

Centre Number	Candidate Number	Name
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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

**COMBINED SCIENCE**

**0653/06**

**CO-ORDINATED SCIENCES**

**0654/06**

Paper 6 Alternative to Practical

May/June 2006

**1 hour**

Candidates answer on the Question Paper.  
No Additional Materials required.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.  
Write in dark blue or black pen in the spaces provided on the Question Paper.  
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.  
You may use a soft pencil for any diagrams, graphs or rough working.  
At the end of the examination, fasten all your work securely together.  
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
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<b>Total</b>	

This document consists of **17** printed pages and **3** blank pages.

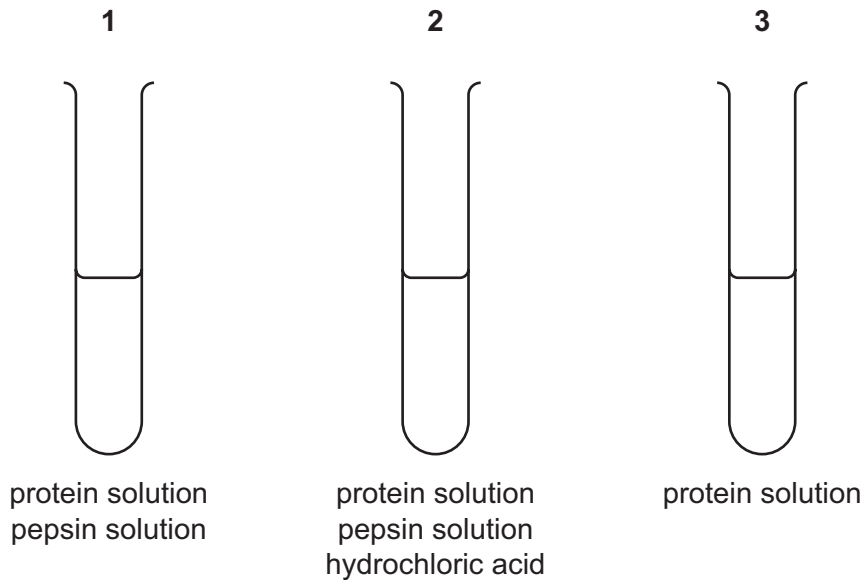


- 1 A student did an experiment with two digestive enzymes, amylase and pepsin, to find whether pH affects their activity. Pepsin breaks down protein in the stomach. Amylase breaks down starch in the mouth and small intestine.

### Pepsin Test

When the enzyme is added to a cloudy protein suspension it will become clear if the protein is digested.

The student prepared three test-tubes as shown in Fig. 1.1.



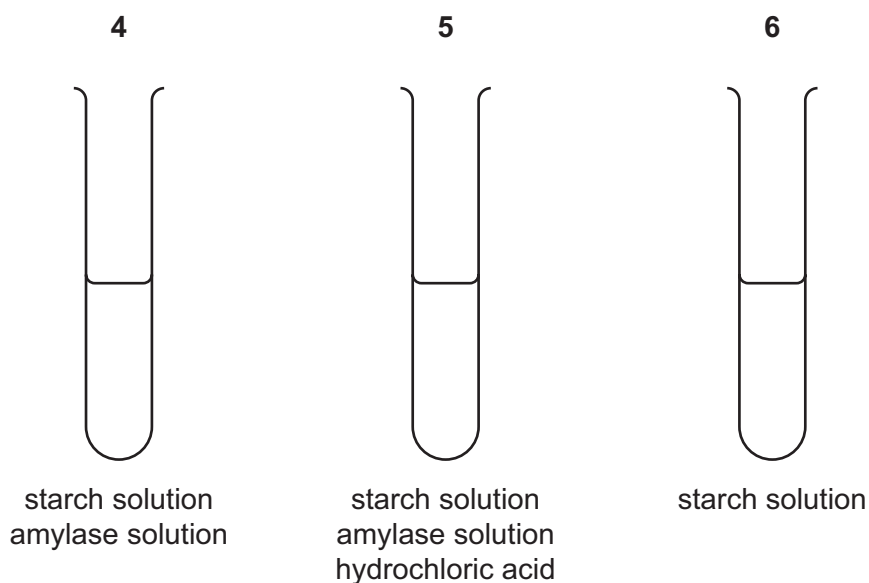
**Fig. 1.1**

Water was added where necessary to make all three tubes have the same total volume of liquid.

