PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

PHYSICS



EXAM QUESTION PACK

TOPIC 14: PARTICLE MODEL (PAPER 2)

SCORE	PERCENTAGE
/160	%

STEMUP

These questions belong to Pearson Edexcel, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by Pearson Edexcel. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with Pearson Edexcel and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. Pearson Edexcel has not endorsed, approved or been involved in the production of it. Pearson Edexcel and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

Pearson Edexcel publishes its past papers, mark schemes and examiner reports. Always check the current specification at qualifications.pearson.com before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Q1.

A student uses the apparatus in Figure 17 to determine the specific heat capacity of water.

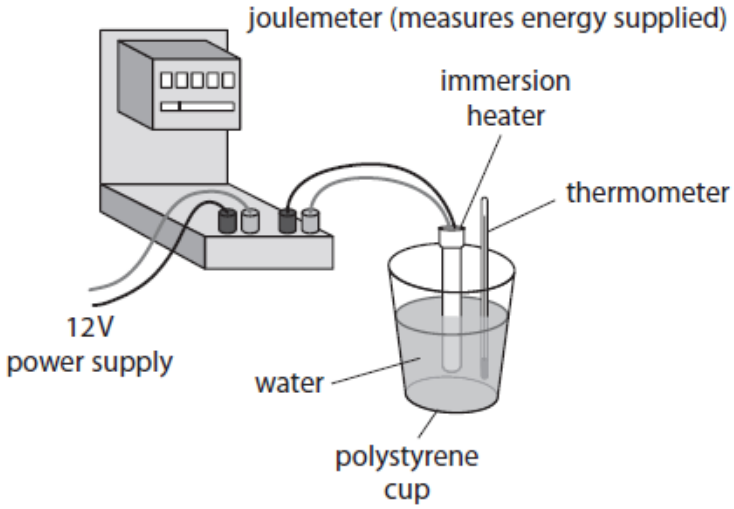


Figure 17

(i) State the measurements needed to calculate the specific heat capacity of water.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

(ii) State **two** ways that the apparatus could be adapted to improve the procedure.

(2)

1 .....

.....

2 .....

.....

(Total for question = 6 marks)

(**Q16 1SC0/2PF, June 2018**)

Q2.

A student uses the apparatus in Figure 3 to determine the specific heat capacity of water.

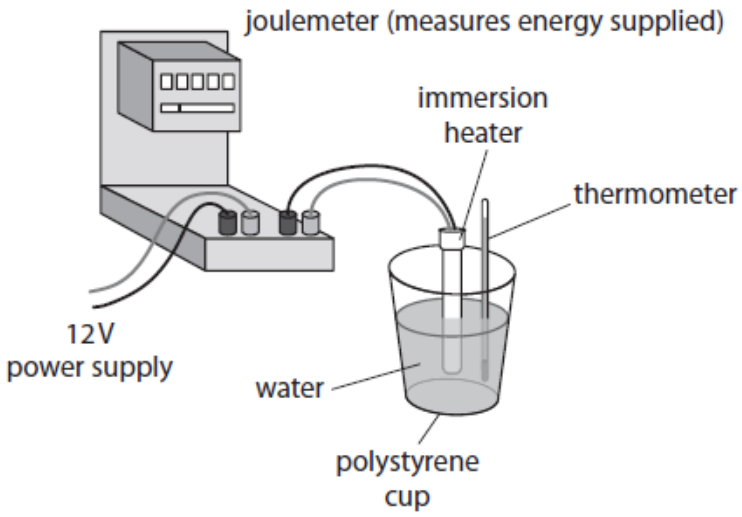


Figure 3

(i) State the measurements needed to calculate the specific heat capacity of water.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

(ii) State **two** ways that the apparatus could be adapted to improve the procedure.

(2)

1 .....

.....

2 .....

.....

(Total for question = 6 marks)

(**Q01 1SC0/2PH, June 2018**)

Q3.

A student sets up an experiment to measure the specific heat capacity of a metal.

Figure 5 shows the apparatus.

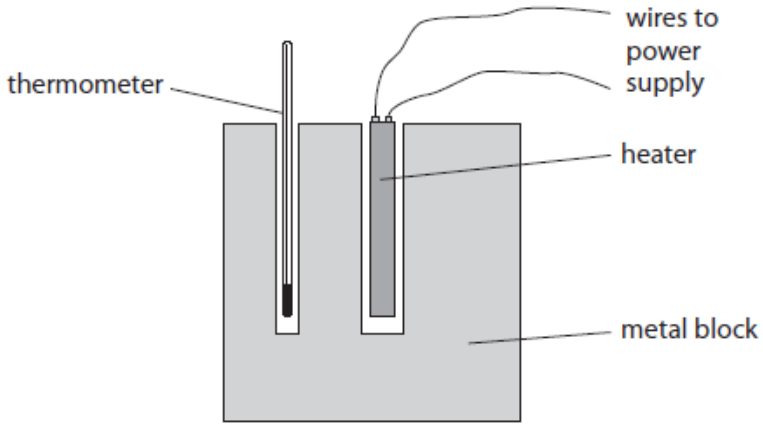


Figure 5

The heater is connected to a power supply and has a power of 50 W.

The student switches on the heater and measures the temperature rise after 5 minutes.

(i) State **two** improvements the student could make to the experiment.

(2)

1 .....

.....

2 .....

.....

(ii) Figure 6 shows the student's results.

mass of metal block	0.92 kg
power of heater	50 W
starting temperature	20 °C
finishing temperature	54 °C
time	300 s

Figure 6

Use the data in Figure 6 to calculate a value for the specific heat capacity of the metal.

Use the equation

$$\text{specific heat capacity} = \frac{\text{power} \times \text{time}}{\text{mass} \times \text{temperature rise}}$$

(3)

specific heat capacity = ... J/kg °C

(Total for question = 5 marks)

(**Q03c 1SC0/2PF/S2, SAM**)

Q4.

A student wants to determine the specific heat capacity of copper.

Figure 10 shows a piece of copper, with a thread tied around it, in a glass beaker of boiling water.

