UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

9079499950

COMBINED SCIENCE **0653/63**

Paper 6 Alternative to Practical **October/November 2012**

1 hour

Candidates answer on the Question paper

No Additional Materials are 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.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

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	
3	
4	
5	
6	
Total	

This document consists of **19** printed pages and **1** blank page.

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UNIVERSITY of CAMBRIDGE
International Examinations

1 The apparatus in Fig. 1.1 was set up to investigate factors affecting the rate of water loss from a plant shoot.

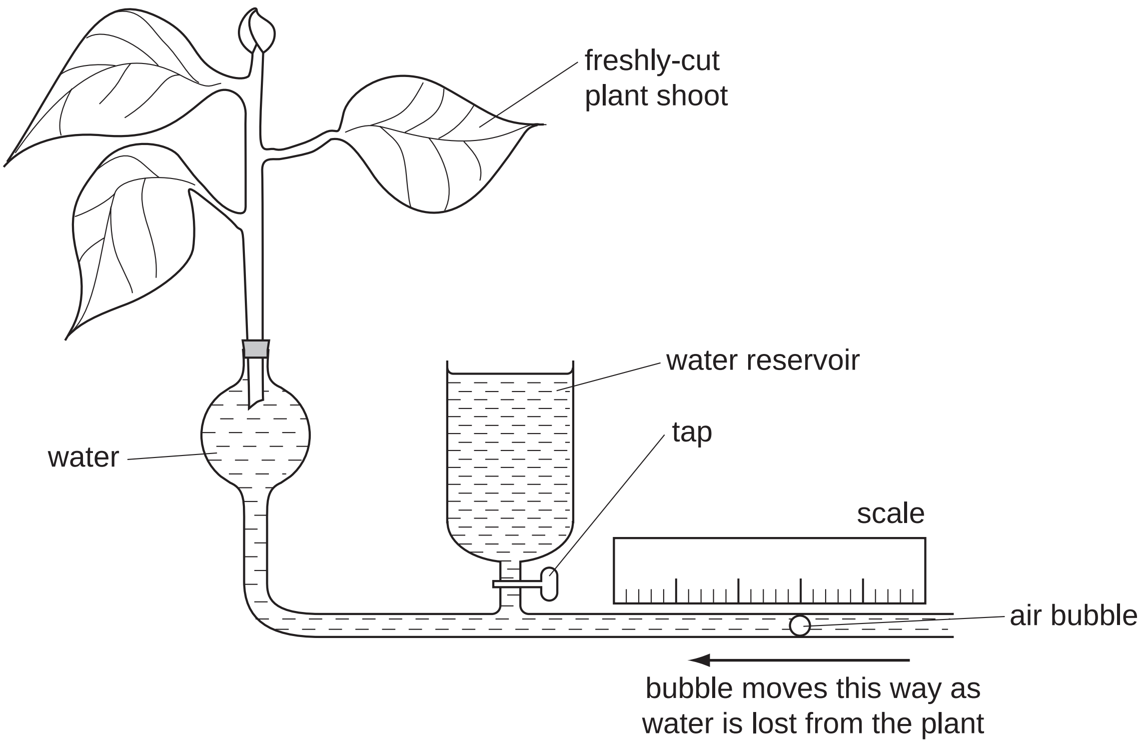

Fig. 1.1

The apparatus was filled with water, and a freshly-cut plant shoot was placed in it as shown. As the shoot loses water by transpiration, water moves into it from the glass tubing to replace that lost. The rate of water uptake is measured by measuring the rate of movement of the air bubble, using the scale. After each trial, the air bubble can be moved back by opening the tap of the water reservoir.

Measurements were made with the plant shoot

- in still air,
- in moving air (using a fan).

(a) In each case, after putting the plant into the apparatus, the experimenter waited ten minutes before taking any measurements.

Explain why it was important to wait for ten minutes.

....

....

.... [1]

Some of the results from experiments using this apparatus are shown in Table 1.1 and Table 1.2. In each case, the **middle** of the bubble was taken as its position on the scale.