### Amylase Test

This enzyme is added to a starch solution. If the starch is digested, iodine remains light brown when tested with the reaction mixture.

The student prepared three more test tubes as shown in Fig. 1.2.



**Fig. 1.2**

Water was added where necessary to make all three tubes have the same total volume of liquid.

The student put all six test-tubes into a water bath at 40 °C for five minutes. Then she observed the tubes. She studied the appearance of tubes **1**, **2** and **3**. Then she tested small samples of tubes **4**, **5** and **6** with iodine and looked for a colour change.

**(a) (i)** Complete the second column of Fig. 1.3 to show the contents of each tube.

tube number	contents	observations
<b>1</b>	protein, pepsin, water	
<b>2</b>		
<b>3</b>		
<b>4</b>		
<b>5</b>		
<b>6</b>		

**Fig. 1.3** [1]

**(ii)** Digestion of protein occurred only in tube **2**. In Fig. 1.3 complete the observations for tubes **1**, **2** and **3**. [2]

**(iii)** Digestion of starch occurred only in tube **4**. In Fig 1.3 complete the observations for tubes **4**, **5** and **6** when they were tested with iodine. [2]

**(b) (i)** Which enzyme worked better in conditions of low pH?

..... [1]

**(ii)** Explain the observations for tube **5** in terms of enzyme action.

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

**(iii)** Why were tubes **3** and **6** included in the experiment?

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

**(c)** Describe a test to show that amylase and pepsin solutions contain protein.

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

- 2 A student is given some plasticine (modelling clay) by his teacher. He is told to find the density of the plasticine by two different methods.

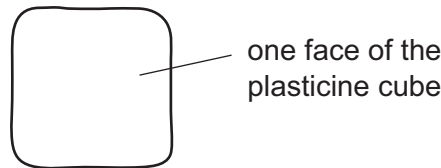
**Method 1**

The student tries to make the plasticine into a cube. He measures the cube so that he can calculate its volume.

Then he weighs the cube of plasticine on a balance.

He calculates the density using the mass and volume.

- (a) (i) Fig. 2.1 shows one face of the cube of plasticine. As accurately as you can, measure one side of the face of the cube to the nearest millimetre. Use this measurement to calculate the volume of the cube in cubic centimetres.



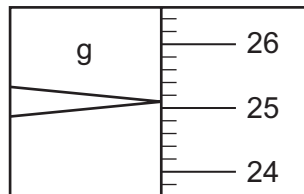
**Fig. 2.1**

length of one side of the cube = ..... mm

length of one side of the cube = ..... cm

volume of the cube = ..... x ..... x ..... = ..... cm<sup>3</sup> [2]

- (ii) The student puts the cube onto a balance. Fig. 2.2 shows the window of the balance. Read and record the mass of the cube.



**Fig. 2.2**

mass of the cube = ..... g [1]

- (iii) Use the answers to (a)(i) and (ii) to calculate the density of the plasticine in g/cm<sup>3</sup>.

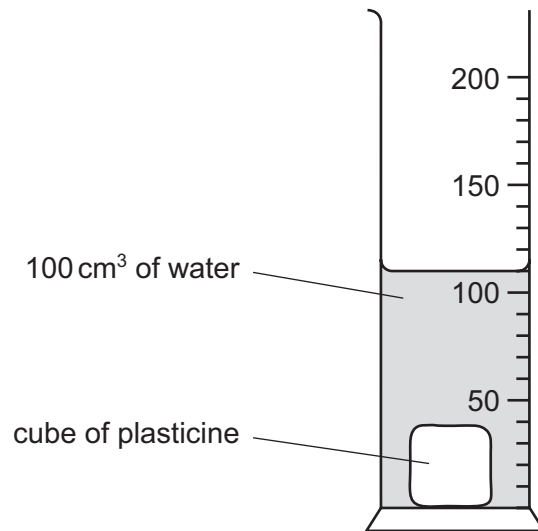
density of plasticine = ..... g/cm<sup>3</sup> [1]

**Method 2**

The student finds the volume of the plasticine by the displacement method. Then he weighs it using a metre rule. He calculates the density of plasticine again.

