

2.2 Thermal Properties and Temperature

Question Paper

Level	IGCSE
Subject	Physics (0625)
Exam Board	Cambridge International Examinations(CIE)
Topic	Thermal Physics
Sub Topic	2.2 Thermal Properties and Temperature
Booklet	Question Paper

Time Allowed: 58 minutes

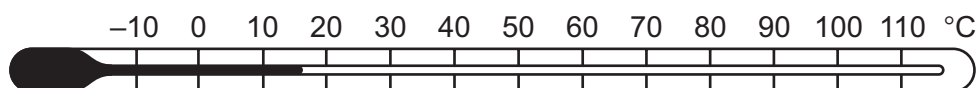
Score: /48

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	75%	60%	45%	35%	25%	<25%

- 1 Which statement about evaporation is correct?
- A** Evaporation causes the temperature of the remaining liquid to decrease.
 - B** Evaporation does not occur from a cold liquid near its freezing point.
 - C** Evaporation does not occur from a dense liquid, such as mercury.
 - D** Evaporation occurs from all parts of a liquid.
- 2 A student wishes to check the upper and the lower fixed points on a Celsius scale thermometer.



She has four beakers P, Q, R and S.

Beaker P contains a mixture of ice and salt.

Beaker Q contains a mixture of ice and water.

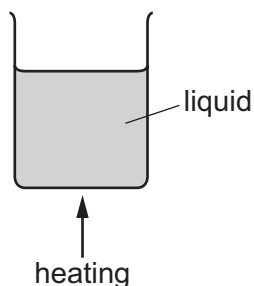
Beaker R contains boiling salt solution.

Beaker S contains boiling water.

Which two beakers should she use to check the fixed points?

- A** P and R **B** P and S **C** Q and R **D** Q and S

- 3 A liquid is heated in a beaker.



The density of the liquid changes as its temperature increases. This causes energy to be transferred throughout the liquid.

How does the density change and what is this energy transfer process?

	density	energy transfer process
A	decreases	conduction
B	decreases	convection
C	increases	conduction
D	increases	convection

- 4 Which statement describes what happens as ice at 0°C starts to melt to become water?

- A** Energy is absorbed and the temperature remains constant.
- B** Energy is absorbed and the temperature rises.
- C** Energy is released and the temperature remains constant.
- D** Energy is released and the temperature rises.

- 5 A liquid is at a temperature below its boiling point.

The liquid is then heated so that it becomes a gas at a temperature above its boiling point.

Which row correctly compares the liquid with the gas?

	average distance between the particles	average speed of the particles
A	greater in the liquid	greater in the liquid
B	greater in the liquid	smaller in the liquid
C	smaller in the liquid	greater in the liquid
D	smaller in the liquid	smaller in the liquid

- 6 5.0 g of water at 25°C is dropped onto a large block of ice at 0°C. The water cools to 0°C and some of the ice melts.

Assume that all the energy lost by the water is gained by the ice.

What is the mass of ice that melts?

The specific heat capacity of water is 4.2 J/(g °C).

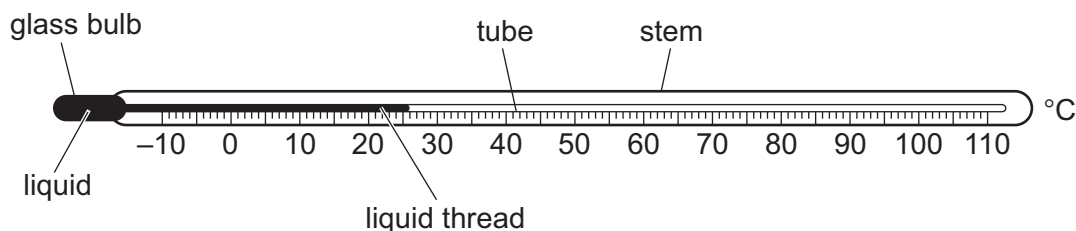
The specific latent heat of fusion of ice is 340 J/g.

- A** 0.062 g **B** 0.087 g **C** 1.5 g **D** 10 g

- 7 What causes the random, zig-zag movement (Brownian motion) of smoke particles suspended in air?

