PEARSON EDEXCEL GCSE PHYSICS (HIGHER) · 1PH0

PHYSICS



EXAM QUESTION PACK

TOPIC 14: PARTICLE MODEL (PACK 1)

SCORE	PERCENTAGE
/141	%

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 3 to determine the specific heat capacity of water.

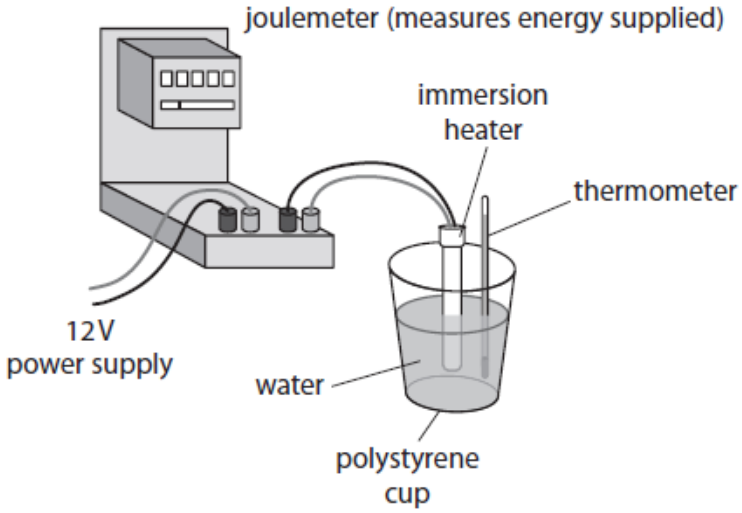


Figure 3

(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)

Q2.

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

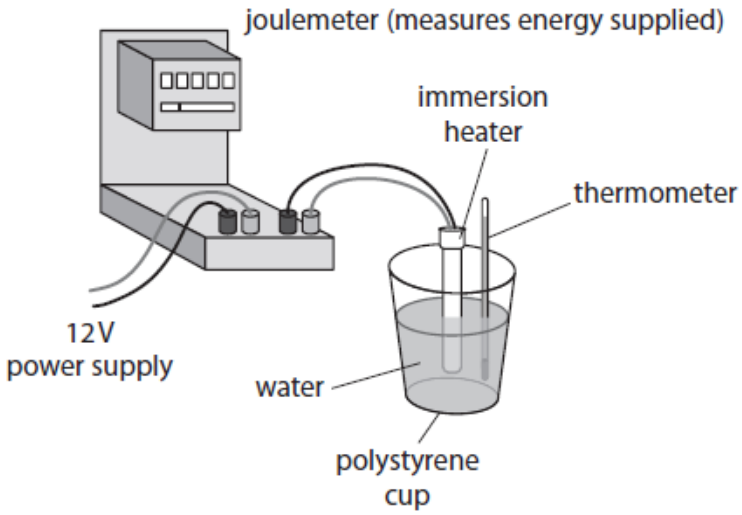


Figure 3

(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)

Q3.

Figure 2 shows a rubber tube that can be used inside a bicycle tyre.

The tube is inflated with a bicycle pump.

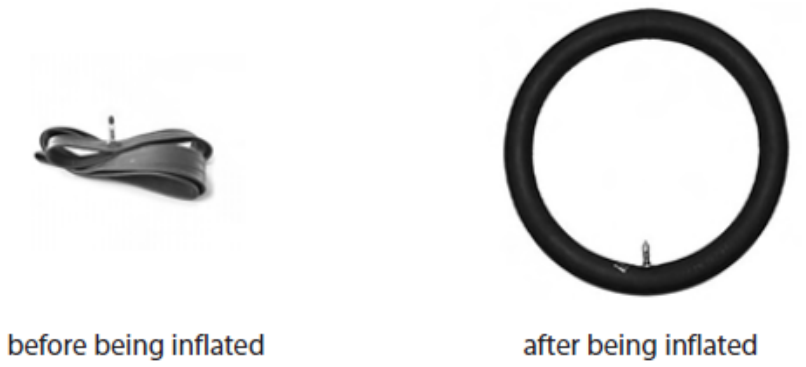


Figure 2

(i) The air inside the tube exerts an outward force on the wall of the tube.

State the angle that this outward force makes with the wall of the tube.