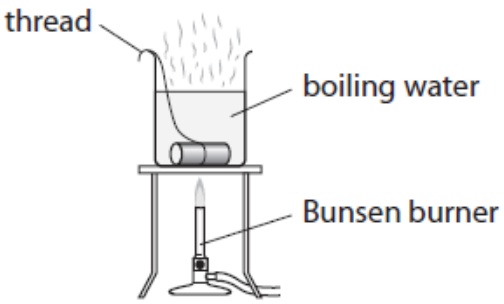


Figure 10

The student leaves the piece of copper in the boiling water so that the copper reaches a temperature of 100 °C.

The student uses the thread to take the piece of copper out of the boiling water.

The student puts the hot piece of copper into a different beaker of cold water at 20 °C.

The apparatus is shown in Figure 11.

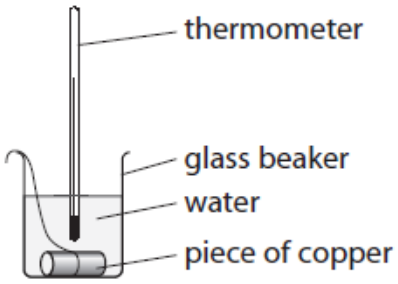


Figure 11

The student assumes that the thermal energy gained by the water equals the thermal energy lost by the piece of copper.

The water and copper both reach a temperature of 22 °C.

The cold water gains 1050 J of energy.

The mass of the piece of copper is 0.058 kg.

(i) Calculate a value for the specific heat capacity of copper, using these results.

Use the equation

change in thermal energy = mass × specific heat capacity × change in temperature

$$\Delta Q = m \times c \times \Delta\theta$$

(2)

specific heat capacity of copper from these results = ... J/kg °C

(ii) The value for the specific heat capacity of copper obtained from the student's results is lower than the correct value.

State **two** ways that the experiment could be improved to give a value that is closer to the correct value.

(2)

1 .....

.....

2 .....

.....

(Total for question = 4 marks)

(**Q05b 1SC0/2PF, Nov 2020**)

Q5.

A student wants to determine the specific heat capacity of copper.

Figure 2 shows a piece of copper, with a thread tied around it, in a glass beaker of boiling water.

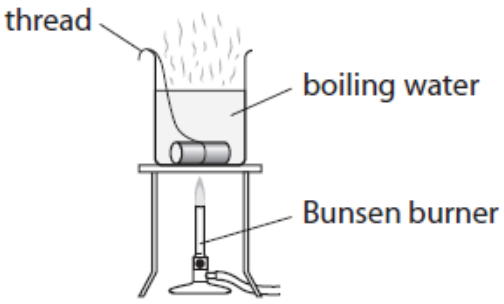


Figure 2

The student leaves the piece of copper in the boiling water so that the copper reaches a temperature of 100 °C.

The student uses the thread to take the piece of copper out of the boiling water.

The student puts the hot piece of copper into a different beaker of cold water at 20 °C.

The apparatus is shown in Figure 3.

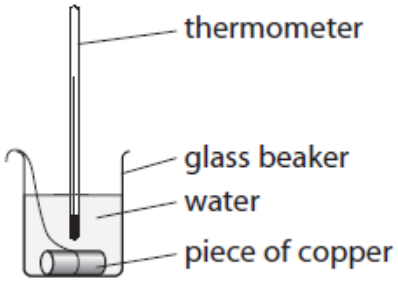


Figure 3

The student assumes that the thermal energy gained by the water equals the thermal energy lost by the piece of copper.

The water and copper both reach a temperature of 22 °C.

The cold water gains 1050 J of energy.

The mass of the piece of copper is 0.058 kg.

(i) Calculate a value for the specific heat capacity of copper, using these results.

Use the equation

change in thermal energy = mass × specific heat capacity × change in temperature

$$\Delta Q = m \times c \times \Delta\theta$$

(2)

specific heat capacity of copper from these results = ...
J/kg°C

(ii) The value for the specific heat capacity of copper obtained from the student's results is lower than the correct value.

State **two** ways that the experiment could be improved to give a value that is closer to the correct value.

(2)

1 .....

.....

2 .....

.....

(Total for question = 4 marks)

(**Q01b 1SC0/2PH, Nov 2020**)

Q6.

A teacher heats a block of wax until all the wax melts.

The teacher pours the melted wax into a container and allows the wax to cool.

Figure 3 shows how the temperature of the wax changes during a time of 20 minutes.

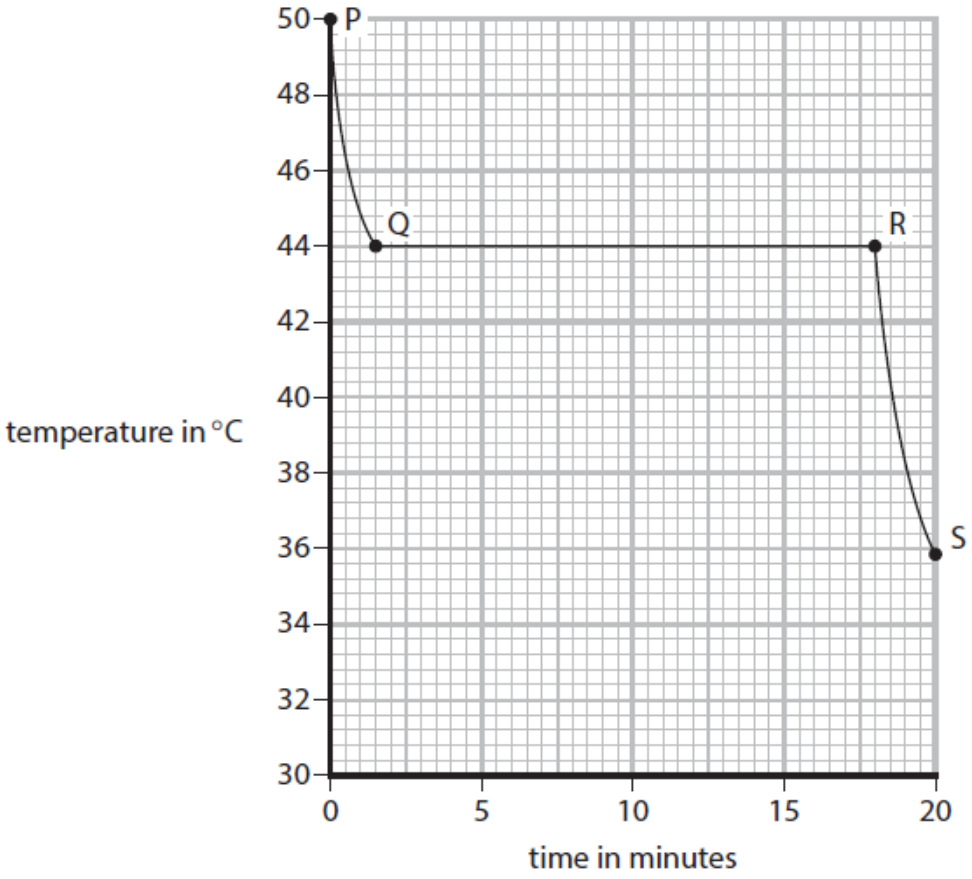


Figure 3

Four different points on the graph are labelled P, Q, R and S.

