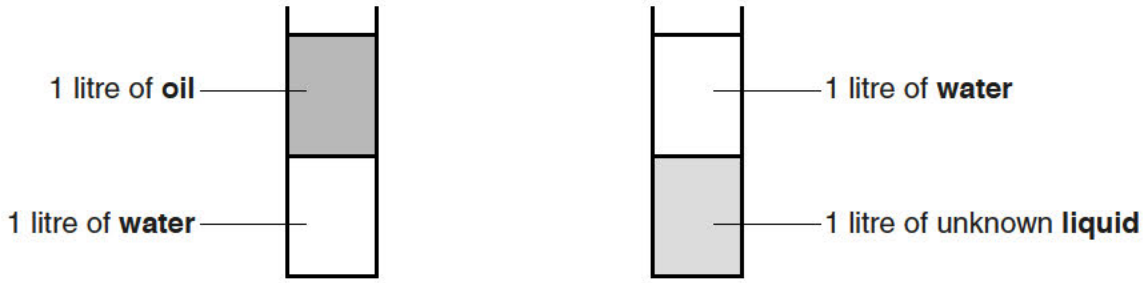
She puts one litre of oil into beaker **A**.

The oil floats on the water because of their densities.

Roxanne puts one litre of another of the liquids into beaker **B**.

The liquids do **not** mix together.

Look at the diagrams.



Which beaker of liquids is heavier, **A** or **B**?

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Explain your answer and suggest which liquid from the table is the **unknown liquid**.

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[3]

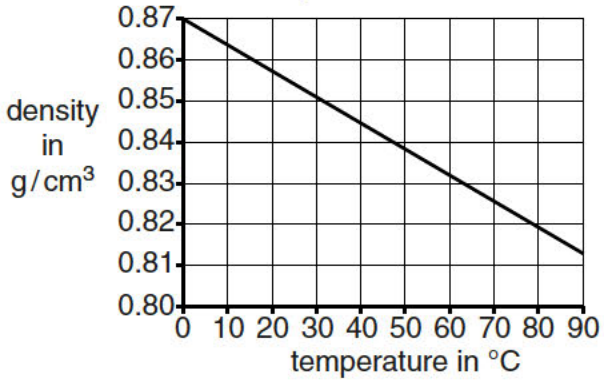
(d) The state of water is affected by temperature.

Water freezes and becomes ice at 0 °C.

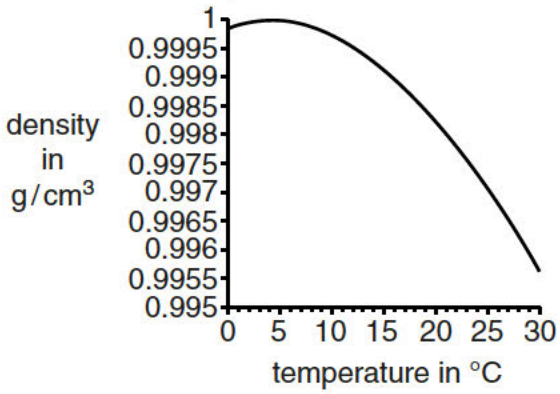
The density of liquids is also affected by temperature.

Look at the graphs for oil and water.

Graph for oil



Graph for water



(i) Describe how the density varies with temperature for **oil**.

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..... **[1]**

(ii) Describe how the density varies with temperature for **water**.

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..... **[1]**

(iii) Water freezes at 0 °C and ice floats on water. The density of ice is 0.92 g/cm^3 at 0 °C.

Use the data in the graph for water to explain why ice floats on water, and suggest how this protects fish at the bottoms of lakes which have frozen over.

