	Centre Number	Candidate Number
Candidate Name ______________________		

International General Certificate of Secondary Education
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

COMBINED SCIENCE 0653/6
CO-ORDINATED SCIENCES 0654/6

PAPER 6 Alternative to Practical

OCTOBER/NOVEMBER SESSION 2001 1 hour

Candidates answer on the question paper.
No additional materials are required.

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
1	
2	
3	
4	
5	
6	
TOTAL	

This paper consists of 15 printed pages and 1 blank page.

SB (CW/JG) SO2905/4

1 A student was investigating the rate of loss of heat energy from animals with different body shapes. He set up two models of animals using the following apparatus.

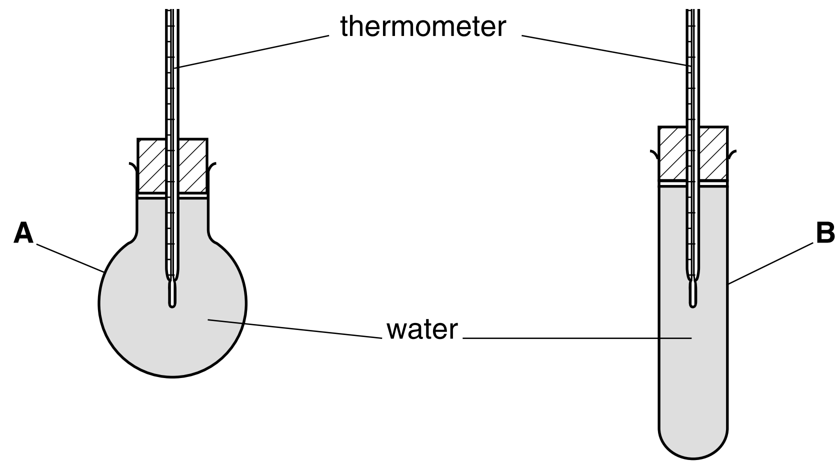

Fig. 1.1

When full, both models held the same volume of water.

- The student filled the containers with water and heated them both to 80 °C.
- He then left them to cool.
- He read both thermometers again after 20 minutes.

(a) How do the two body shapes of these models differ in surface area?

....

....[1]

(b) The thermometers in Fig. 1.2 show the temperatures after 20 minutes.

Write down the temperatures in the spaces provided.

A ....   **B** ....   [2]

Fig. 1.2

For Examiner's Use

(c) The temperature of the water in both models was 80 °C at the start of the investigation.

Calculate the fall in temperature for each model.

A ....

B ....[2]

(d) (i) Which model lost more heat energy during the first 20 minutes? ....[1]

(ii) What conclusion can you come to about the effect of body shape on the loss of heat energy from these model animals?

....

....[1]

(iii) Suggest an explanation for your conclusion.

....

....[1]

(e) State what will happen to the temperatures of the containers over the next few hours.

....

....[1]

(f) Name the process by which animals can produce heat energy from food.

....[1]

2 A ray box produces a beam of light 0.5 cm wide. The light falls on a mirror set at an angle to the beam. The ray box and mirror are placed on a sheet of paper, as shown in Fig. 2.1.