- A** air molecules colliding with smoke particles
- B** convection currents as the hot smoke rises
- C** smoke particles colliding with each other
- D** smoke particles reacting with oxygen molecules in the air

- 8 The diagram shows a liquid-in-glass thermometer.



How can the thermometer be made more sensitive?

- A increase the internal diameter of the tube containing the liquid thread
 - B increase the internal volume of the glass bulb and the volume of the liquid
 - C increase the length of the tube and stem
 - D increase the thickness of the glass in the glass bulb
- 9 In an experiment to measure specific heat capacity, a block of aluminium is heated and its rise in temperature is measured.
- The amount of energy gained by the block is E . The mass of the block is m . The rise in temperature of the block is ΔT .
- Which expression gives the specific heat capacity of aluminium?
- A $\frac{m}{E\Delta T}$
 - B $\frac{m\Delta T}{E}$
 - C $\frac{E}{m\Delta T}$
 - D $\frac{E\Delta T}{m}$
- 10 Which quantity gives the *thermal capacity* of a solid object?
- A the energy lost by radiation from the object in 1.0 s
 - B the energy needed to melt the object
 - C the energy needed to raise the temperature of the object by 1.0 °C
 - D the total amount of thermal energy in the object

- 11 To mark a temperature scale on a thermometer, standard temperatures known as fixed points are needed.

Which of these is a fixed point on the Celsius scale?

- A** room temperature
- B** the temperature inside a freezer
- C** the temperature of pure melting ice
- D** the temperature of pure warm water

- 12 In an experiment, a liquid is heated at a constant rate.

The temperature of the liquid increases and eventually becomes constant.

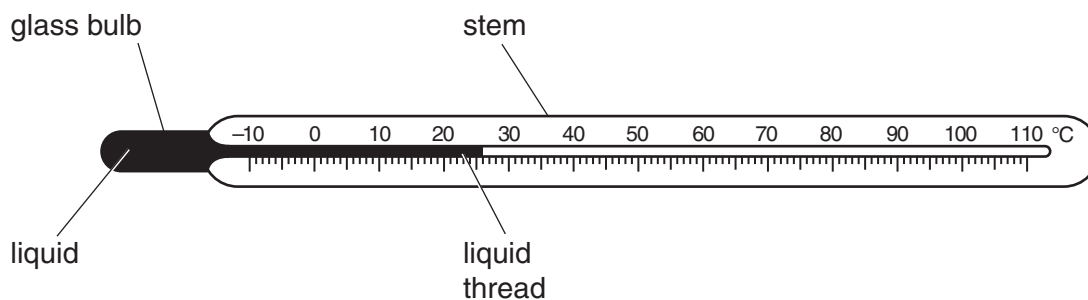
Which statement about the experiment is correct?

- A** Boiling occurs at all temperatures but only on the liquid surface.
- B** Boiling occurs throughout the liquid but only at the constant temperature.
- C** Evaporation occurs throughout the liquid and at all temperatures.
- D** Evaporation occurs only at the constant temperature and only on the liquid surface.

- 13 Which line in the table shows the relative expansion of the three states of matter from the most expansion to the least expansion?

	most expansion			least expansion	
A	solids	>	liquids	>	gases
B	solids	>	gases	>	liquids
C	gases	>	liquids	>	solids
D	gases	>	solids	>	liquids

- 14 The diagram shows a liquid-in-glass thermometer.



Which two features both affect the sensitivity of the thermometer?

- A** mass of liquid and diameter of liquid thread
 - B** mass of liquid and length of stem
 - C** thickness of glass bulb and diameter of liquid thread
 - D** thickness of glass bulb and length of stem
- 15 A student wishes to calculate the specific heat capacity of copper.

He has a block of copper and an electrical heater. He knows the power of the heater.