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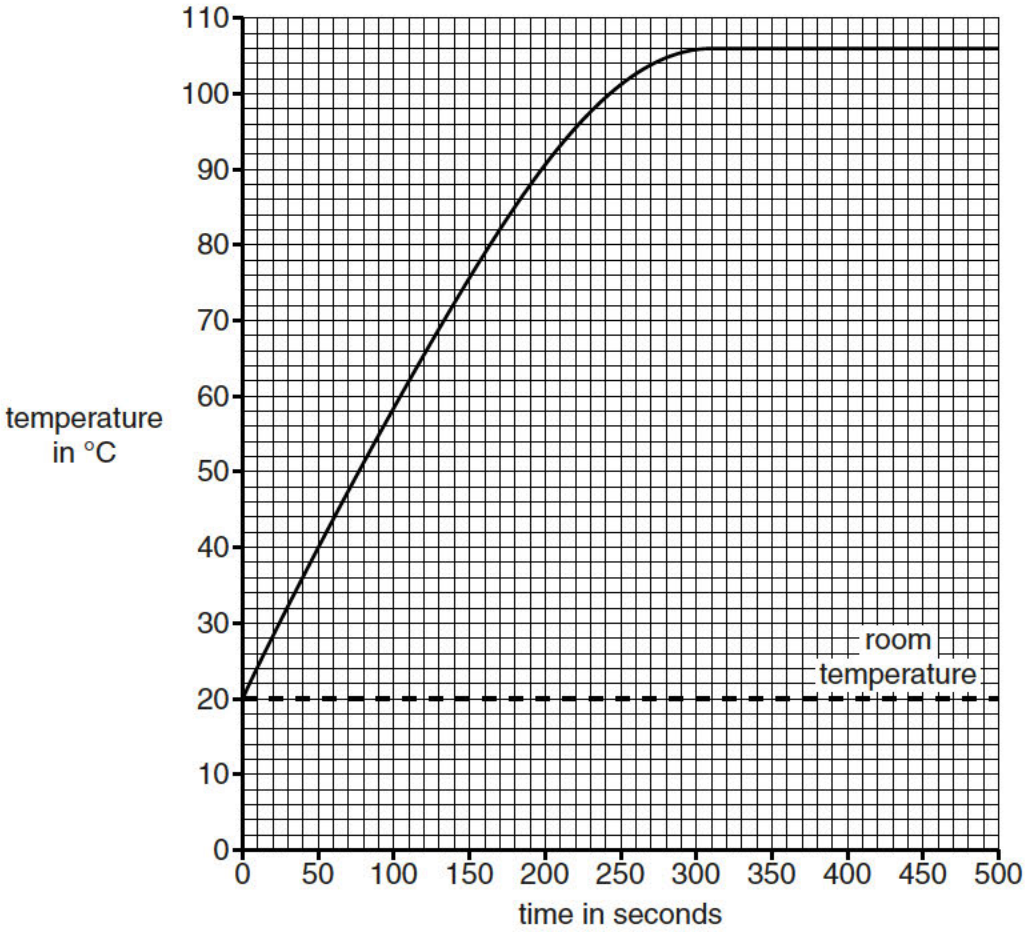
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..... **[2]**

[Total: 10]

4 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]**

[Total: 2]

5 Dave experiments heating different materials.

(a) 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.

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

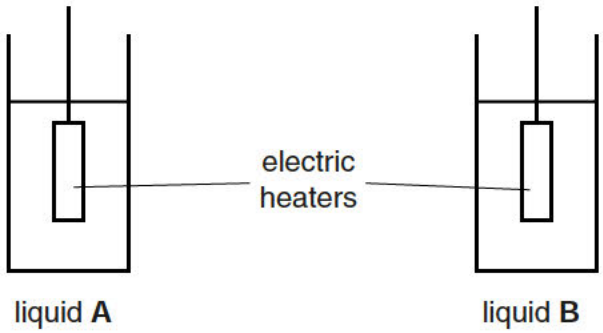
(b) Dave's teacher gives him two different liquids to boil.

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.



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	48 000	20
B	48 000	53

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

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..... **[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.

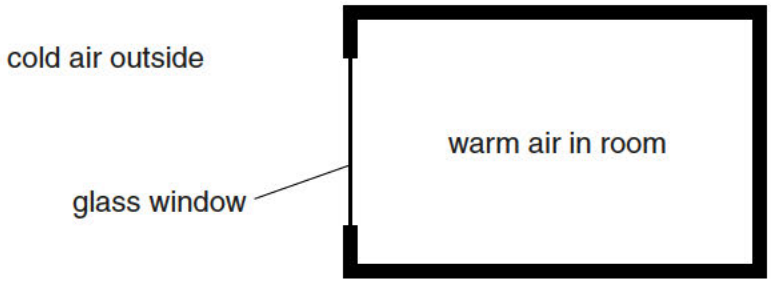
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..... **[1]**

[Total: 5]

6 Bilhar has high fuel bills. His house has poor insulation.

(a) Look at the diagram of a window in his house.