Figure 4 shows the values of some properties of the wax.

property	value
density when solid	930 kg / m³
density when liquid	830 kg / m³
specific latent heat	190 kJ / kg
specific heat capacity of solid wax	2.1 kJ / kg °C

Figure 4

(i) The wax has a mass of 3.9 kg.

Using information from Figure 4, calculate the volume of the wax when it is all liquid.

Use the equation

$$\rho = \frac{m}{V}$$

(2)

volume = ... m^3

(ii) State, using information from Figure 4, how the volume of the wax changes when it becomes a solid.

(1)

.....

.....

(iii) Explain why, using Figure 4, the time from R to S is much shorter than the time from Q to R on the graph in Figure 3.

(3)

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

(**QU03c 1SC0/2PH, June 2025**)

Q7.

(i) A student heats an aluminium block, as shown in Figure 4.

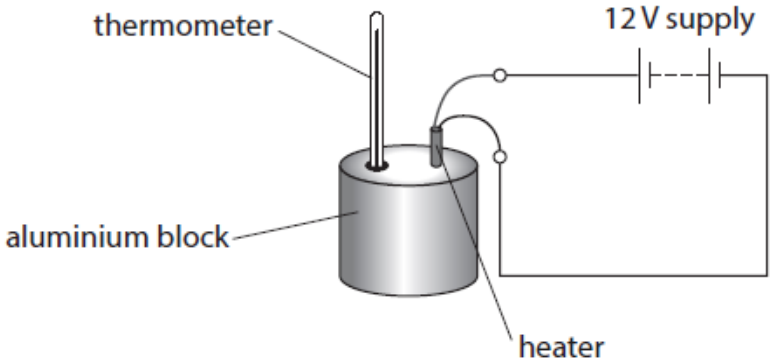


Figure 4

The aluminium block has a mass of 0.96 kg.

The specific heat capacity of aluminium is 920 J/kg °C.

The temperature of the block increases from 18 °C to 35 °C.

Calculate the change in thermal energy of the aluminium block.

Use the equation

change in thermal energy = mass × specific heat capacity × change in temperature

(2)

change in thermal energy = ... J

(ii) Suggest **one** way the student could reduce the energy loss from the aluminium block during the experiment.

(1)

.....

.....

(iii) The thermometer does not show the maximum temperature reached by the aluminium block until some time after the heater is switched off.

Give **one** reason for this.

(1)

.....

.....

(Total for question = 4 marks)

Q8.

* The table shows some properties of two materials used as thermal insulation.

The higher the R-value, the better the thermal insulating properties of the material.

material	R-value	fire resistance
fibreglass, made from sand	R-3.3	non-flammable
polystyrene, made from petroleum oil	R-4.0	melts at 270 °C and spreads fire very quickly

Assess which of these materials may be the more suitable to use as thermal insulation in a building.

Your answer should compare the properties of fibreglass and polystyrene given in the table.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

(**QU06d 1SC0/2PF, June 2023**)

Q9.

Aluminium has a melting point of 660 °C.

The absolute zero of temperature is −273 °C.

(i) Calculate the melting point of aluminium in kelvin.

(1)

melting point of aluminium = ... K

(ii) Describe the motion of particles in liquid aluminium (above 660 °C).

(2)

.....

.....

.....

(Total for question = 3 marks)

(**QU02c 1SC0/2PH, June 2023**)

Q10.

Figure 13 shows a storage heater.

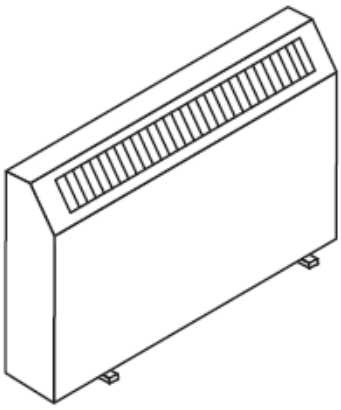


Figure 13

The storage heater contains bricks.

The bricks are heated electrically.

The electrical heater supplies 210 kJ of energy to each brick in the storage heater.

One brick has a mass of 5.8 kg.

The specific heat capacity for the brick is 860 J/kg K.

(i) Use this data to calculate the increase in temperature of the brick.

(2)

temperature increase = ... °C

(ii) The actual temperature increase will be smaller than you calculated in (i).

Explain why the actual temperature increase will be smaller than the value in (i).

(2)

.....

.....

.....

.....

(Total for question = 4 marks)

(**QU06c 1SC0/2PH, June 2024**)

Q11.

A steel ball has a volume of 3.6 cm^3 and a mass of 28 g.

(i) Calculate the density of steel in kg/m3.

(3)

density = ... kg/m^3

(ii) The steel ball is at a room temperature of 20 °C.

It is then put in a pan of boiling water maintained at 100 °C.

Calculate how much thermal energy the ball gains as its temperature increases from 20 °C to 100 °C.

Specific heat capacity of steel = 510 J/kg °C

Use an equation selected from the list of equations at the end of this paper.

(2)

thermal energy gained = ... J

(iii) The steel ball is put into a furnace where it melts.

Compare the motion of particles in the steel when they are in the solid state with their motion when in the molten (liquid) state.

(3)

.....

.....

.....

.....

.....

.....

(Total for question = 8 marks)

(**Q04a 1SC0/2PH/S2, SAM**)

Q12.