(1)

.....

.....

(ii) It takes 4.8 litres of air from the atmosphere to inflate the empty tube to a pressure of 400 000 Pa.

Atmospheric pressure is 100 000 Pa.

Calculate the volume of air inside the tube.

Assume the temperature of the air inside the tube is the same as the temperature of the air outside the tube.

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

(3)

volume = ... litres

(iii) When a bicycle pump is used to inflate the tube, the air in the bicycle pump gets warm.

You should ignore any effects of friction in the pump.

Explain why the air in the bicycle pump gets warm.

(2)

.....

.....

.....

.....

(Total for question = 6 marks)

Q4.

Figure 1 shows air inside a cylinder with a movable piston.

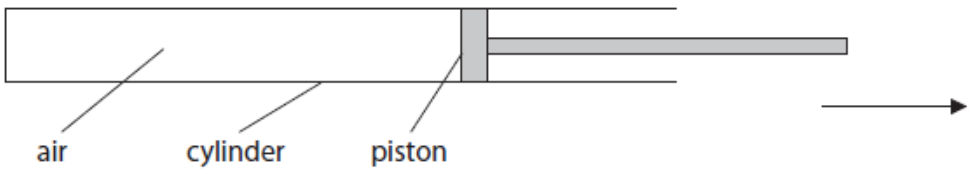


Figure 1

The piston is pulled a little way in the direction of the arrow, but stays inside the cylinder.

Which of these increases?

(1)

☒ **A** The mass of the air inside the cylinder.

☒ **B** The rate at which air particles collide with the walls of the cylinder.

☒ **C** The volume of the air inside the cylinder.

☒ **D** The pressure of the air inside the cylinder.

(Total for question = 1 mark)

Q5.

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

Figure 5 shows a piece of copper, with a thread tied around it, in a glass beaker of boiling water.

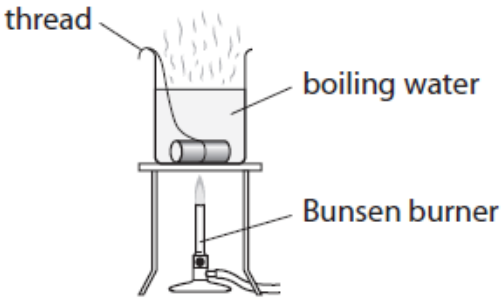


Figure 5

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 6.

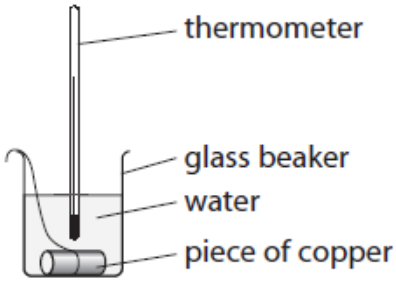


Figure 6

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)

Q6.

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.

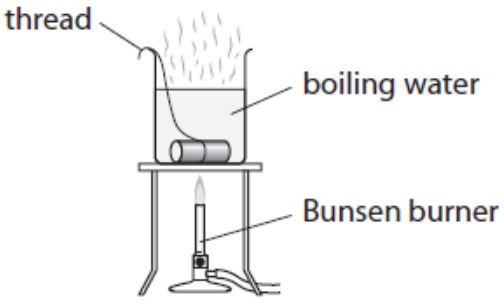


Figure 2

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.

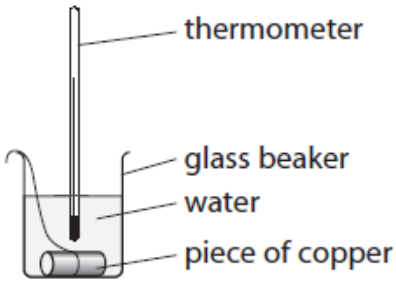


Figure 3

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)

Q7.

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/m^3.

(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)

Q8.

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)

Q9.

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 at the end of this paper.

(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 at the end of this paper.

(2)

specific latent heat = ... MJ/kg

(iii) The graph in Figure 13 shows how the **volume** of 1 kg of water changes with temperature.