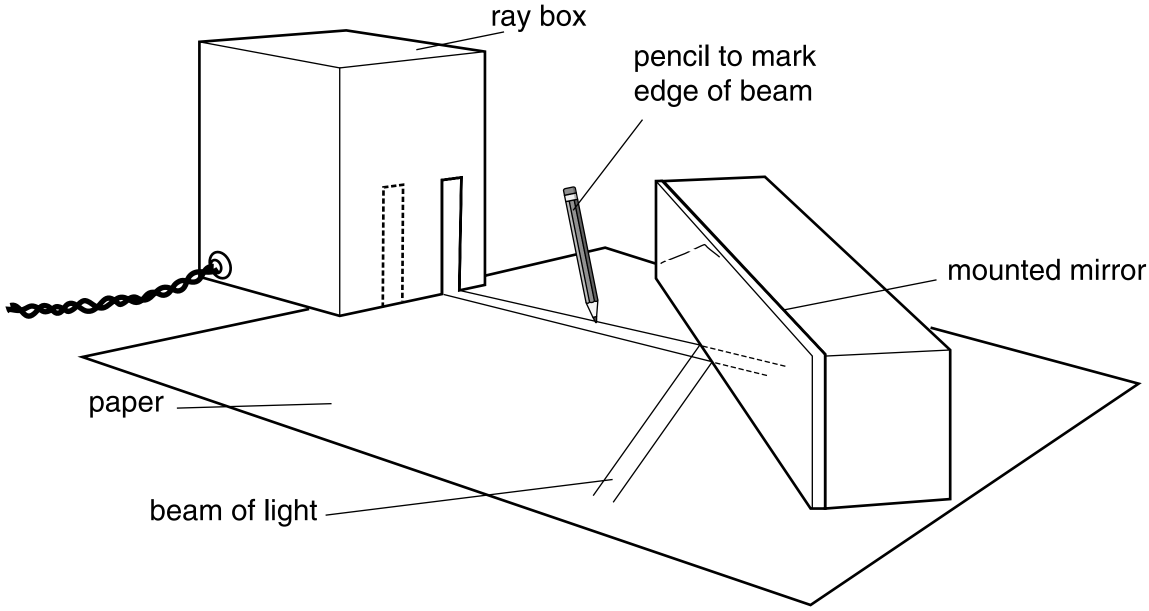

Fig. 2.1

On the paper, a student marks the position of the mirror. He draws a ray of light at each edge of the beam. He has not finished the diagram.

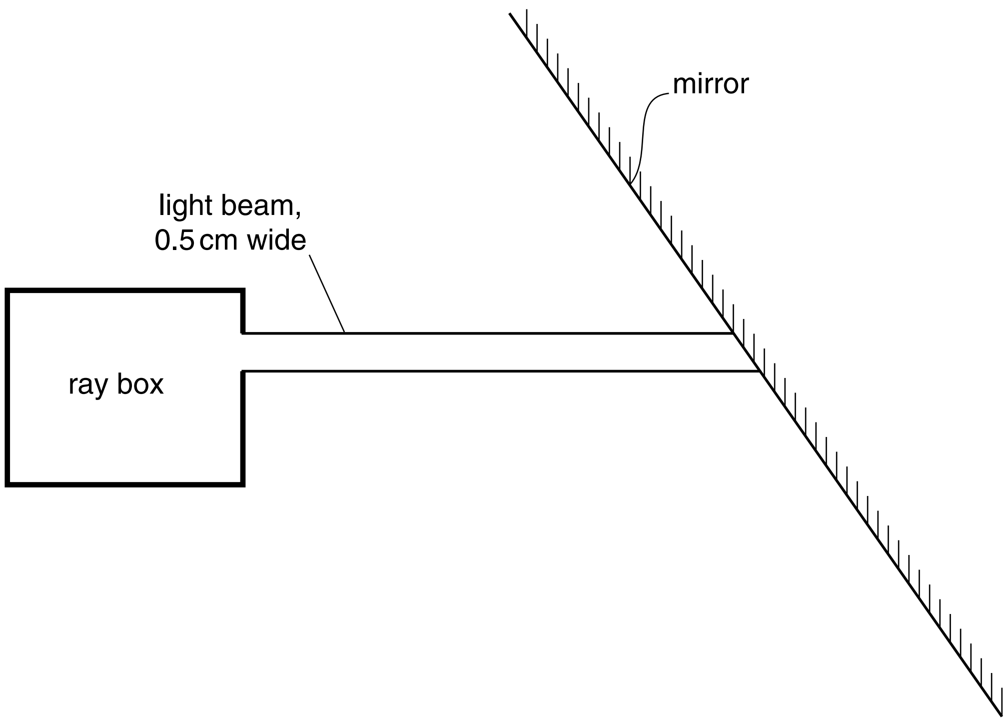

Fig. 2.2

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(a) **(i)** On the diagram, Fig. 2.2, draw a line at right-angles to the mirror (the normal) at the point where one ray meets the mirror. [1]

(ii) On the diagram, Fig. 2.2, clearly mark the angle of incidence of the ray. [1]

(iii) Measure, in degrees, the angle of incidence that you have marked in **(a)(ii)**.

angle of incidence = ... degrees [1]

(iv) Complete the diagram, Fig. 2.2, to show, as accurately as you can, the reflected rays at each edge of the beam. [1]

(b) The ray box is altered so that it produces two parallel beams. A convex lens is placed on the paper and the rays passing through the lens are marked. As before, the student has not finished the diagram, Fig. 2.3.