A student investigates the density of a copper block and the density of a small stone, as shown in Figure 2.

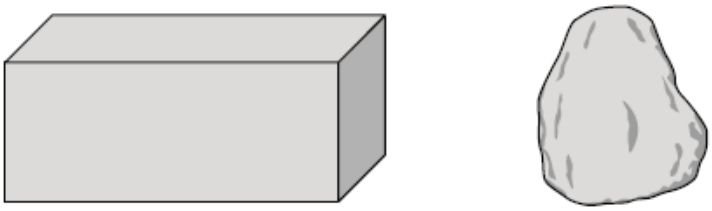


Figure 2

The student calculates the volume of the block as 13 cm^3.

She finds that the mass of the block is 100 g.

Calculate the density of the block.

Use the equation

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

(2)

density = ... g/cm^3

(Total for question = 2 marks)

(**Q01bi 1SC0/2PF, SAM 2016**)

Q13.

Aluminium has a melting point of 660 °C.

The absolute zero of temperature is −273 °C.

(i) Calculate the melting point of aluminium in kelvin.

(1)

melting point of aluminium = ... K

(ii) Describe the motion of particles in liquid aluminium (above 660 °C).

(2)

.....

.....

.....

(Total for question = 3 marks)

(**QU06c 1SC0/2PF, June 2023**)

Q14.

An electric heater is used to heat some water.

Figure 8 shows the experimental setup used.

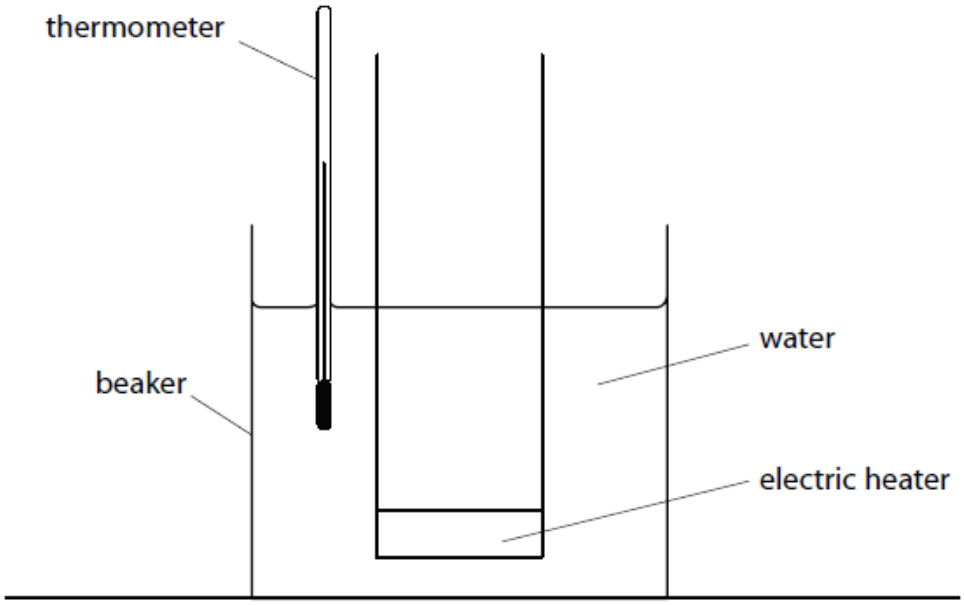


Figure 8

The initial mass of the water in the beaker is 0.72 kg.

The electric heater is switched on for some time and the water boils.

The mass of the water after the heater is switched off is 0.60 kg.

The thermal energy transferred to the water while it boils is 270 000 J.

Use an equation from the formula sheet to calculate the specific latent heat of the water.

(3)

specific latent heat = ... J/kg°C

(Total for question = 3 marks)

(**Q02c 1SC0/2PF, SAM 2016**)

Q15.

A beaker contains 0.25 kg of water at room temperature.
The beaker of water is heated until the water reaches boiling point (100 °C).
The specific heat capacity of water is 4200 J/kg °C.
The total amount of thermal energy supplied to the water is 84 000 J.

(i) Calculate the temperature of the water before it was heated.

Use an equation selected from the list of equations from the relevant equation sheet.

(3)

temperature before heating = ... °C

(ii) The heating continues until 0.15 kg of the water has turned into steam.

The thermal energy needed to turn the boiling water into steam is 0.34 MJ.

Calculate the specific latent heat of vapourisation of water.
Use an equation selected from the list of equations from the relevant equation sheet.

(2)

specific latent heat = ... MJ/kg

(iii) The graph in Figure 6 shows how the **volume** of 1 kg of water changes with temperature.

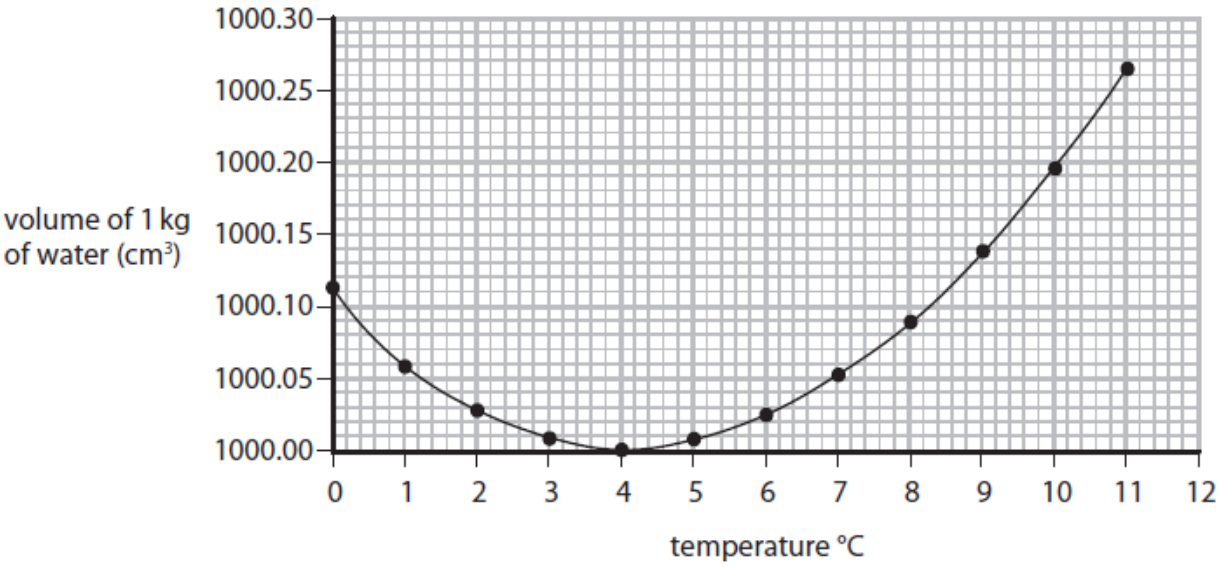


Figure 6

Describe how the **density** of water changes with temperature over the range of temperature shown in Figure 6.