(b) The student puts  $100 \text{ cm}^3$  of water into a measuring cylinder. Then he places the plasticine into the water. Fig. 2.3 shows the new level of water in the measuring cylinder.

(i) Read the level of water in the measuring cylinder. Then calculate the volume of the plasticine.



**Fig. 2.3**

water level in the measuring cylinder = .....  $\text{cm}^3$

volume of the plasticine = .....  $\text{cm}^3$  [1]

The student hangs a 50 g mass on a metre rule at the 30 cm mark. He hangs the plasticine on the other end so that the rule balances.

- (ii) Use Fig. 2.4 to calculate the distances of the plasticine and the 50 g mass from the pivot.

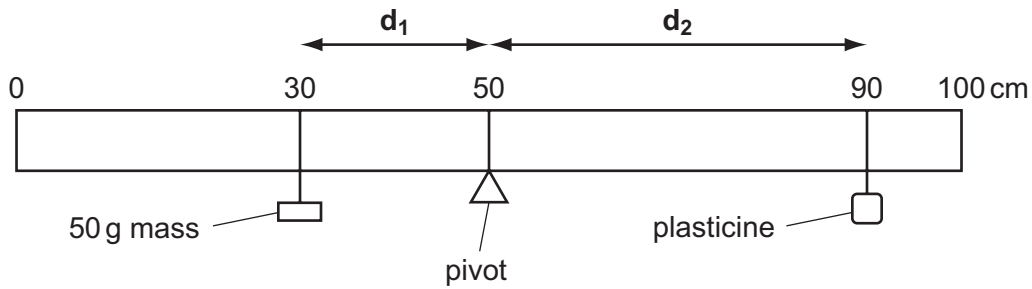


Fig. 2.4

The distance  $d_1$  of the 50 g mass from the pivot is ..... cm

The distance  $d_2$  of the plasticine from the pivot is ..... cm [1]

- (iii) Use the following equation to calculate the mass of the plasticine.

$$d_1 \times 50 = d_2 \times \text{mass of the plasticine}$$

mass of the plasticine = ..... g [1]

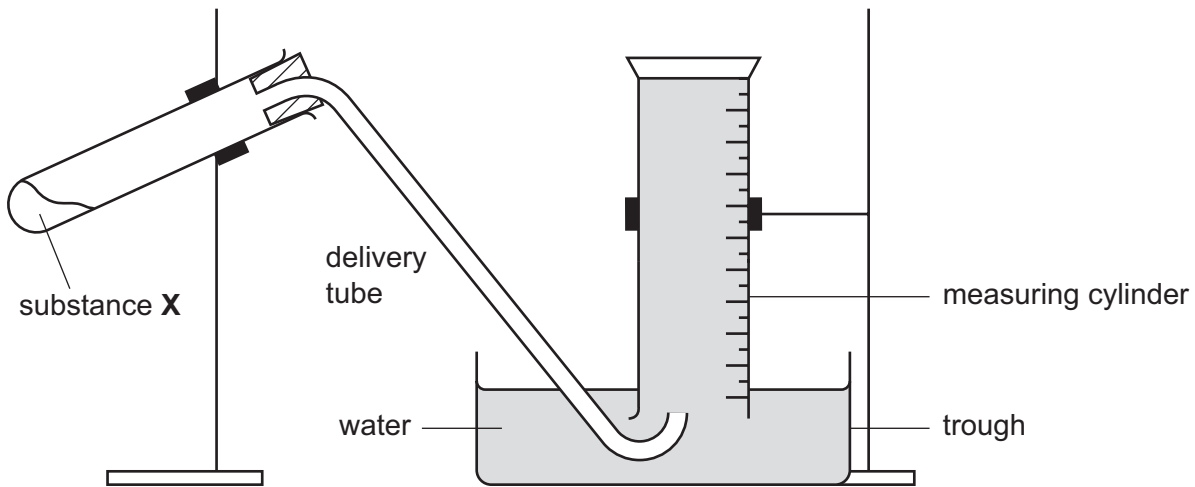
- (iv) Calculate the density of the plasticine using your answers to (b)(i) and (iii).

density of plasticine = ..... g/cm<sup>3</sup> [1]

- (c) Which measurement of volume, (a)(i) or (b)(i), is more accurate? Give a reason for your answer.