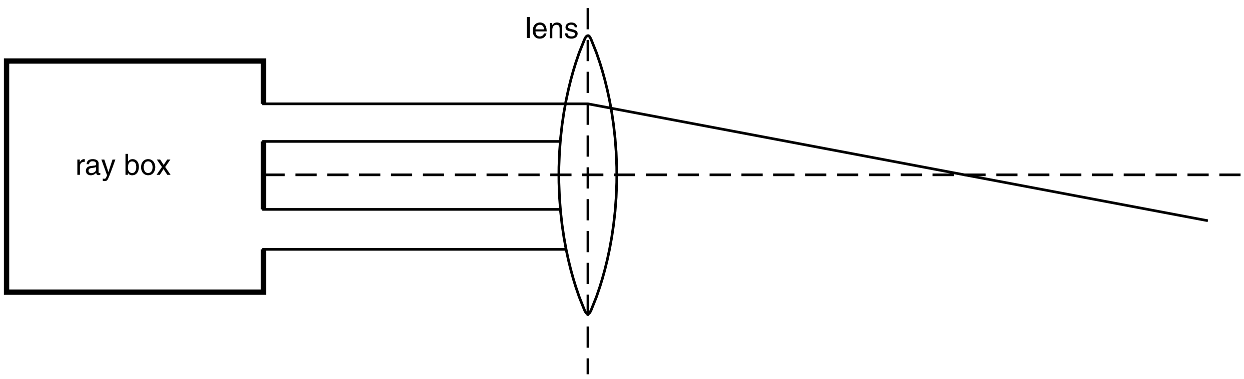

Fig. 2.3

(i) A ray at the edge of one of the beams of light has already been drawn.

Complete the diagram, Fig. 2.3, to show both of the beams of light passing through the lens. [1]

(ii) On the diagram, Fig. 2.3, clearly mark the focal length of the lens. [1]

(iii) Measure the focal length of the lens to the nearest millimetre.

focal length = ... mm [1]

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(c) The convex lens is replaced by a parallel-sided glass block, as shown in Fig. 2.4.

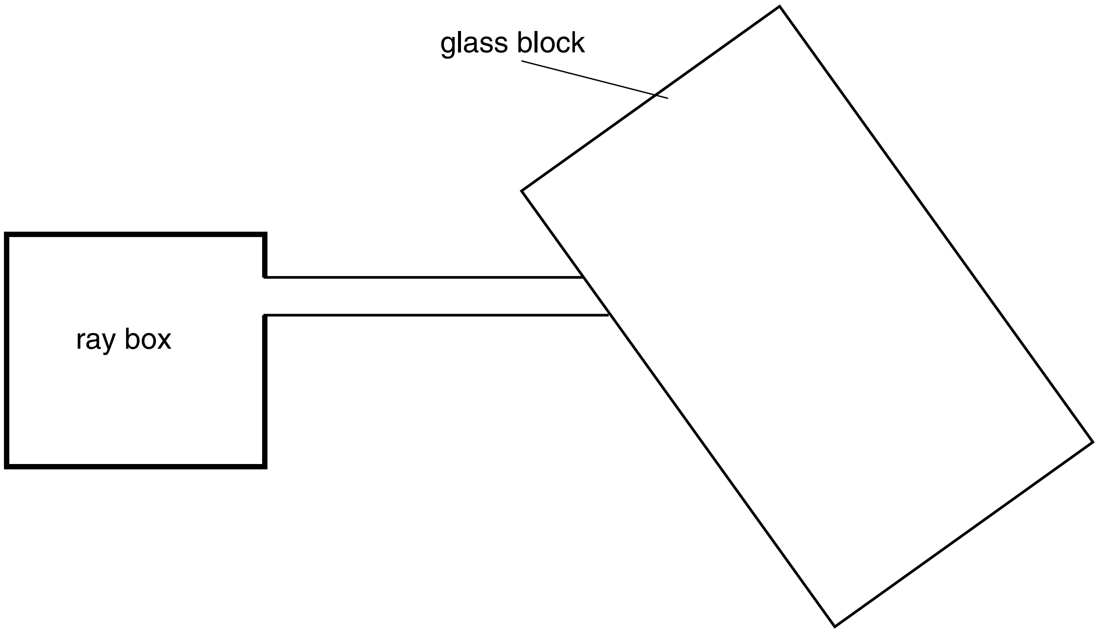

Fig. 2.4

Complete Fig. 2.4 to show how the beam passes **into** and **out of** the block. [2]

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3 A student was told to analyse crystalline solid **A**, which contains two cations and one anion, using the flow chart shown in Fig. 3.1, which contains **tests 1 to 5**.

Study the flow chart and answer the questions.