Which other apparatus does he need?

	balance	stop watch	thermometer
A	✓	✓	✓
B	✓	✓	x
C	✓	x	✓
D	x	✓	✓

key

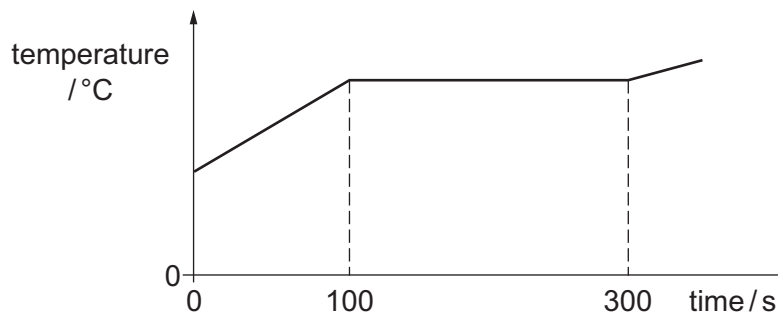
✓ = needed

x = not needed

16 A mass of 0.20 kg of a substance is initially solid.

It is heated at a steady rate of 500 W.

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

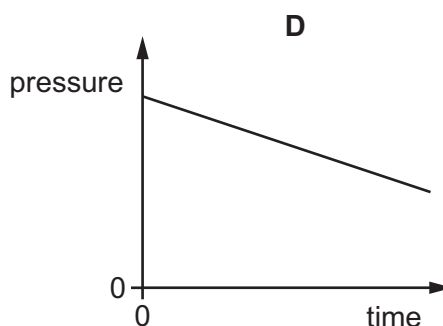
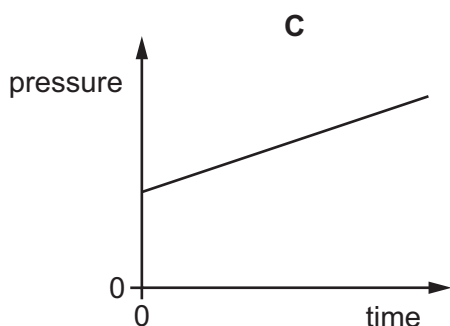
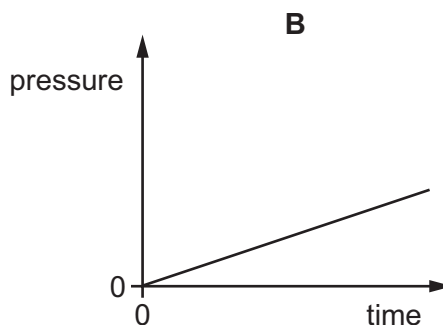
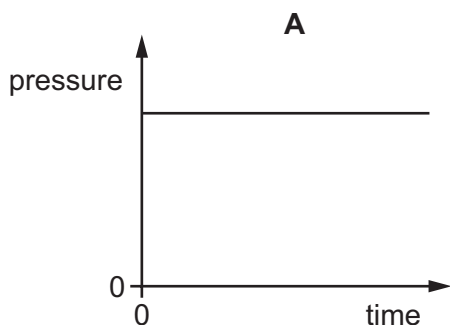


What is the specific latent heat of fusion of the substance?

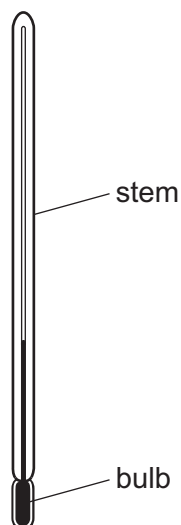
- A 20 000 J/kg
- B 30 000 J/kg
- C 500 000 J/kg
- D 750 000 J/kg

17 The pressure of a fixed mass of gas in a cylinder is measured. The temperature of the gas in the cylinder is then slowly increased. The volume of the cylinder does not change.

Which graph shows the pressure of the gas during this process?



- 18 The thermometer in the diagram has no scale.



Where must the bulb be placed so that 0°C can be marked on the stem?

- A in a freezer
 - B in pure boiling water
 - C in pure cold water
 - D in pure melting ice
- 19 Two metal blocks X and Y are at room temperature. Each block is heated so that its temperature rises by 10°C .