Calculations are not required.

(2)

.....

.....

.....

.....

(Total for question = 7 marks)

(**Q04b 1SC0/2PH, June 2019**)

Q16.

A student boils some water.

Calculate the amount of thermal energy needed to change 60.0 g of water to steam at its boiling point.

The specific latent heat of vaporisation of water, L, is 2.26×10^6 J/kg.

Use the equation

$Q = m \times L$

(2)

amount of thermal energy = ... J

(Total for question = 2 marks)

(**QU06c 1SC0/2PF, June 2024**)

Q17.

A student boils some water.

Calculate the amount of thermal energy needed to change 60.0 g of water to steam at its boiling point.

The specific latent heat of vaporisation of water, L, is 2.26×10^6 J/kg.

Use the equation

$$Q = m \times L$$

(2)

amount of thermal energy = ... J

(Total for question = 2 marks)

(**QU02c 1SC0/2PH, June 2024**)

Q18.

Figure 9 shows a small piece of copper about 3 cm high.



© David J. Green/Alamy Stock Photo

Figure 9

A student wants to determine the density of copper.

The student uses a balance to measure the mass of the piece of copper.

(i) Explain how the student could measure the volume of the piece of copper.

(3)

.....

.....

.....

.....

.....

.....

(ii) The mass of the piece of copper is 0.058 kg.

The volume of the piece of copper is 6.5×10^{-6} m^3.

Calculate the density of copper.

(2)

density of copper = ... kg/m^3

(Total for question = 5 marks)

(**Q05a 1SC0/2PF, Nov 2020**)

Q19.

Figure 1 shows a small piece of copper about 3 cm high.



© David J. Green/Alamy Stock Photo

Figure 1

A student wants to determine the density of copper.

The student uses a balance to measure the mass of the piece of copper.

(i) Explain how the student could measure the volume of the piece of copper.

(3)

.....

.....

.....

.....

.....

.....

(ii) The mass of the piece of copper is 0.058 kg.

The volume of the piece of copper is 6.5×10^{-6} m^3.

Calculate the density of copper.

(2)

density of copper = ... kg/m^3

(Total for question = 5 marks)

(**Q01a 1SC0/2PH, Nov 2020**)

Q20.

An object has a mass of 7.22×10^{-2} kg and a volume of 2.69×10^{-5} m^3.

Calculate the density, ρ, of the object.

Use the equation

$$\rho = \frac{m}{V}$$

(3)

State the unit.

density = ... unit .....

(Total for question = 3 marks)

(**QU06b 1SC0/2PF, June 2023**)

Q21.

An object has a mass of 7.22×10^{-2} kg and a volume of 2.69×10^{-5} m^3.

Calculate the density, ρ, of the object.

Use the equation

$$\rho = \frac{m}{V}$$

(3)

State the unit.

(Total for question = 3 marks)

(**QU02b 1SC0/2PH, June 2023**)

Q22.

(i) Figure 6 shows an electric kettle.

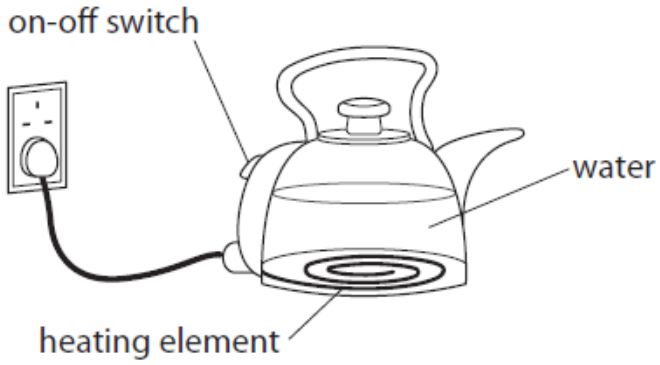


Figure 6

The kettle contains 1.5 kg of water.

The kettle is switched on.

Calculate the energy needed to raise the temperature of the water by 50 °C.

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

Use the equation

$$\Delta Q = m \times c \times \Delta\theta$$

(2)

energy needed = ... J

(ii) The amount of energy, E, needed to bring the water to boiling point is 670 000 J.

The kettle has a power of 3500 W.

Calculate the time, *t*, it takes to bring the water to boiling point.

Use the equation

$$P = \frac{E}{t}$$

(3)

time to bring the water to boiling point = ... s

(Total for question = 5 marks)

(**Q04c 1SC0/2PF, June 2019**)

Q23.

Figure 8 shows a saucepan of milk being heated on an electric cooker.



© Por Fabian Ponce Garcia/Shutterstock

Figure 8

Figure 9 is a table of data about the milk being heated.

mass of milk	0.82 kg
starting temperature of milk	10 °C
final temperature of milk	40 °C
change in thermal energy of milk	96 000 J

Figure 9

(i) Using data from the table in Figure 9, calculate the increase in temperature of the milk.

(1)

increase in temperature = ... °C

(ii) Using data from the table in Figure 9, calculate the specific heat capacity of the milk.

Use the equation

$$\text{specific heat capacity} = \frac{\text{change in thermal energy}}{\text{mass} \times \text{increase in temperature}}$$

(2)

specific heat capacity = ... J/kg °C

(Total for question = 3 marks)

Q24.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

A student determines the density of a liquid.

The student puts an empty measuring cylinder on a balance (Figure 5a).
The student then adds liquid to the measuring cylinder (Figure 5b).