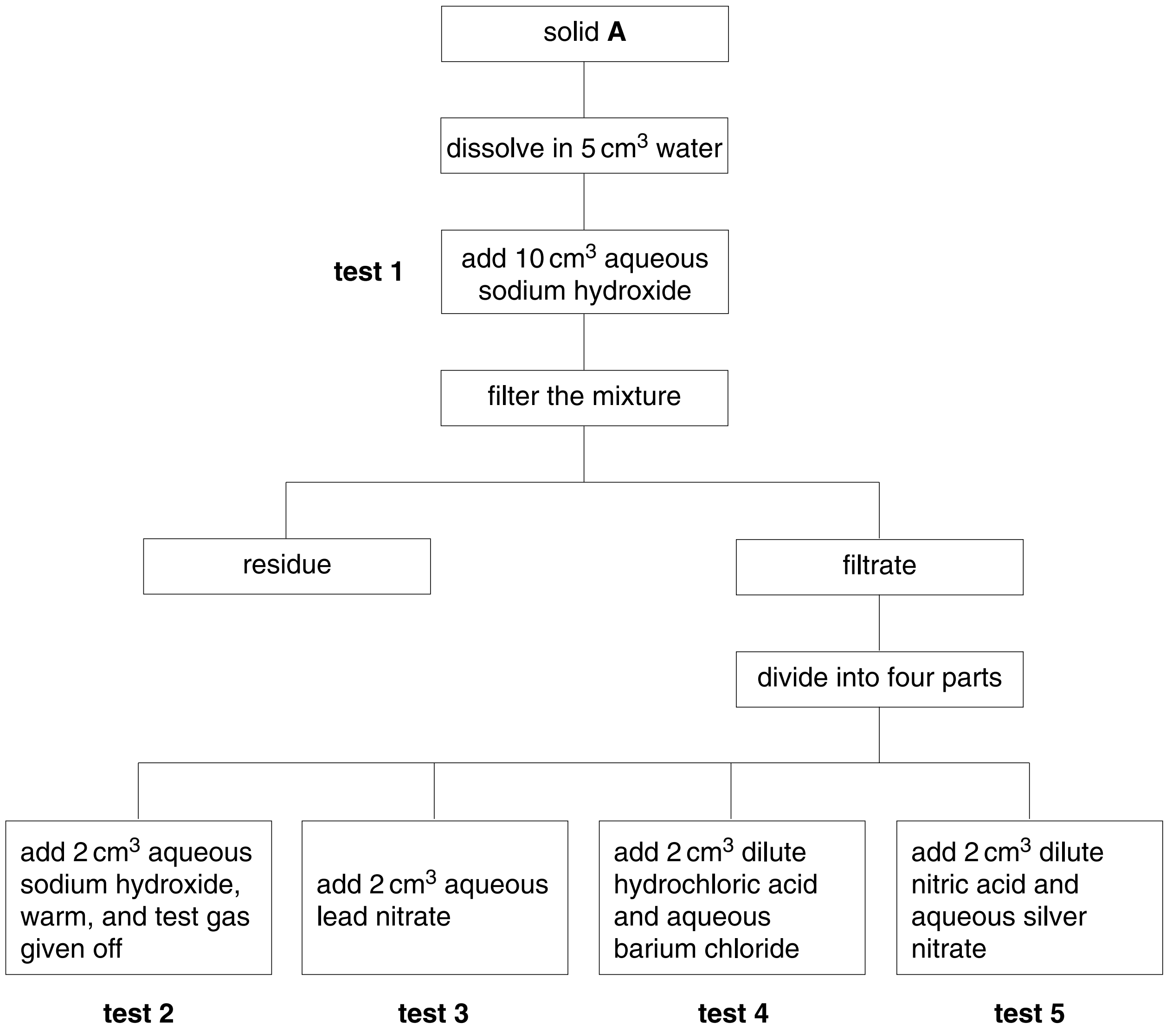


Fig. 3.1

(a) The residue from **test 1** was green.

Suggest one conclusion which can be made from this observation.

.... [1]

(b) The gas given off in **test 2** turned red litmus blue.

Name this gas.

.... [1]

(c) A precipitate was formed in **test 3**.

What is meant by the term *precipitate*?

....

....[1]

(d) A white precipitate was formed in **test 4**.

What can be concluded from this observation?

....[1]

(e) A white precipitate was formed in **test 5**.

What can be concluded from this observation?

....[1]

(f) Write the formula of **one** of the ions contained in solid **A**.

....[1]

(g) Solid **A** contains water, which forms parts of the crystal structure. This water is given off when solid **A** is heated.

Describe how you would carry out an experiment to determine the percentage of water in a sample of solid **A**. Indicate how the percentage of water can be calculated from the results of the experiment.