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

- 3 The teacher gives a sample of substance **X** to two students. He tells them to use the apparatus shown in Fig. 3.1 to find the volume of gas given off when substance **X** is heated.



**Fig. 3.1**

The students completely fill the measuring cylinder with water. Then they gently heat the test-tube containing substance **X**. A gas is given off.

- (a) When no more gas is given off, the students stop heating the tube. They do not remove the delivery tube from below the surface of the water. This is **not** the correct procedure.

Explain

- (i) what happens,

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

- (ii) why this happens.

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

- (b) Fig. 3.2 shows the inverted measuring cylinder.  
Read the scale of the measuring cylinder to find the volume of gas it contains.

volume of gas = ..... cm<sup>3</sup> [1]

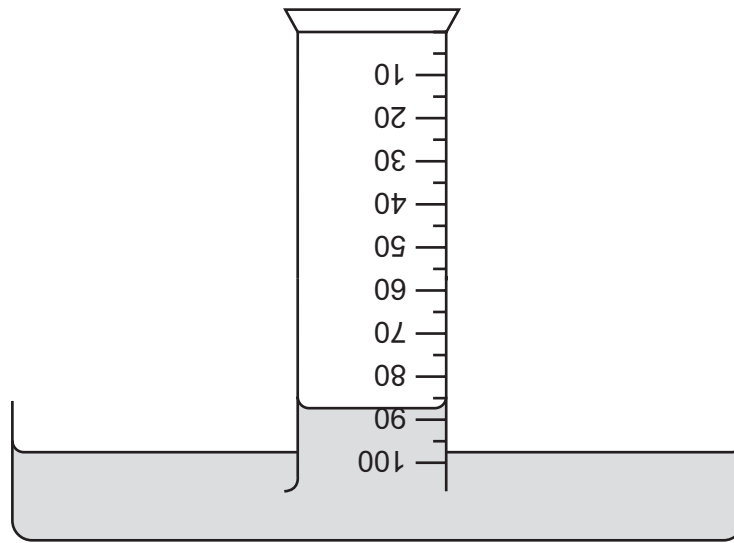


Fig. 3.2

- (c) (i) Explain how the students can use limewater to test the gas that is in the measuring cylinder.

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

- (ii) The limewater turns cloudy.

Name the gas ..... [1]

- (d) (i) One of the students takes a little of substance **X** and dissolves it in water. Then he adds three drops of Universal Indicator.  
He decides that the pH of the solution is about 8.  
What is the colour of the Universal Indicator in the solution of substance **X**?

..... [1]

- (ii) He does the same test with the white residue that is left in the tube after heating substance **X**.  
He decides that the pH of the solution is about 10.  
What is the colour of the Universal Indicator this time?

..... [1]



- (e) The teacher calculates the expected volume of gas using the mass of substance **X**. The volume actually collected was less than this volume. He said that some of the gas must have dissolved in the water.

Draw a diagram to show a different method, that does **not** use water, of collecting the gas and measuring its volume.

[2]

- 4 Transpiration is the loss of water vapour from the surface of leaves. A student set up an experiment to find out whether more water loss occurs from the upper surface than the lower surface of privet leaves. He applied grease to selected surfaces of the leaves. The grease formed a waterproof covering that prevented water loss. He weighed the leaves before and after the experiment. Any water loss made the leaves lighter.