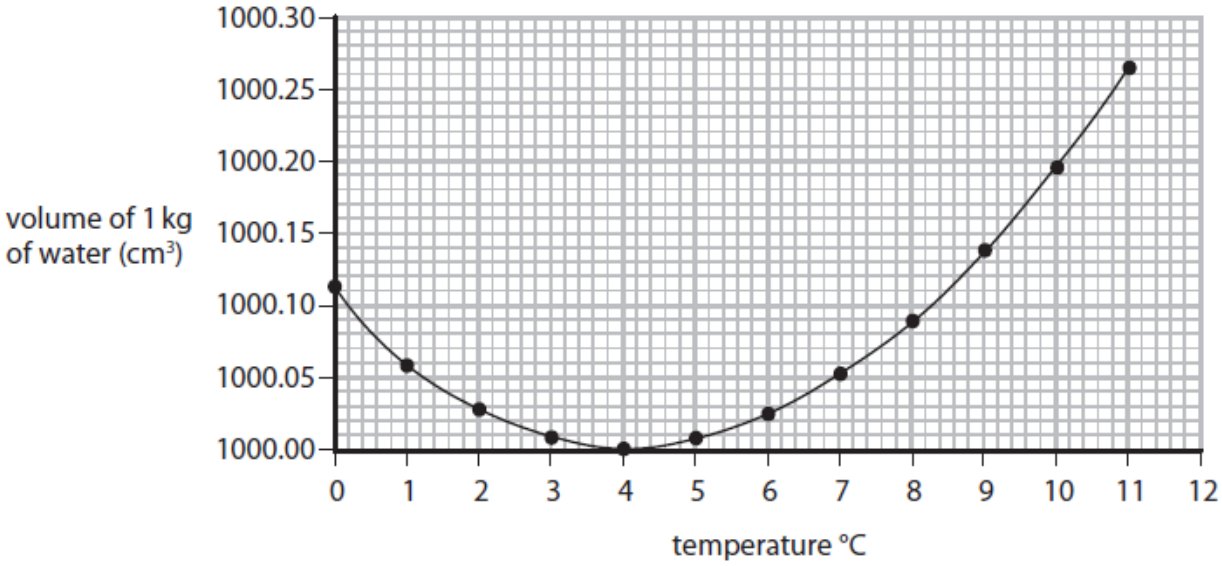


Figure 13

Describe how the **density** of water changes with temperature over the range of temperature shown in Figure 13.

Calculations are not required.

(2)

.....

.....

.....

.....

(Total for question = 7 marks)

Q10.

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.

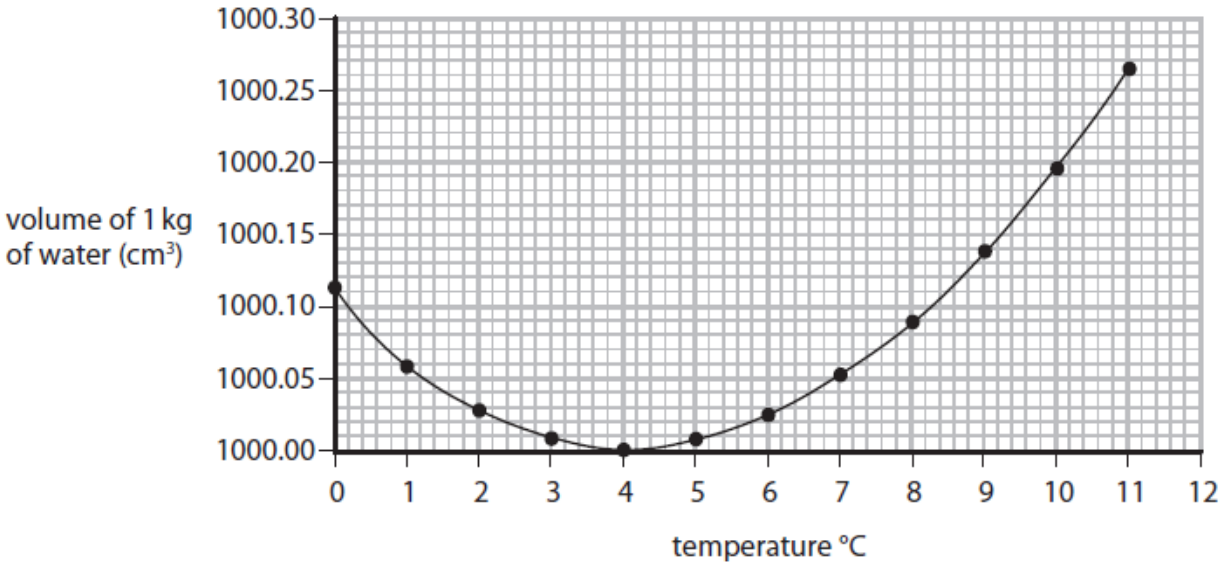


Figure 6

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)

Q11.