Table 1.1

experiment	position of bubble in still air		
	start / mm	after 5 mins / mm	distance moved / mm
1	2	5	3
2	0	4	
3	2	4	
average			

Table 1.2

experiment	position of bubble in moving air		
	start / mm	after 5 mins / mm	distance moved / mm
4	1	8	7
5	3	9	
6			
average			

(b) Fig. 1.2 shows the positions of the air bubble at the beginning and at the end of experiment **6** in moving air.

Read off the positions and record the readings in Table 1.2. [2]

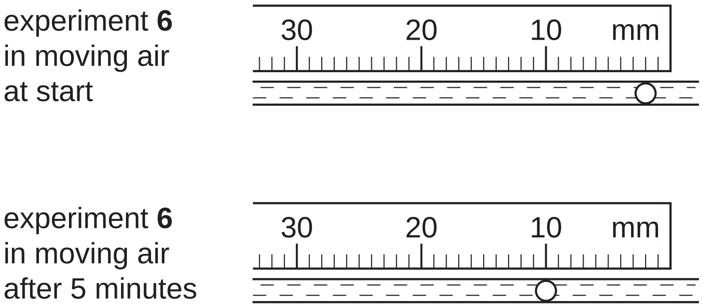

Fig. 1.2

(c) Complete the tables to show the distances moved by the bubble in experiments **2**, **3**, **5** and **6** and calculate the average distance moved in each case. [3]

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(d) Using the information in Table 1.1 and Table 1.2, state how air movement affects the rate of transpiration of this cut shoot.

....

....

.... [1]

(e) Suggest **one** condition that should be kept constant during this experiment.

....

.... [1]

(f) Explain why three experiments were carried out for each environmental condition, rather than just one.

....

....

.... [1]

(g) Suggest a possible reason why the amount of water taken up by the plant shoot may **not** be exactly the same as the amount lost by transpiration.

....

....

.... [1]

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2 The science teacher is doing experiments with aluminium. He has three samples of aluminium foil, **A**, **B** and **C**, of different thicknesses.

(a) Aluminium is used to make containers for cooking food.

Suggest **two** properties of aluminium metal that make it suitable for this use.

1 ....

2 .... [2]

(b) The teacher shows the class a simple experiment, using one of the pieces of foil, to prove that aluminium is a metal.

Suggest how he does this.

....

.... [1]

(c) The teacher cuts a square, size 1 cm x 1 cm, from each of the foils **A**, **B** and **C**.

- He places the square of foil **A** into a test-tube. Then he adds concentrated hydrochloric acid and fits a delivery tube.
- Hydrogen is given off. He collects the hydrogen, measures its volume and records it in Table 2.1.
- He repeats the experiment using the squares of foils **B** and **C**.

(i) Draw a diagram to show how the hydrogen gas can be collected over water in a measuring cylinder.

[2]

[Turn over

(ii) Fig. 2.1 shows the scales of the measuring cylinders containing the hydrogen given off from foils **B** and **C**.

Read the volumes and record them in Table 2.1. [2]

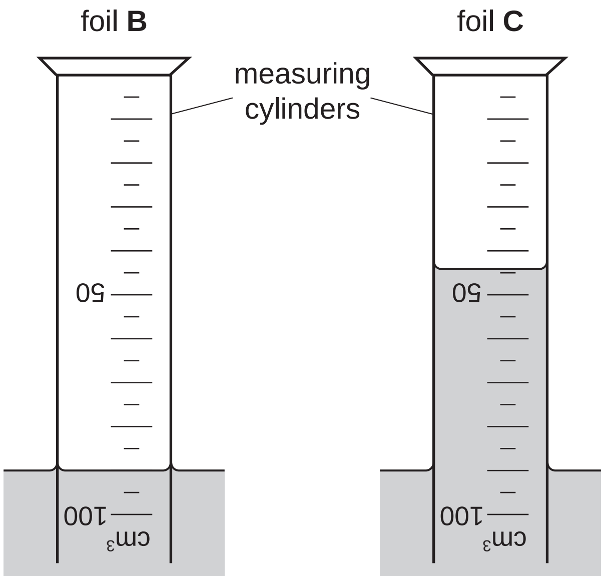

Fig. 2.1

Table 2.1

foil	**A**	**B**	**C**
volume of gas from 1 square of foil / cm^3	20		
thickness of foil / millimetres	0.06		

(d) The teacher gives the students a graph, shown in Fig. 2.2. They use the graph to find the thickness of the pieces of aluminium foil.