The student took 12 leaves of roughly the same size from the same plant. He treated them as follows:

Group A	leaves 1, 2 and 3	no grease
Group B	leaves 4, 5 and 6	grease on upper surface only
Group C	leaves 7, 8 and 9	grease on lower surface only
Group D	leaves 10, 11 and 12	grease on both surfaces

He weighed each leaf, noted the mass, then used cotton thread to hang the leaves to a line of string as shown in Fig. 4.1. He then left the leaves for 48 hours. After this time he re-weighed the leaves and recorded their new masses.

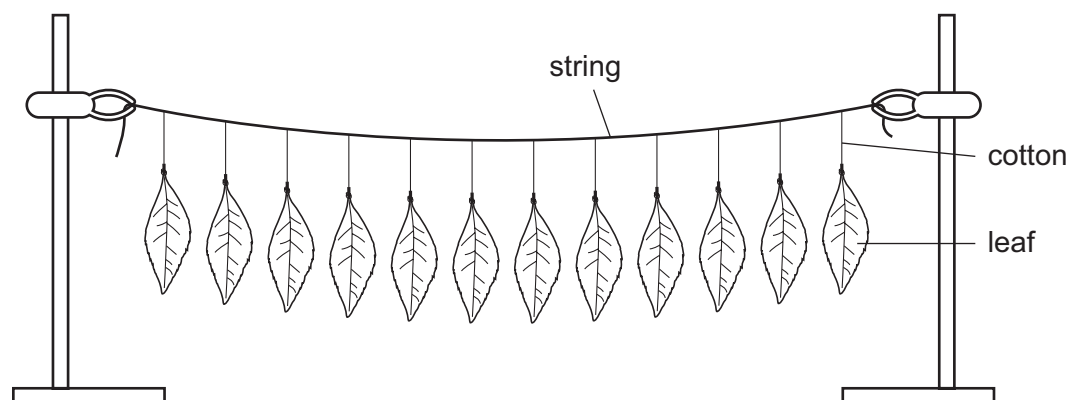


Fig. 4.1

### Results

group	leaf number	mass at start/g	mass at end/g	loss of mass/g
<b>A</b>	1	1.0	0.7	
	2	1.1	0.7	
	3	1.2	0.9	
<b>B</b>	4	1.2	0.9	
	5	1.1	0.9	
	6	1.3	1.1	
<b>C</b>	7	1.4	1.2	
	8	1.2	1.1	
	9	1.2	1.1	
<b>D</b>	10	1.3	1.3	
	11	1.5	1.4	
	12	1.4	1.4	

Fig. 4.2

(a) Complete Fig. 4.2 to show the mass lost by each leaf. [2]

(b) (i) Calculate the average loss of mass for each group of leaves and write your answers in Fig. 4.3.

group	space for calculation	average mass loss / g
<b>A</b>		
<b>B</b>		
<b>C</b>		
<b>D</b>		

**Fig. 4.3** [4]

(ii) Compare the results for groups **A** and **D**. Was the grease effective in preventing water loss? Explain your answer.

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

(iii) Compare the results for groups **B** and **C**. Which surface, upper or lower, allowed the greater amount of water loss? Use the results to explain your answer.

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

(iv) Use your knowledge of leaf structure to explain the results described in (iii) above.

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

5 An experiment is done to investigate the heat energy needed to melt ice.

- A sample of 50g of ice at a temperature of  $0^{\circ}\text{C}$  is placed in an insulated beaker.
- Eight test-tubes each containing  $10\text{ cm}^3$  of water are placed in a water bath at  $80^{\circ}\text{C}$ .
- One of the test-tubes of water at  $80^{\circ}\text{C}$  is poured into the ice, the mixture is stirred for 20 seconds and the temperature of the mixture is measured and recorded in Fig. 5.1.
- This is repeated until all eight of the test-tubes of hot water have been added.

number of $10\text{ cm}^3$ portions of hot water added	0	1	2	3	4	5	6	7	8
temperature of mixture/ $^{\circ}\text{C}$	0	0	0	0	0	0			

Fig. 5.1

The last three temperature readings are shown in Fig. 5.2.