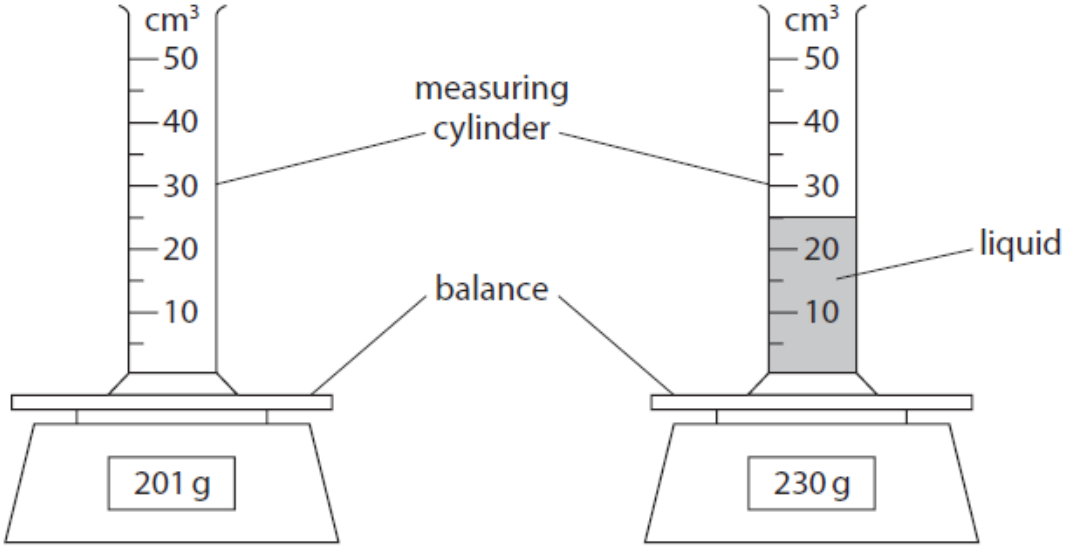


Figure 5a **Figure 5b**

Calculate the mass of liquid added and the volume of liquid added.

Use the information in Figures 5a and 5b.

(i) mass of liquid added = ... g

(1)

(ii) volume of liquid added = ... cm^3

(1)

(iii) Which equation should the student use to calculate the density of the liquid?

(1)

☒ **A** density = mass + volume

☒ **B** density = mass − volume

☒ **C** density = mass × volume

☒ **D** density = $\frac{\text{mass}}{\text{volume}}$

(iv) State **two** improvements the student could make to this investigation.

(2)

1 .....

.....

2 .....

.....

(Total for question = 5 marks)

(**Q04b 1SC0/2PF, June 2019**)

Q25.

Figure 13 shows the dimensions of a solid block of concrete.

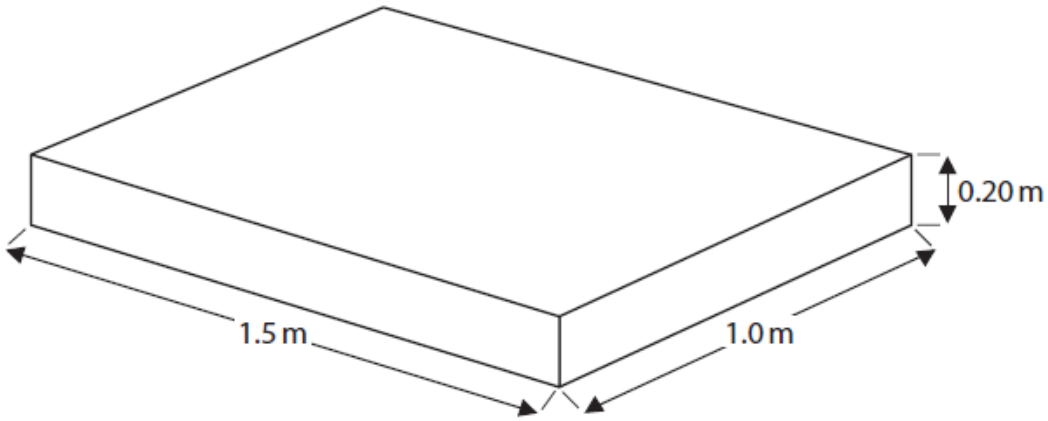


Figure 13

Density of concrete, ρ, = 2100 kg / m^3.

Calculate the mass of the concrete block.

Use the equation:

$$m = \rho \times V$$

(3)

mass of concrete block = ... kg

(Total for question = 3 marks)

(**Q06b 1SC0/2PF, Nov 2021**)

Q26.

Figure 3 shows the dimensions of a solid block of concrete.

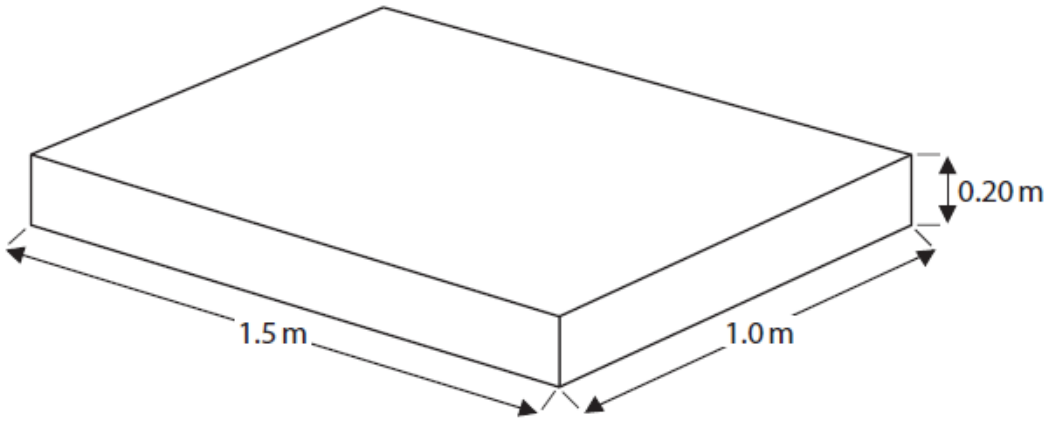


Figure 3

Density of concrete, ρ, = 2100 kg / m^3.

Calculate the mass of the concrete block.