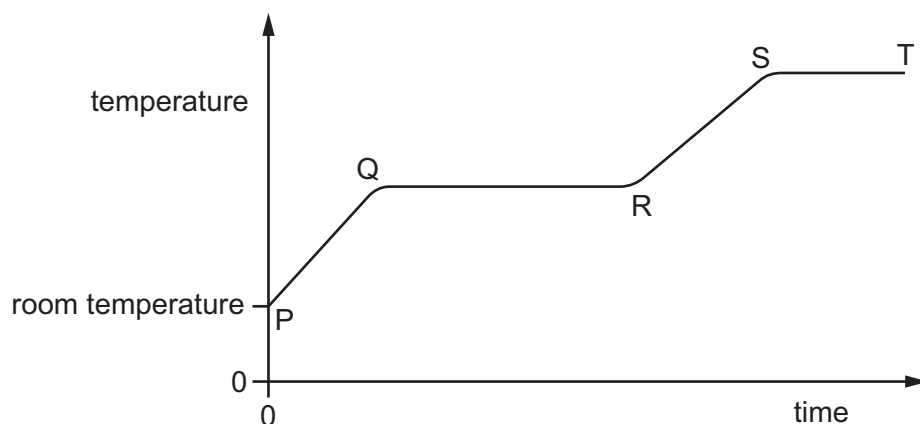
The blocks are now allowed to cool back to room temperature.

Block Y has a greater thermal capacity than block X.

Which block needs more thermal (heat) energy to heat it up by 10°C and which block loses more thermal (heat) energy as it cools back to room temperature?

	more energy	
	heating	cooling
A	X	X
B	X	Y
C	Y	X
D	Y	Y

- 20 A solid is heated from room temperature. The graph shows how its temperature changes with time as it is heated constantly.



Between which labelled points on the graph is the substance partly solid and partly liquid?

- A** between P and Q
 - B** between Q and R
 - C** between R and S
 - D** between S and T
- 21 A circular metal disc is heated.
- Which quantity decreases?
- A** its density
 - B** its diameter
 - C** its thickness
 - D** its volume
- 22 The same quantity of thermal (heat) energy is given to two objects X and Y. The temperature rise of object X is less than the temperature rise of object Y.
- What accounts for this difference?
- A** X has a larger thermal capacity than Y.
 - B** X is a better thermal conductor than Y.
 - C** Y has a larger thermal capacity than X.
 - D** Y is a better thermal conductor than X.

- 23 A block of copper and a block of lead are heated. The internal energy of each block increases by the same amount.

The block of copper has a lower thermal capacity than the block of lead.

Which conclusion can be made from this information?

- A** The temperature increase of the copper is greater than the temperature increase of the lead.
- B** The temperature increase of the copper is the same as the temperature increase of the lead.
- C** The temperature increase of the copper is less than the temperature increase of the lead.
- D** The melting point of copper is lower than the melting point of lead.

- 24 The diagram shows a mercury-in-glass thermometer. The scale of the thermometer has not been marked.



The length l increases uniformly with temperature.

The length l is measured when the thermometer bulb is placed in water at 0°C , and also when it is in water at 100°C . The table shows the results.

temperature / $^{\circ}\text{C}$	length l / cm
0	2.0
100	26.0

What is the value of l when the bulb is placed in water at 50°C ?

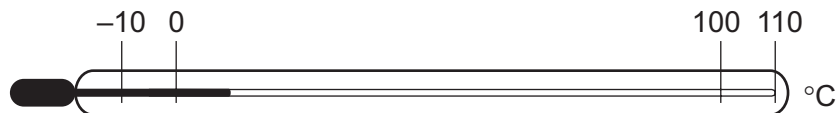
- A** 12.0 cm **B** 13.0 cm **C** 14.0 cm **D** 16.0 cm

- 25 When steam condenses it becomes liquid water. When liquid water solidifies it becomes ice.

What happens to the temperature of steam while it is condensing, and what happens to the temperature of water while it is solidifying?

	temperature of steam while it is condensing	temperature of water while it is solidifying
A	decreases	decreases
B	decreases	stays the same
C	stays the same	decreases
D	stays the same	stays the same

- 26 A thermometer has graduations which start at -10°C and end at 110°C .