....

....

....

....

....

....[4]

4 A student did an experiment to find out how the force needed to move a slider along a horizontal surface varied with the weight of the slider. See Fig. 4.1.

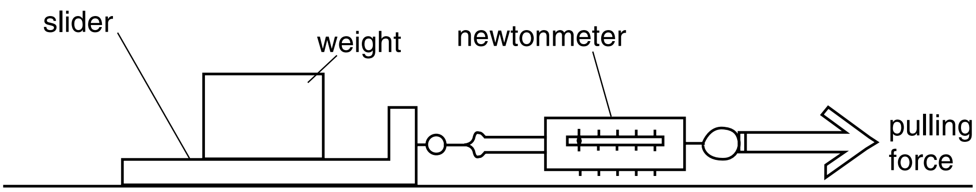


Fig. 4.1

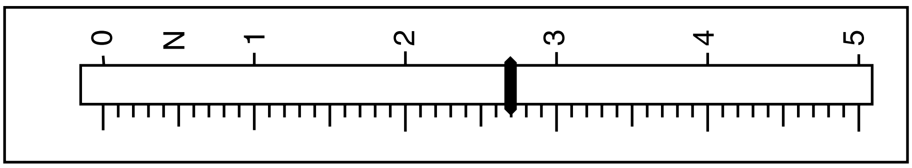
He placed a 5 N weight on the slider. He pulled it along the surface at a steady speed and noted the reading on the newtonmeter. He recorded the reading in the table, Fig. 4.2.

weight added to slider / N	5	10	15	20	25	30
pulling force / N	1.1	1.8		3.4		4.9

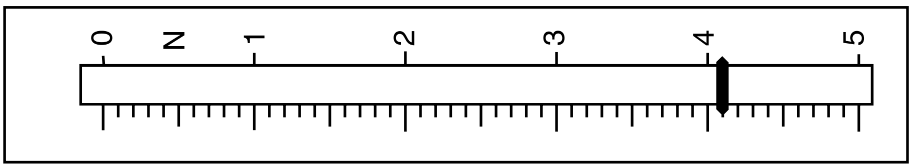
Fig. 4.2

He found the pull needed using weights up to 30 N on the slider.

(a) Fig. 4.3 shows the newtonmeter scale using two of the weights.



weight added = 15 N



weight added = 25 N

Fig. 4.3

For each weight, read the scale and record the force needed in Fig. 4.2. [2]

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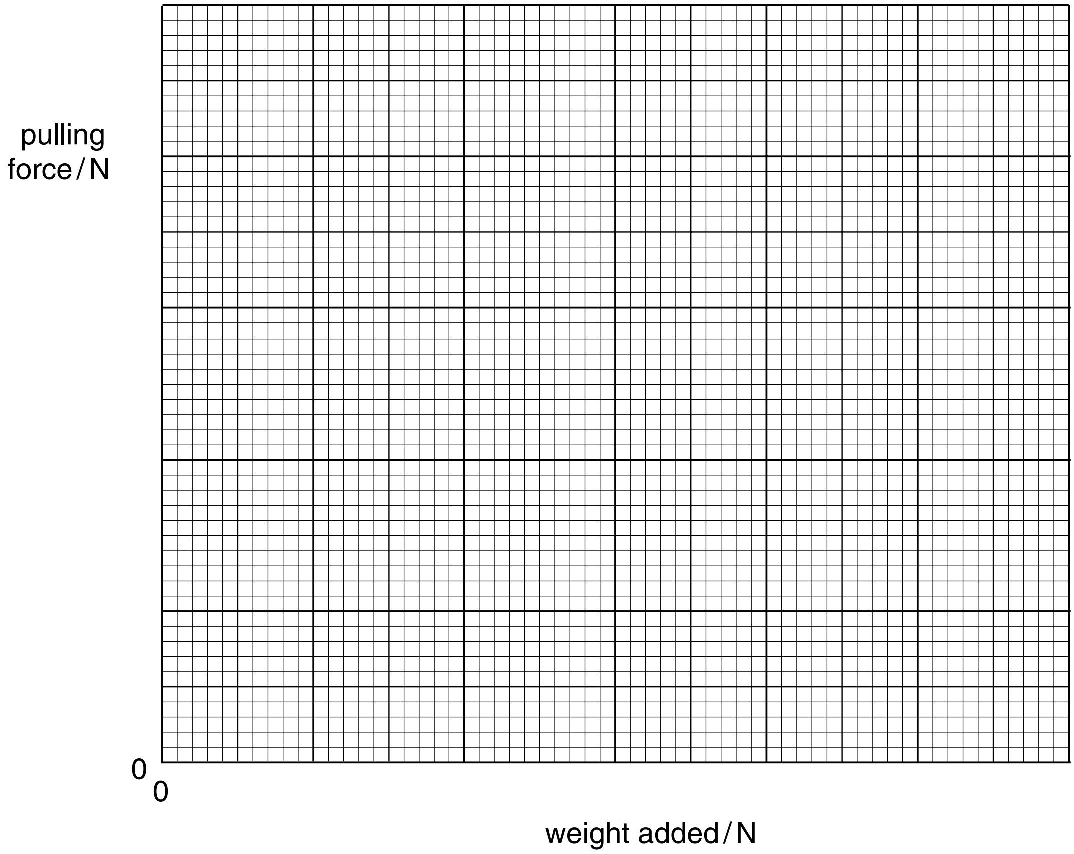
(b) On the grid, Fig. 4.4, plot a graph of pulling force against weight added. Draw the best straight line to fit the points plotted.