Figure 4 shows a small piece of copper about 3 cm high.



© David J. Green/Alamy Stock Photo

Figure 4

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/cm^3

(Total for question = 5 marks)

Q12.

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)

Q13.

Figure 6 shows the dimensions of a solid block of concrete.

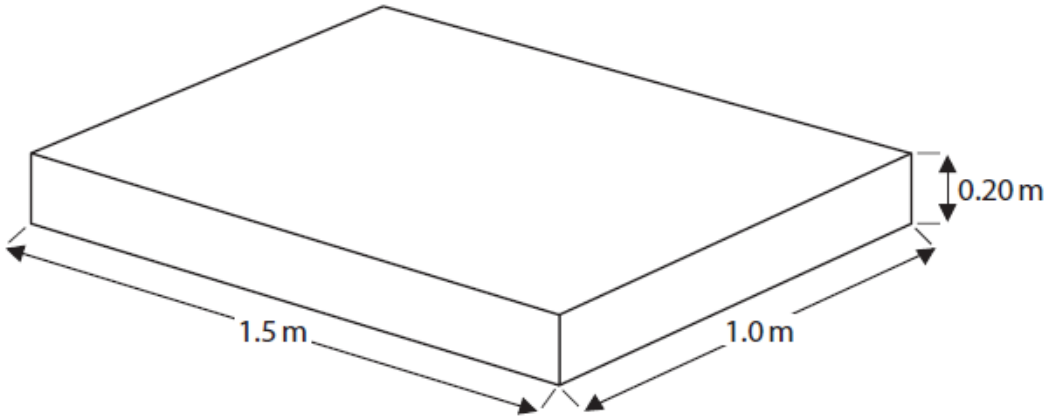


Figure 6

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)

Q14.

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

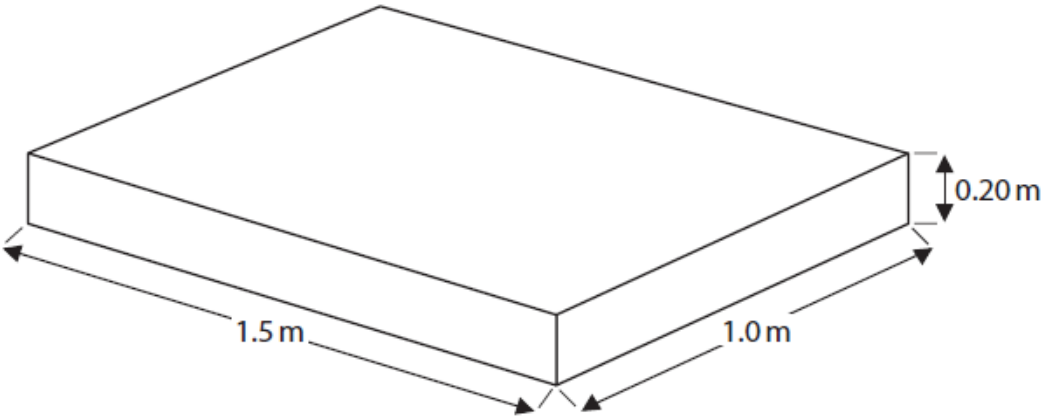


Figure 3

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)

Q15.

Figure 5 shows some water in a measuring cylinder and a lump of iron.