(a) Read the thermometers in Fig. 5.2 and record the temperatures in Fig. 5.1. [3]

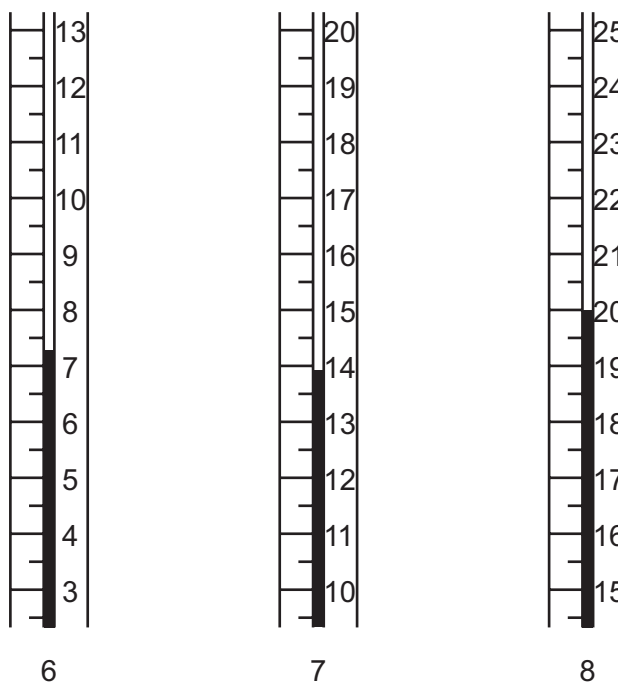
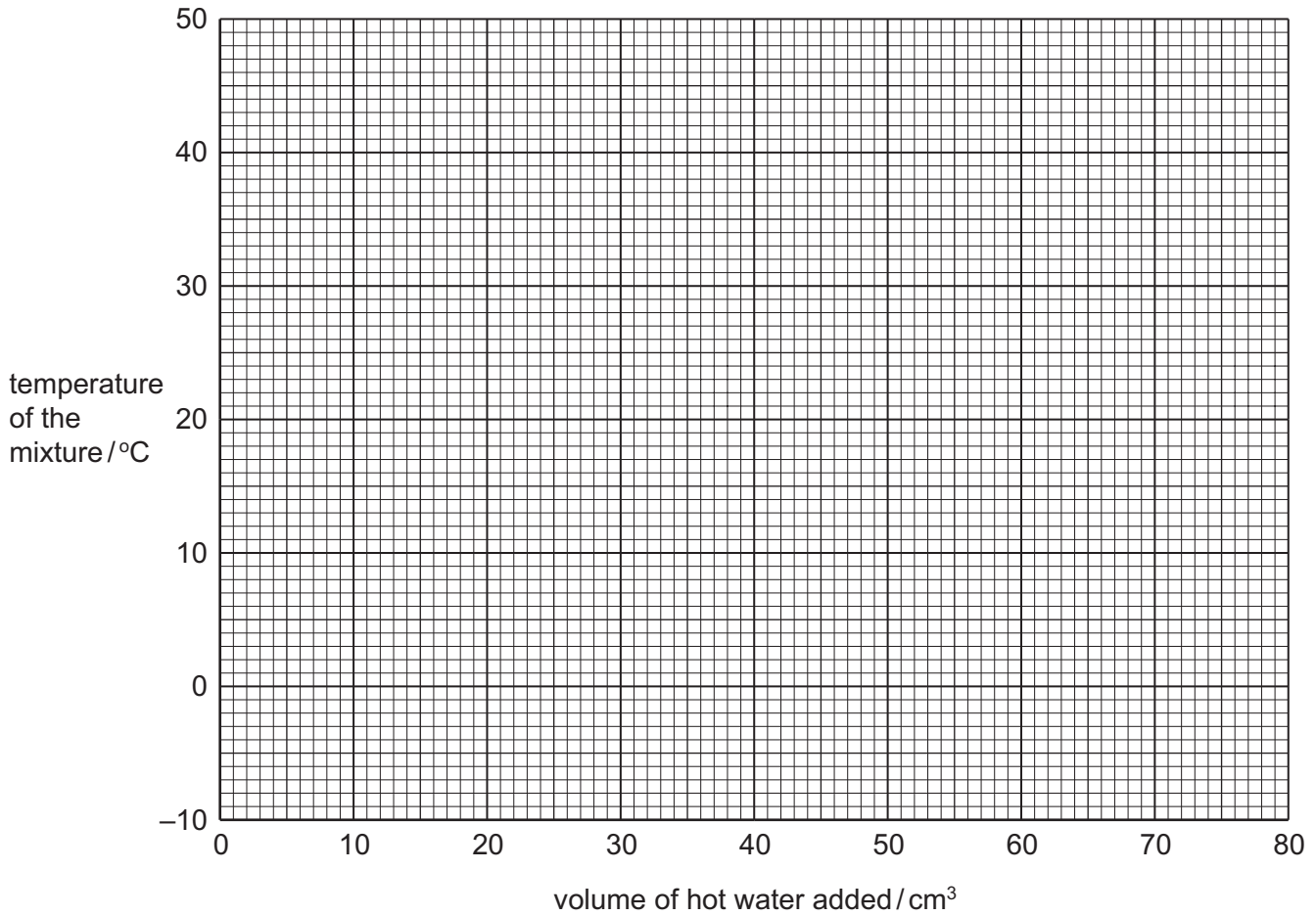