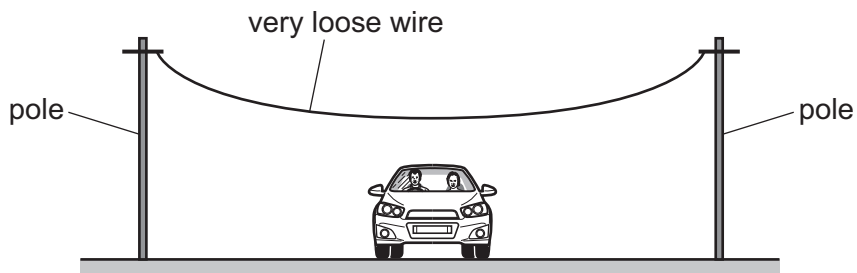


What is the lower fixed point and what is the upper fixed point of the Celsius scale?

	lower fixed point / $^{\circ}\text{C}$	upper fixed point / $^{\circ}\text{C}$
A	-10	100
B	-10	110
C	0	100
D	0	110

- 27 A telephone engineer connects a wire between two poles when the weather is very cold.

He makes the wire very loose. The wire passes over a road.



The weather changes and it becomes very hot.

What could happen to the wire and why?

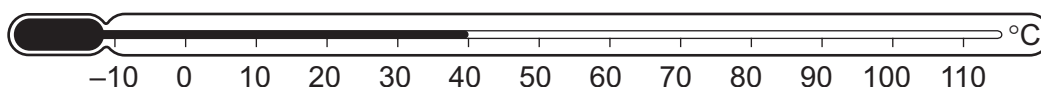
	what could happen	why
A	it breaks	it contracts
B	it breaks	it expands
C	it sags and touches cars on the road	it contracts
D	it sags and touches cars on the road	it expands

- 28 In an experiment, a thermometer is placed in a test-tube of hot liquid. The temperature of the liquid is recorded every half minute. The table shows the results.

time / minutes	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5
temperature / °C	73	65	59	55	55	55	51	48	45	42	40	38	36	35	34	33

What is the melting point of the substance?

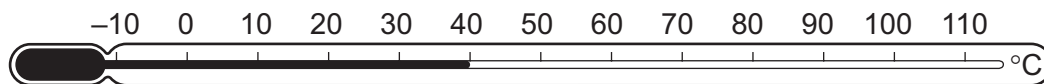
- A** 0°C **B** 33°C **C** 55°C **D** 73°C
- 29 A liquid-in-glass thermometer is marked with a scale in °C.



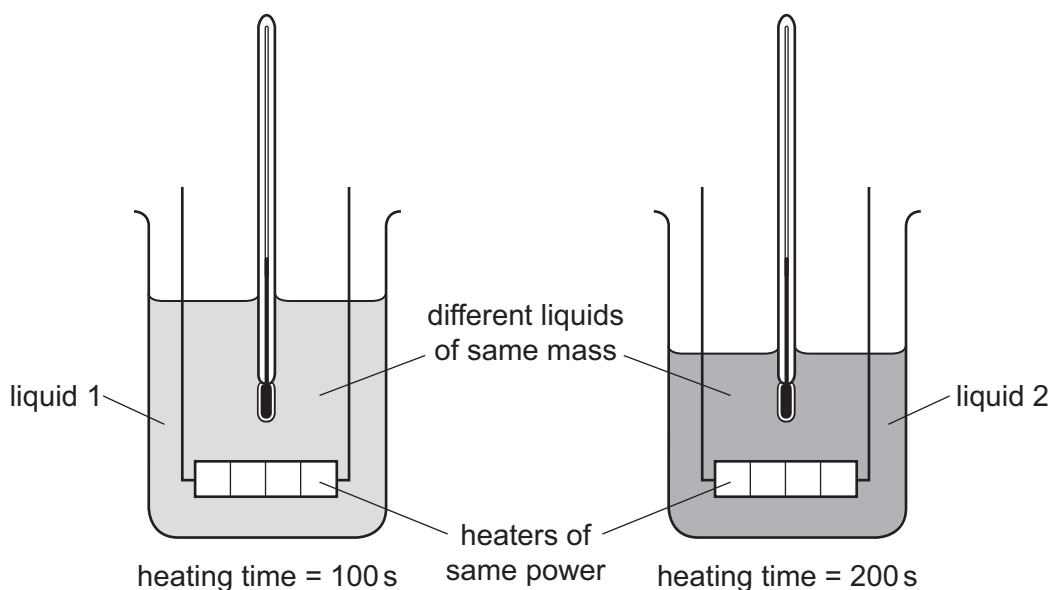
What is the temperature difference between the two fixed points for this thermometer?