Use the equation

$$m = \rho \times V$$

(3)

mass of concrete block = ... kg

(Total for question = 3 marks)

(**Q02b 1SC0/2PH, Nov 2021**)

Q27.

Figure 11 shows some water in a measuring cylinder and a lump of iron.

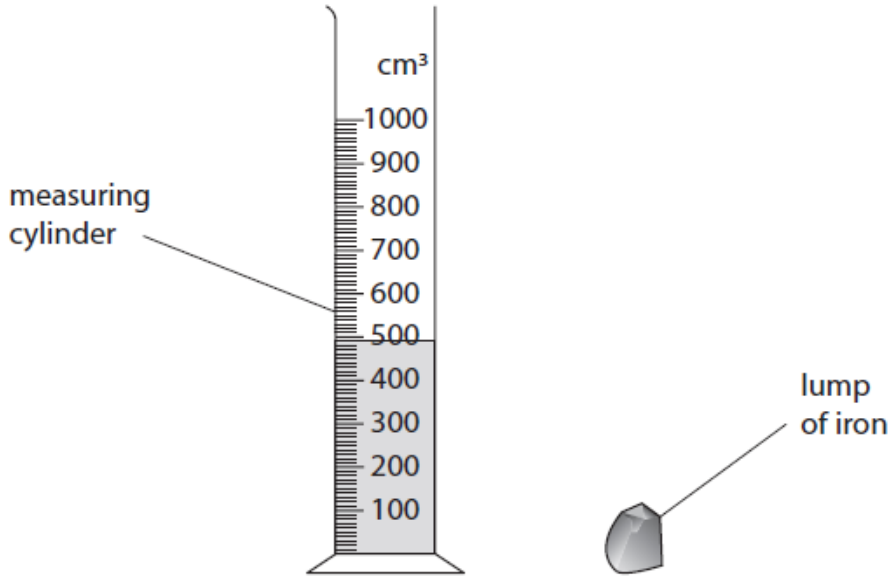


Figure 11

The lump of iron is lowered fully into the water.

The water level in the measuring cylinder rises to 530 cm^3.

The density of iron is 7.9 g / cm^3.

Calculate the mass of the lump of iron.

Use the equation

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

Give your answer to 2 significant figures.

(4)

mass = ... g

(Total for question = 4 marks)

(**QU06b 1SC0/2PF, June 2022**)

Q28.

Figure 3 shows some water in a measuring cylinder and a lump of iron.

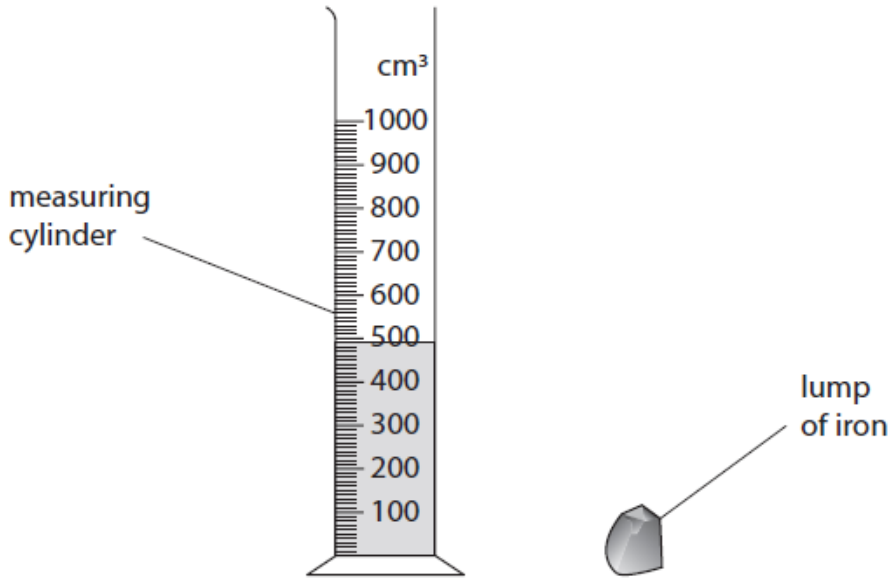


Figure 3

The lump of iron is lowered fully into the water.

The water level in the measuring cylinder rises to 530 cm^3.

The density of iron is 7.9 g / cm^3.

Calculate the mass of the lump of iron.

Use the equation

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

Give your answer to 2 significant figures.

(4)

mass = ... g

(Total for question = 4 marks)

(**QU02b 1SC0/2PH, June 2022**)

Q29.

An electric kettle is used to boil some water.

While the water is boiling, 566 000 J of thermal energy turns 0.250 kg of water into steam.

Calculate the specific latent heat of vaporisation of water.

Use an equation selected from the list of equations at the end of this paper.

(3)

specific latent heat = ... J/kg

(Total for question = 3 marks)

(**Q03d 1SC0/2PF/S2, SAM**)

Q30.

On a very cold day, the temperature of the air is −4 °C.

Calculate the value of this temperature on the kelvin scale.

(1)

temperature = ... K

(Total for question = 1 mark)

(**Q02d 1SC0/2PH, Nov 2021**)

Q31.

A coil of copper wire has a mass of 14.1 g.

The density, ρ, of copper is 8.96 g/cm^3.

Calculate the volume of the copper wire.

$$\rho = \frac{m}{V}$$

(3)

volume ..... cm^3

(Total for question = 3 marks)

(**QU06a 1SC0/2PF, June 2024**)

Q32.

A coil of copper wire has a mass of 14.1 g.

The density, ρ, of copper is 8.96 g/cm^3.

Calculate the volume of the copper wire.

Use the equation

$$\rho = \frac{m}{V}$$

(3)

volume = ... cm^3

(Total for question = 3 marks)

(**QU02a 1SC0/2PH, June 2024**)

Q33.

Some students measure the volume of a lump of modelling clay using a measuring jug, as shown in Figure 5.