Fig. 5.2

- (b) On the grid provided, plot a graph of temperature of the mixture (vertical axis) against volume of hot water added. [3]



- (c) (i) Explain why the temperature of the mixture did not rise until six portions of hot water had been added.

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

- (ii) From your graph, find the minimum volume of hot water needed to just melt the 50 g of ice. Show this volume by marking **m** on the horizontal axis of the graph.

volume of hot water needed = .....cm<sup>3</sup> [1]

- (d) Calculate the amount of heat energy needed to just melt the 50 g of ice, using the equation below.

$$\begin{array}{l} \text{heat energy needed} \\ \text{to melt the ice/J} \end{array} = \begin{array}{l} \text{volume of hot water} \\ \text{added/cm}^3 \end{array} \times \begin{array}{l} \text{temperature of hot} \\ \text{water/}^\circ\text{C} \end{array} \times 4.2$$

heat energy needed to melt the ice = .....J [2]

- 6 A student does an experiment to find out how much air dissolves in water. He takes a flask full of clear water from a mountain stream. He boils the water in the apparatus shown in Fig. 6.1.

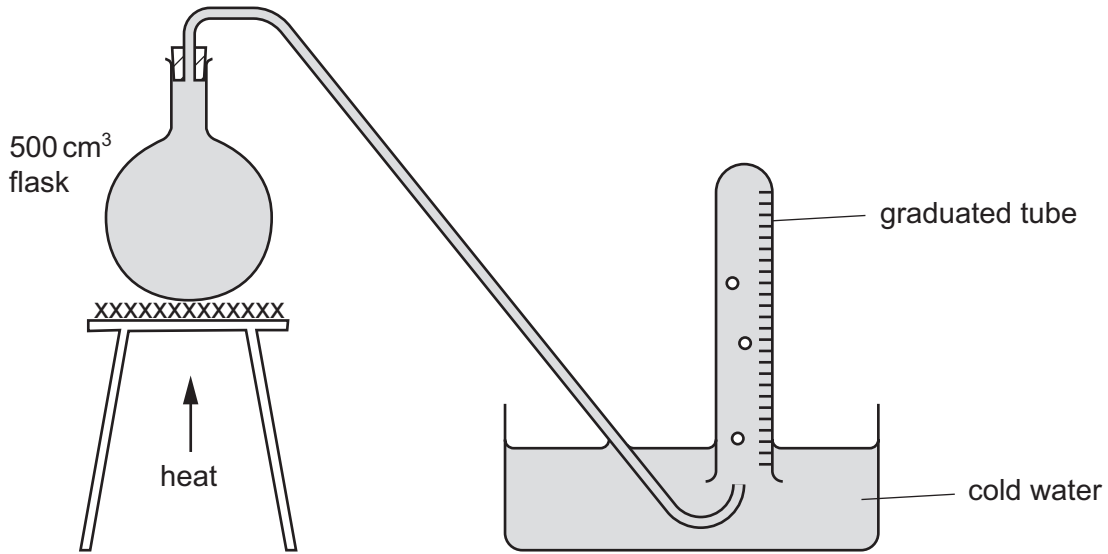


Fig. 6.1

The student places the graduated tube over the end of the delivery tube. Then he heats the flask until the water is boiling. Bubbles of air come out of the boiling water and are collected in the graduated tube. The student stops heating when no more bubbles are seen.