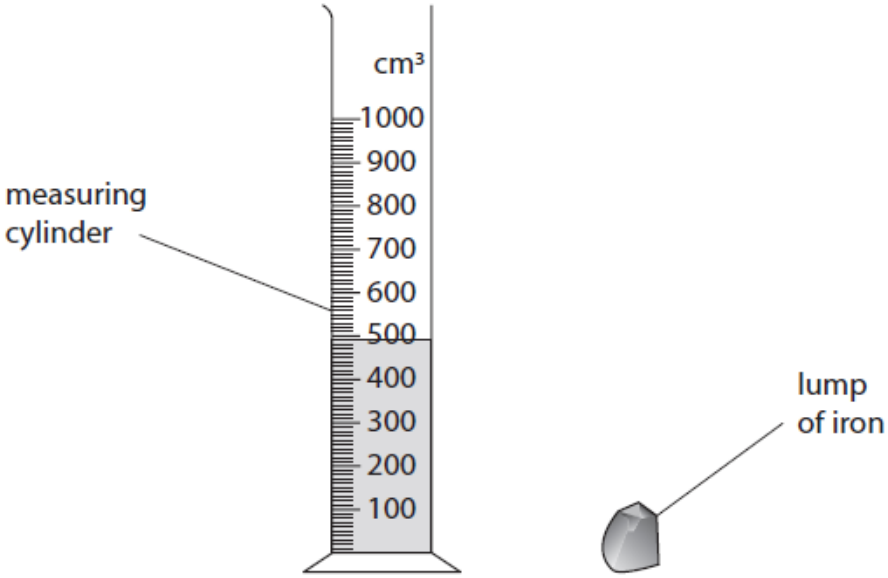


Figure 5

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)

Q16.

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

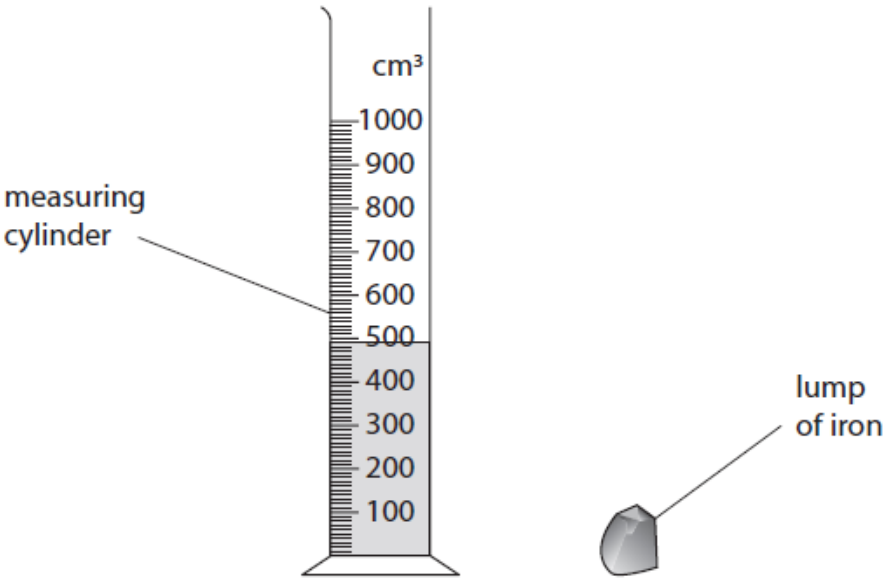


Figure 3

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)

Q17.

Figure 1 shows some gas in a container.

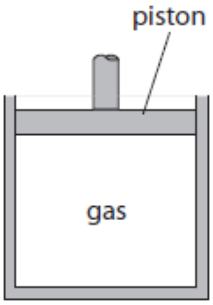


Figure 1

The pressure of gas in Figure 1 is 103 kPa, and the volume of gas is 0.010 m^3.

Calculate the pressure of the gas in Figure 2 if the volume is now 0.0070 m^3.

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

(3)

pressure = ... kPa

(Total for question = 3 marks)

Q18.

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)

Q19.

Figure 24 shows a submarine underwater.