[3]

Fig. 4.4

(c) Describe the relationship between the force and the weight.

....[1]

(d) Use your graph to comment on whether the weight of the slider alone affected the results.

....

....[1]

(e) Calculate the slope of the line, showing **on the graph** how you do this.

....[2]

(f) It was suggested that the temperature of the slider increases as it is pulled along the surface.

Describe an experiment you could do to test this suggestion.

....

....

....

....[2]

5 A student carried out an experiment using Visking tubing. Visking tubing acts as a partially permeable membrane. It allows small molecules to pass through it but large molecules are either too big to pass through or they pass through very slowly.

The student was provided with two solutions, labelled **A** and **B**, **one** of which contained starch. She was asked to find out which solution contained starch and to come to some conclusions about molecular size.

The student was given two pieces of Visking tubing of the same length.

- She took one of the pieces of Visking tubing and tied it firmly with cotton at one end.
- She then filled it with solution **A**. She tied the top securely with cotton and rinsed the outside thoroughly.
- She placed the filled Visking tubing in a beaker of water.
- She repeated this procedure with solution **B**, placing it in a different beaker.
- She added enough iodine solution to the water in both beakers so that the brown colour could be seen in the water.
- She left the beakers for approximately 10 minutes.

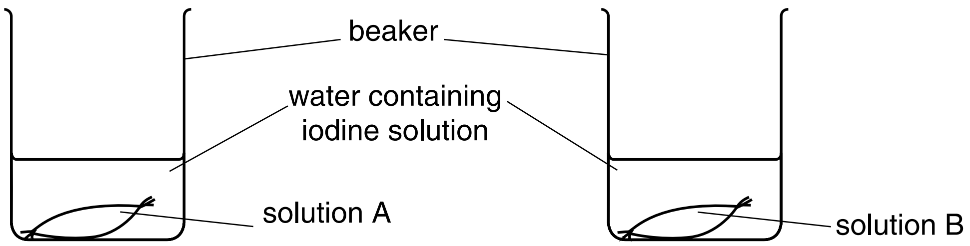


Fig. 5.1

After 10 minutes, the water in the beakers was still brown. She removed the pieces of Visking tubing from the beakers, rinsed them with water and looked carefully at them.

(a) (i) Complete the table which summarises the results.

solution	observations of Visking tubing contents	conclusion
A		starch present
B	no change	

[2]

(ii) How do these observations suggest that starch molecules are larger than iodine molecules?

....

....[2]

(b) The wall of the small intestine is partially permeable. Visking tubing can therefore be used to show why digestion is necessary.

(i) In Fig. 5.1, the Visking tubing represents the intestine wall. The starch solution represents the food molecules inside the small intestine.

What does the water in the beaker represent?

....[1]

(ii) Why do the starch molecules need to be digested?

....[1]

(c) The student was provided with two further solutions, **C** and **D**. One of these contained just starch. The other contained a mixture of starch and the reducing sugar glucose. She wanted to find out which solution, **C** or **D**, contained glucose.

- She put samples of the two solutions in Visking tubing and covered them with water in beakers, as in the first part of the experiment.
- She waited for one hour, then tested the water in each beaker for reducing sugar. She took a sample of the water surrounding solution **C**, put it into a test-tube, then added an equal volume of Benedict's solution. She put the tube into a boiling water bath.
- She did the same with a sample of the water surrounding solution **D**.
- After a few minutes, she examined the tubes.