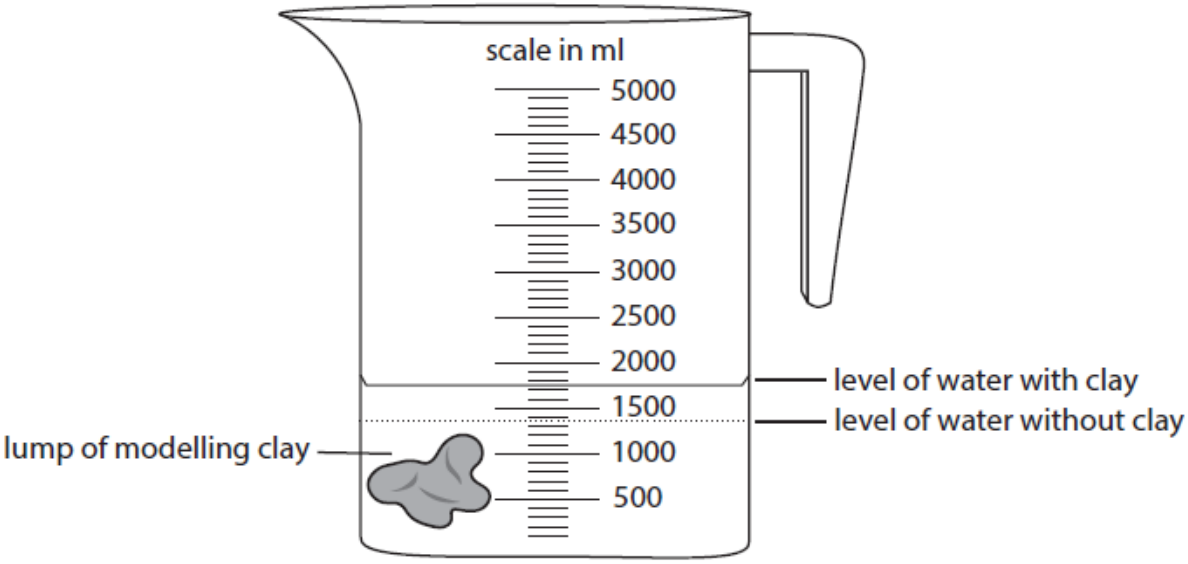


Figure 5

Using Figure 5, estimate the volume of the modelling clay in cm^3.

You may assume that 1 litre = 1000 cm^3.

(2)

volume = ... cm^3

(Total for question = 2 marks)

(**QU02d 1SC0/2PH, June 2024**)

Q34.

An electric kettle contains 1.41 kg of water at 25 °C.

The kettle is switched on.

After a while, the water reaches boiling point at 100 °C.

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

(i) Calculate the amount of thermal energy supplied to the water by the kettle.
Give your answer to the appropriate number of significant figures.

Use an equation selected from the list of equations at the end of the paper.

(3)

energy supplied = ... J

(ii) The kettle is kept switched on and the water continues to boil.

After a while, the mass of the water in the kettle has decreased to 1.21 kg.

The thermal energy supplied to the water during this time was 450 000 J.

Calculate the specific latent heat of vaporisation of water.

Use an equation selected from the list of equations at the end of the paper.

(3)

specific latent heat of vaporisation = ... J/kg

(Total for question = 6 marks)

(**Q06a 1SC0/2PH, Nov 2021**)

Q35.

The volume of 380 g of ice is 410 cm^3.

Calculate the density of the ice in g/cm^3.

(2)

density = ... g/cm^3

(Total for question = 2 marks)

(**Q19 1SC0/2PF, June 2018**)

Q36.

Another student decides to melt some ice.

The student melts 380 g of ice at 0 °C.

The specific latent heat of fusion of ice is 3.34×10^5 J/kg.

Calculate the thermal energy needed to melt the ice.

Select an equation from the list of equations at the end of this paper.

(2)

thermal energy needed = ... J

(Total for question = 2 marks)

(**Q18 1SC0/2PF, June 2018**)

Q37.

Another student decides to melt some ice.

The student melts 380 g of ice at 0 °C.

The specific latent heat of fusion of ice is 3.34 × 105 J/kg.

Calculate the thermal energy needed to melt the ice.

Select an equation from the list of equations at the end of this paper.

(2)

thermal energy needed = ... J

(Total for question = 2 marks)

(**Q03 1SC0/2PH, June 2018**)

Q38.

The espresso machine shown in Figure 27 is an electrical appliance.



(Source: © tanawaty/123RF)

Figure 27

The espresso machine has an electrical heater connected to a 440 V mains supply.

The power of the electrical heater is 3.5 kW.

(i) The rating of a fuse is the current above which it melts.

Which of these is the most suitable fuse for the espresso machine circuit?

(1)

☒ **A** 1 A

☒ **B** 5 A

☒ **C** 10 A

☒ **D** 13 A

(ii) Before the espresso machine can be used, its heater must raise the temperature of some cold water.

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

Show that it takes the heater about 90 s to raise the temperature of 1 kg of water from 18°C to 95°C.

Use an equation from the formula sheet.

(3)

(Total for question = 4 marks)

Q39.

The espresso machine shown in Figure 27 is an electrical appliance.



(Source: © tanawaty/123RF)

Figure 27

The espresso machine has a steam pipe that can be used to heat milk in a jug, as shown in Figure 28.



(Source: © Wavebreak Media Ltd/123RF)

Figure 28

Steam from the pipe enters the milk, where steam condenses to water.

The steam and hot water heat the milk.

(i) Describe, in terms of energy, how the arrangement and movement of particles in the steam changes as the steam enters the milk, condenses and cools.

(2)

.....

.....

.....

.....

(ii) The specific heat capacity of milk is 3840 J/kg K.

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

The specific latent heat of condensation of steam is 2260 kJ/kg.

The temperature of the steam is 100°C

The mass of steam that condenses is 25 g.

The temperature of the milk rises from 5°C to 65°C.

By considering the transfer of energy from the steam to the milk, calculate the mass of milk that is heated by the steam and hot water.

Use equations from the formula sheet.

(4)

mass of milk = ... kg

(iii) Give **two** reasons why the actual mass of steam needed to heat the milk from 5°C to 65°C is greater than 25 g.

(2)

1 .....

.....

2 .....

.....

(Total for question = 8 marks)

(**Q10b 1SC0/2PH, SAM 2016**)

Q40.

* Describe how a student should carry out an experiment to determine the specific heat capacity of water.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

(**Q05c 1SC0/2PF, SAM 2016**)