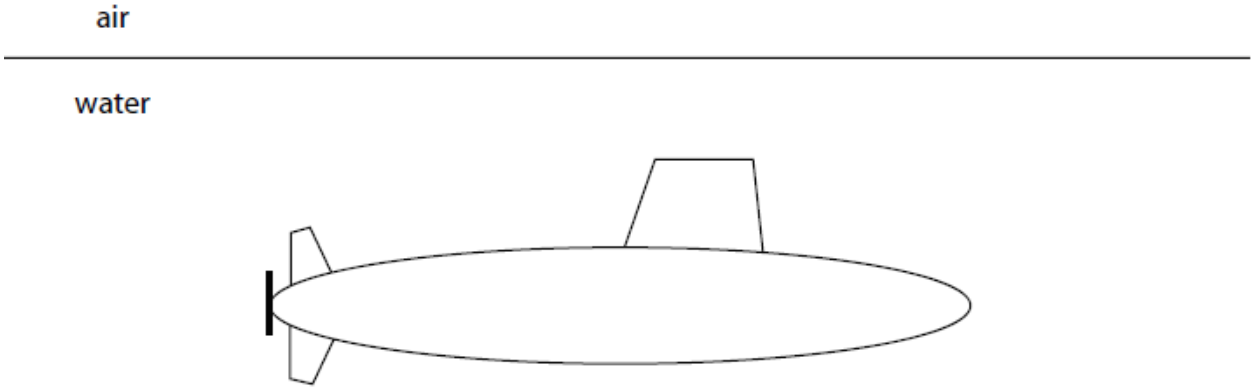


Figure 24

A bubble of gas escapes from the submarine.

The volume of the bubble is 23.0 cm^3.

The pressure of the gas inside the bubble is 297 kPa.

The bubble rises to the surface without changing temperature.

Calculate the volume of the bubble when it reaches the surface.

Atmospheric pressure = 101 kPa

Use an equation from the formula sheet.

(3)

volume = ... cm^3

(Total for question = 3 marks)

Q20.

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)

Q21.

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)

Q22.

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)

Q23.

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)

Q24.

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)

Q25.

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)

Q26.

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

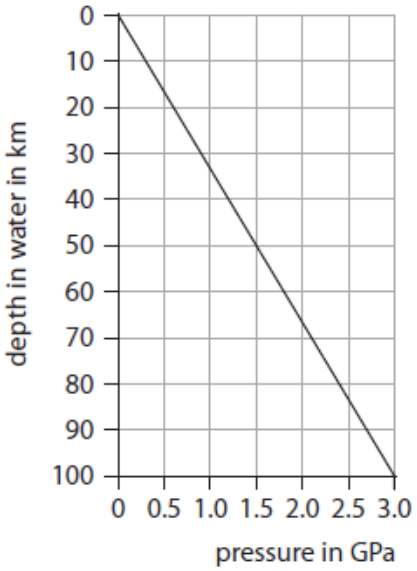
(Total for question = 1 mark)

Q27.

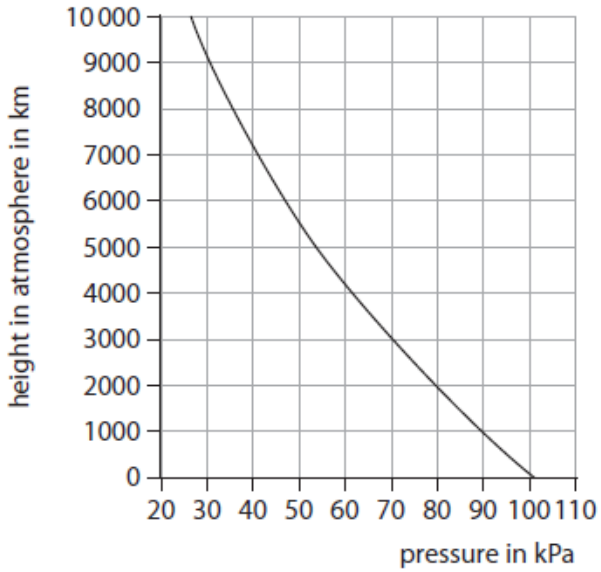
Figure 17 shows information about the pressures in the ocean and in the atmosphere of a distant planet.

Graph A shows the variation of pressure as the depth in the ocean increases.

Graph B shows the variation of pressure as the height in the atmosphere increases.



Graph A



Graph B

Figure 17

(i) Use information from Graph A to obtain a value for the density of the ocean water.

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

(4)

density = ... kg/m^3

* (ii) Explain the similarities and differences in the pressure variations shown in graphs A and B.

Your answer should refer to both the particle model (kinetic theory) and to density.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 10 marks)

Q28.

Describe, in terms of particles, **two** differences between a solid and a liquid of the same substance.

(2)

1 .....

.....

2 .....

.....

(Total for question = 2 marks)

Q29.