(i) Complete the results table.

	result of Benedict's test	is glucose present?
water around solution **C**		no
water around solution **D**		yes

[2]

(ii) Why did she test the water in the beaker for reducing sugar?

....

....[1]

(iii) Does glucose need to be digested? Explain your answer.

....

....[1]

6 An experiment was done to find out how dry breathed-out air differs from ordinary air. Two samples of air were analysed using the apparatus shown in Fig. 6.1.

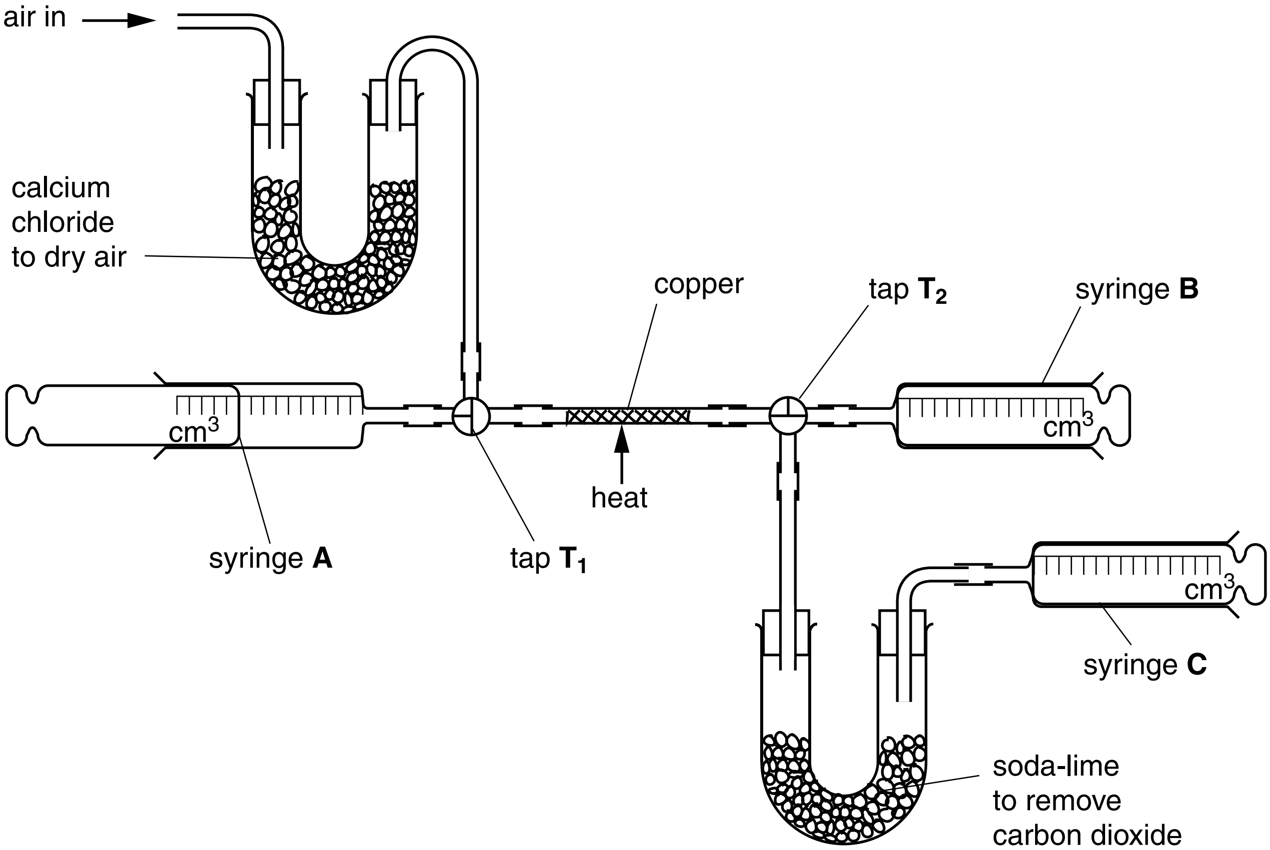


Fig. 6.1

(a) Analysis of ordinary air

- 100 cm^3 of air was drawn into syringe **A** through the U-tube of calcium chloride. The calcium chloride dried the air.
- Taps $\mathbf{T_1}$ and $\mathbf{T_2}$ were turned so that this air could pass through the heated copper into syringe **B**. Part of the air was absorbed by the hot copper.
- The air was passed from syringe **B** into syringe **A** and back again until the volume was constant. This volume was measured in syringe **B** and recorded in the table, Fig. 6.2.
- Tap $\mathbf{T_2}$ was turned and the remaining gas was pushed from syringe **B**, through the soda-lime tube, into syringe **C**. The soda-lime removed carbon dioxide from the air. The final volume was measured in syringe **C** and recorded in Fig. 6.2.

air used	volume / cm^3		
	in syringe **A**	in syringe **B**	in syringe **C**
ordinary air	100	80	79.5
breathed-out air	100		

Fig. 6.2

(i) The hot copper reacted with one of the gases in the air.