- A** 40°C **B** 50°C **C** 100°C **D** 120°C
- 30 Which statement gives the thermal capacity of a solid body?
- A** the energy needed to melt the body without a change in temperature
- B** the energy per degree Celsius needed to raise the temperature of the body
- C** the increase in the volume of the body when its temperature is raised by one degree Celsius
- D** the total amount of internal energy in the body

- 31 Which points are the fixed points of the liquid-in-glass thermometer shown?



- A the beginning and end points of the column of liquid
 - B the beginning and end points of the thermometer scale
 - C the points marked 0°C and 100°C
 - D the top and bottom points of the thermometer bulb
- 32 Equal masses of two different liquids are put into identical beakers.
- Liquid 1 is heated for 100 s and liquid 2 is heated for 200 s by heaters of the same power.
- The temperature of both liquids increases by the same amount.



Which statement is correct?

- A Both liquids receive the same amount of energy.
- B Liquid 1 receives more energy than liquid 2.
- C Both liquids have equal thermal capacity.
- D The thermal capacity of liquid 1 is less than the thermal capacity of liquid 2.

- 33 The metal surface of a kettle is hot.

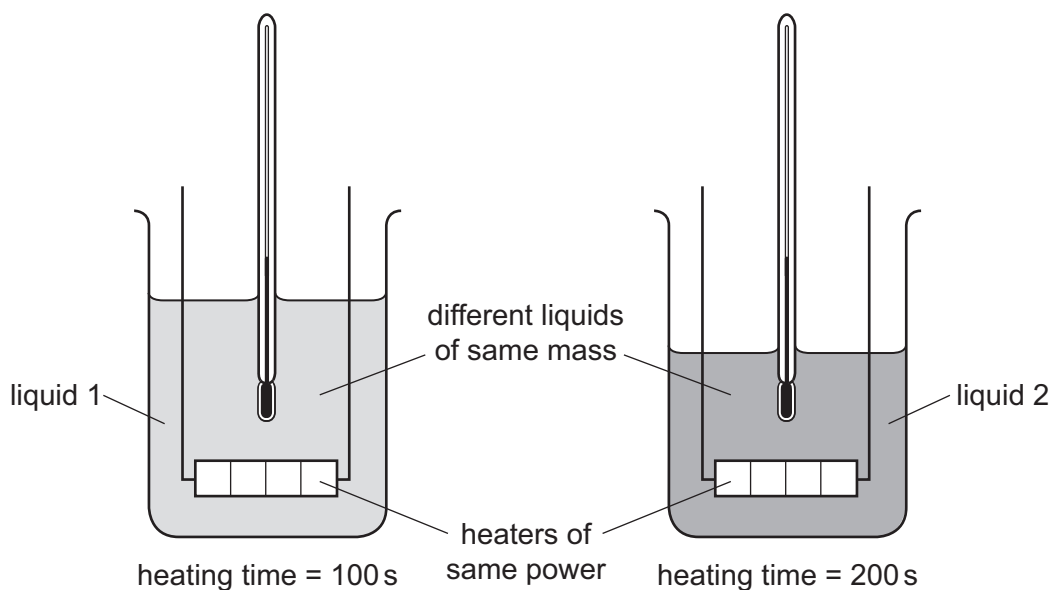
What happens to the cool air outside the kettle when it comes into contact with the hot kettle?

- A** The density of the air decreases and the air falls.
- B** The density of the air decreases and the air rises.
- C** The density of the air increases and the air falls.
- D** The density of the air increases and the air rises.

- 34 Equal masses of two different liquids are put into identical beakers.

Liquid 1 is heated for 100 s and liquid 2 is heated for 200 s by heaters of the same power.

The temperature of both liquids increases by the same amount.

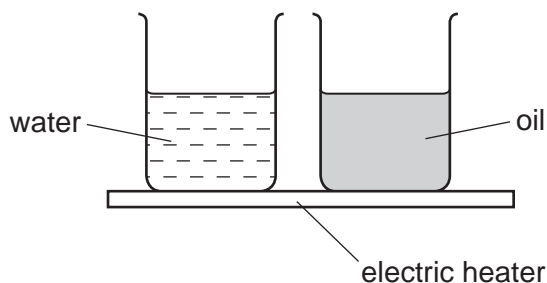


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- D** The thermal capacity of liquid 1 is less than the thermal capacity of liquid 2.