- (a) What is contained in the graduated tube before the student places it over the end of the delivery tube?

..... [1]

- (b) What happens to the steam produced when the water in the flask boils?

..... [1]

- (c) Fig. 6.2 shows the scale of the graduated tube containing the air. Read and record the volume of air.

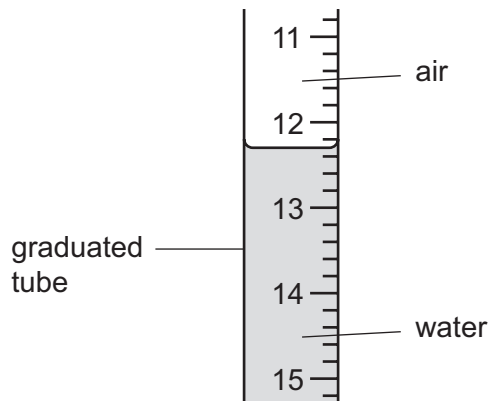


Fig. 6.2

volume of air = ..... cm<sup>3</sup> [1]

The student ties some iron filings into a cloth bag and fixes it on the end of a piece of wire. Making sure that no air escapes from the graduated tube, he pushes the bag on the end of the wire up into the tube. See Fig. 6.3.

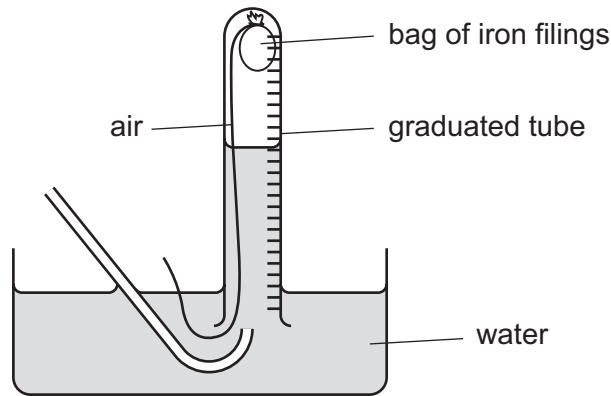


Fig. 6.3

After 24 hours, the student carefully removes the bag of iron filings from the tube, making sure that no air escapes. He sees that the iron has rusted.

- (d) Fig. 6.4 shows the scale of the graduated tube. Read and record the volume of air left after the iron has rusted.

volume of air left = ..... cm<sup>3</sup> [1]

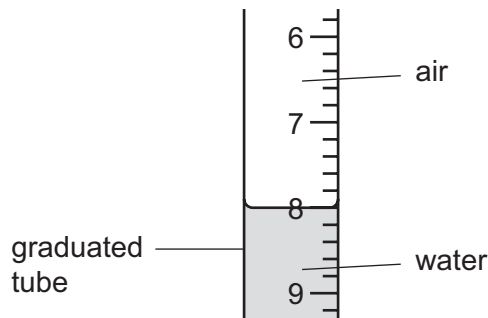


Fig. 6.4

- (e) (i) Calculate the volume of oxygen removed by the iron when it rusted.

volume of oxygen removed = ..... cm<sup>3</sup> [1]

- (ii) Calculate, to the nearest whole number, the percentage by volume of oxygen in the original sample of air.

percentage of oxygen = .....% [2]



(f) Normal air contains about 20% of oxygen and 79% of nitrogen.

(i) Compare this with the result you have obtained in (d)(ii).  
Which is more soluble in water, oxygen or nitrogen? Explain your answer.

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

(ii) Explain why the solubility of oxygen in water is important to aquatic plants and animals.

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



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