Name this gas.

....[1]

(ii) Name **one** of the gases left in syringe **C** at the end of the experiment.

....[1]

(b) Analysis of breathed-out air

The experiment was repeated, but this time a student blew gently into the apparatus. 100 cm^3 of his breath was dried and passed into syringe **A**, as shown in Fig. 6.3.

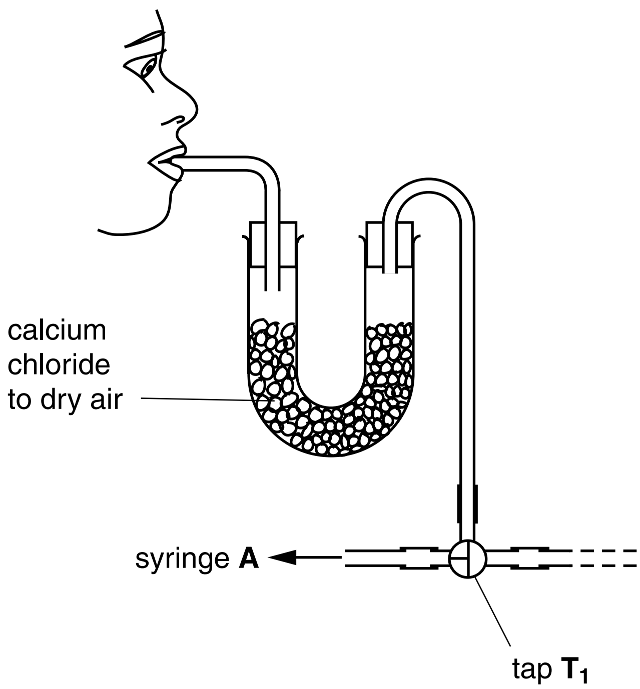


Fig. 6.3

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Fig. 6.4 shows a part of each of the scales of syringe **B** and syringe **C** during this experiment.

Read the volumes in the syringes and record them in Fig. 6.2. [2]

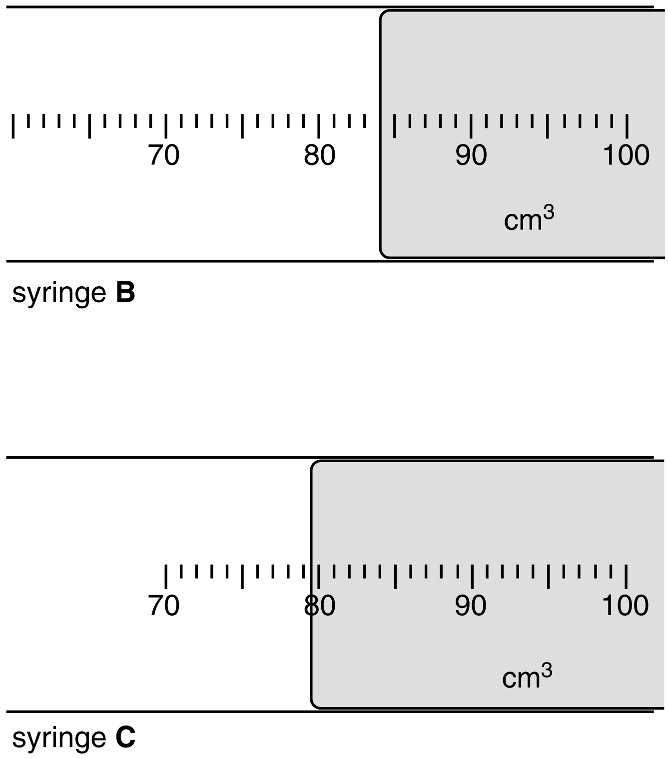

Fig. 6.4

(c) Suggest two differences between the dried breathed-out air and the dried ordinary air. Show how you used the data in the completed table, Fig. 6.2, to obtain your answers.

difference 1 ....

....

....

difference 2 ....

....

....[4]

(d) Explain how the results of these experiments show that gaseous exchange occurs in the lungs.

....

....

....[2]