- 35 To mark the lower fixed point of a Celsius scale on a thermometer, the thermometer should be placed in
- A** pure alcohol.
 - B** pure distilled water.
 - C** pure melting ice.
 - D** pure mercury.

- 36 The diagram shows an electric heater being used to heat a beaker of water and an identical beaker of oil for several minutes.

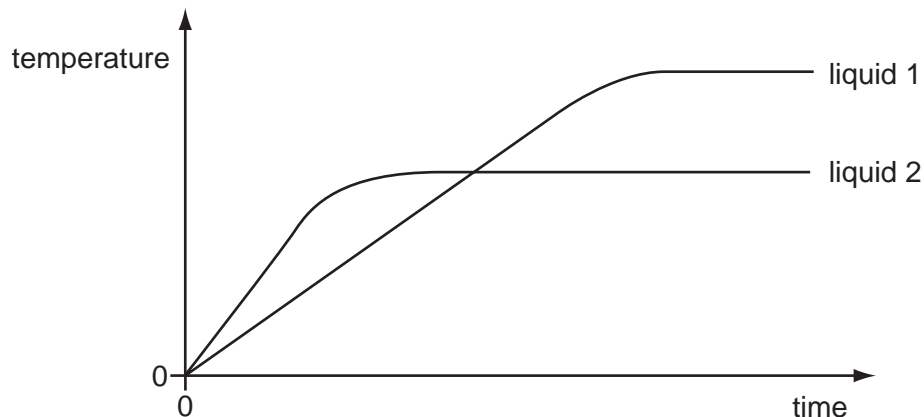


The temperature of the water and the temperature of the oil increase constantly. The rise in temperature of the oil is much greater than that of the water.

Why is this?

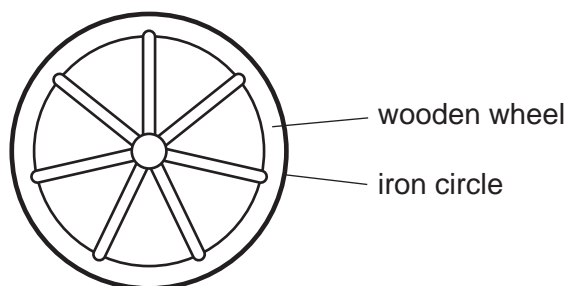
- A** The oil has a higher boiling point than water.
- B** The oil has a higher thermal capacity than water.
- C** The oil has a lower boiling point than water.
- D** The oil has a lower thermal capacity than water.

- 37 Equal masses of two different liquids are heated using the same heater. The graph shows how the temperature of each liquid changes with time.



What does the graph tell us about the liquids?

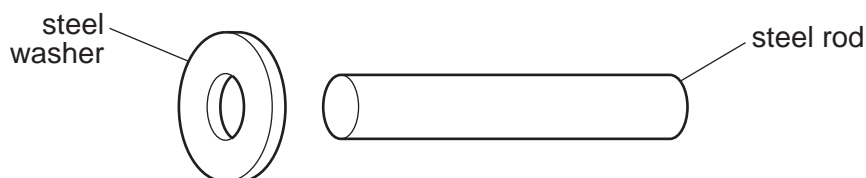
- A** Liquid 1 has a higher melting point than liquid 2.
 - B** Liquid 1 has a higher boiling point than liquid 2.
 - C** Liquid 1 starts to melt sooner than liquid 2.
 - D** Liquid 1 starts to boil sooner than liquid 2.
- 38 A wooden wheel can be strengthened by putting a tight circle of iron around it.



Which action would make it easier to fit the circle over the wood?