A lot of energy is lost through the window.

Explain, in terms of particles, how the energy is transferred from the warm air inside the house to the cold air outside the house.

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

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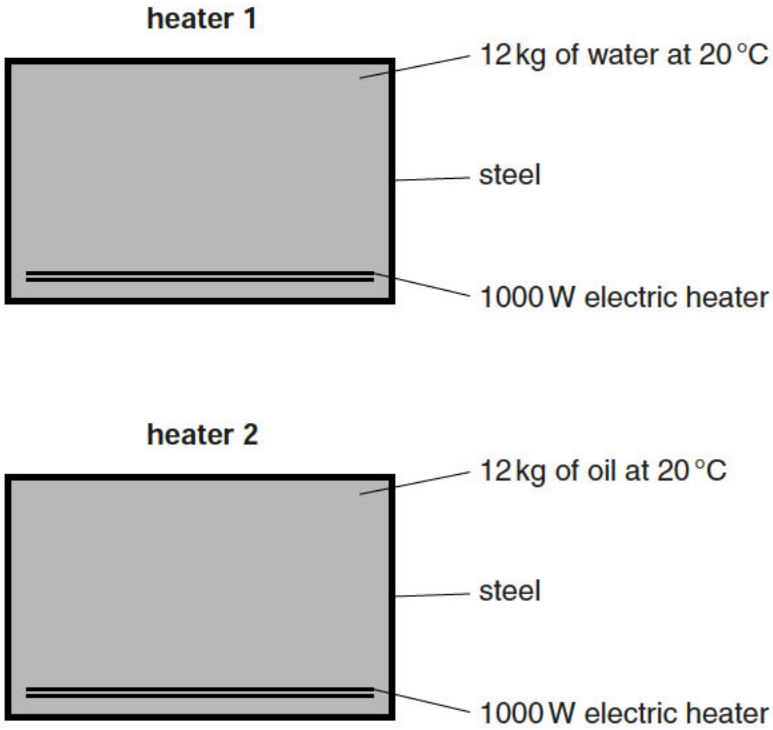
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..... **[6]**

(b) Bilhar has two types of heater. They are filled with different liquids.

Look at the diagrams of Bilhar's heaters.



Heater **1** is filled with water. Heater **2** is filled with oil.

(i) The water in heater **1** is at 20 °C.

Bilhar switches on heater **1**. The electric heater heats the water.

The heater supplies 2 100 000 J of energy to the 12 kg of water.

The specific heat capacity of water is 4200 J/kg °C.

Calculate the maximum **temperature** of the water.

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answer ..... °C **[3]**

(ii) It is unlikely the water will get to this temperature. Suggest why.

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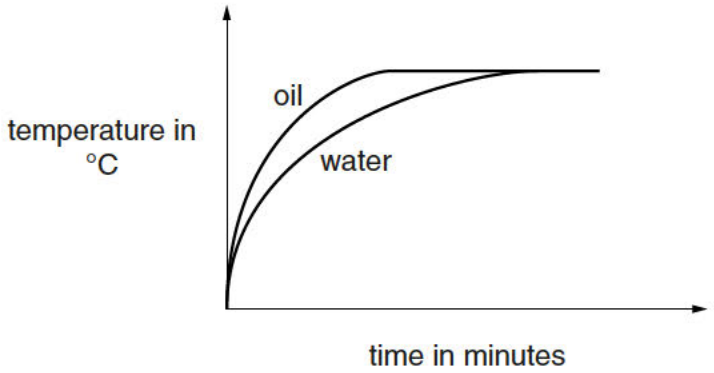
..... **[1]**

(c) Bilhar switches on heater **2**.

The specific heat capacity of oil is 1670 J/kg °C.

The liquids in the two heaters are heated to a temperature of 50 °C.

Look at the graph of the temperatures of the liquids in the heaters.



Water filled heaters are more useful for heating Bilhar's house.

Use the graph to help you explain why.

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..... **[3]**

[Total: 13]