* This question is about determining the specific heat capacity of aluminium.
An aluminium block is placed in boiling water as shown in Figure 21.

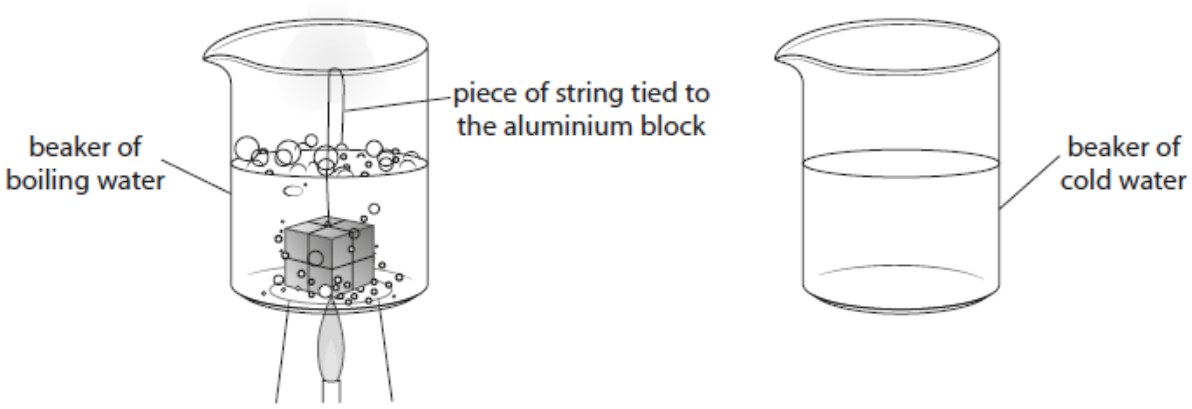


Figure 21

The piece of string is tied to the aluminium block so the block can be transferred from the boiling water to the cold water.

Describe how a student could use this apparatus, and any additional items needed, to determine the specific heat capacity of aluminium.

Your answer should include how the student would

- obtain the necessary measurements
- use the measurements to calculate the specific heat capacity of aluminium.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

Q30.

* This question is about determining the specific heat capacity of aluminium.
An aluminium block is placed in boiling water as shown in Figure 10.

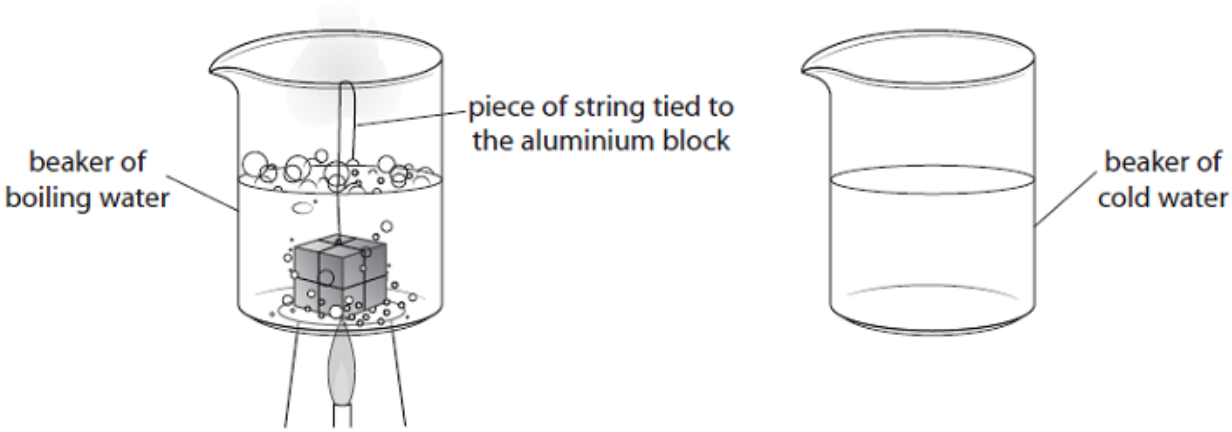


Figure 10

The piece of string is tied to the aluminium block so the block can be transferred from the boiling water to the cold water.

Describe how a student could use this apparatus, and any additional items needed, to determine the specific heat capacity of aluminium.

Your answer should include how the student would

- obtain the necessary measurements
- use the measurements to calculate the specific heat capacity of aluminium.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)