- A** cooling the iron circle
- B** heating the iron circle
- C** heating the wooden wheel and cooling the iron circle
- D** heating the wooden wheel but not heating or cooling the iron circle

- 39 Which pair contains **only** physical quantities that vary with temperature and so could be used in making a thermometer?
- A activity of a radioactive source, volume of a gas
 - B mass of a liquid, volume of a liquid
 - C activity of a radioactive source, mass of a solid
 - D volume of a gas, volume of a liquid
- 40 A heater supplies 80 J of energy to a block of metal. The temperature of the block rises by 20 °C. What happens to the block of metal when its temperature falls by 10 °C?
- A Its internal energy decreases by 40 J.
 - B Its internal energy decreases by 160 J.
 - C Its internal energy increases by 40 J.
 - D Its internal energy increases by 160 J.
- 41 An engineer wants to fix a steel washer on to a steel rod. The rod is just too big to fit into the hole of the washer.



How can the engineer fit the washer on to the rod?

- A Cool the washer and put it over the rod.
- B Cool the washer and rod to the same temperature and push them together.
- C Heat the rod and then place it in the hole.
- D Heat the washer and then place it over the rod.

- 42 A solid object has a very large thermal capacity.

What does this mean?

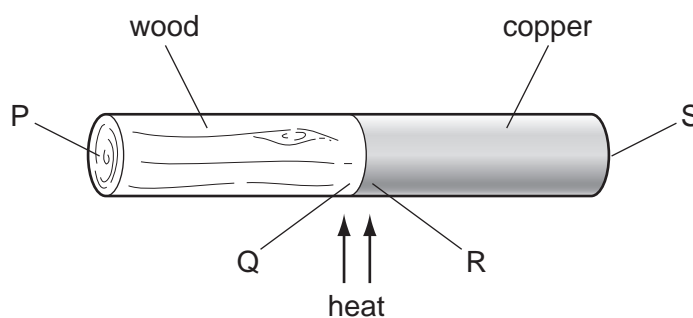
- A** A large amount of energy is needed to make the object become hot.
- B** A large amount of energy is needed to make the object melt.
- C** A small amount of energy is needed to make the object become hot.
- D** A small amount of energy is needed to make the object melt.

- 43 A hot drink is left in a room that is at a temperature of 20°C .

What has happened to the drink after ten minutes?

- A** Its density is lower.
- B** Its internal energy is lower.
- C** Its particles have equal energies.
- D** Its particles move more quickly.

- 44 A rod is made of copper and wood joined together.

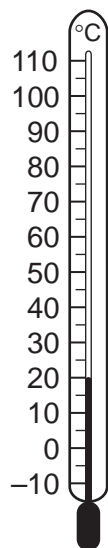


The rod is heated at the join in the centre for about a minute.

At which labelled point will the temperature be lowest, and at which point will it be highest?

	lowest temperature	highest temperature
A	P	Q
B	P	R
C	S	P
D	S	R

- 45 The diagram shows a thermometer calibrated in degrees Celsius.



What are the values of the lower fixed point and of the upper fixed point on the Celsius scale?

	lower fixed point/ $^{\circ}\text{C}$	upper fixed point/ $^{\circ}\text{C}$
A	-10	110
B	0	20
C	0	100
D	20	100

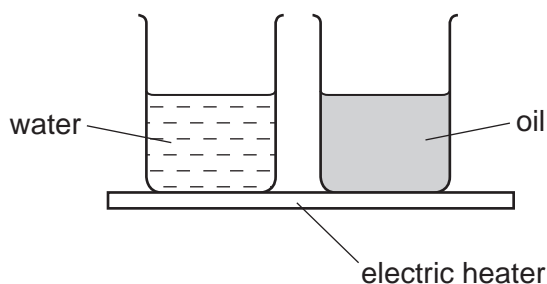
- 46 An ice cube at a temperature of 0°C is put into a drink at a temperature of 10°C .
After a short time, some of the ice has melted and the drink has cooled to a temperature of 8°C .

What is the temperature of the remaining ice?

- A** 0°C **B** 2°C **C** 4°C **D** 8°C

- 47 To mark the lower fixed point of a Celsius scale on a thermometer, the thermometer should be placed in
- A** pure alcohol.
 - B** pure distilled water.
 - C** pure melting ice.
 - D** pure mercury.

- 48 The diagram shows an electric heater being used to heat a beaker of water and an identical beaker of oil for several minutes.



The temperature of the water and the temperature of the oil increase constantly. The rise in temperature of the oil is much greater than that of the water.

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- B** The oil has a higher thermal capacity than water.
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- D** The oil has a lower thermal capacity than water.