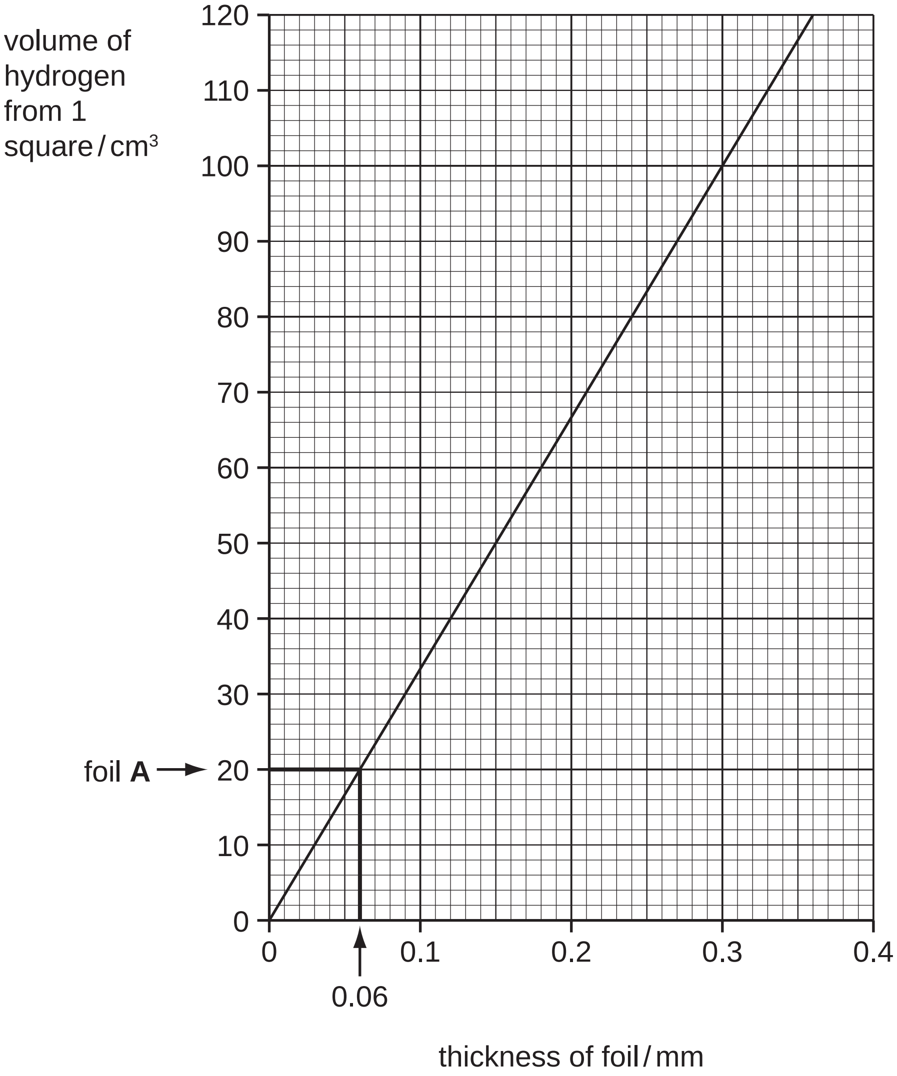

Fig. 2.2

Use the graph, Fig. 2.2, and the volumes of hydrogen from Table 2.1, to find the thickness of the foils **B** and **C** to the nearest 0.01 mm.

Foil **A** has been done for you.

Show, in the same way, on the graph how you do this for foils **B** and **C**. Record the results in Table 2.1. [3]

3 A science student is using the apparatus shown in Fig. 3.1 to investigate the relationship between the mass of a trolley and the time taken to travel along a track.

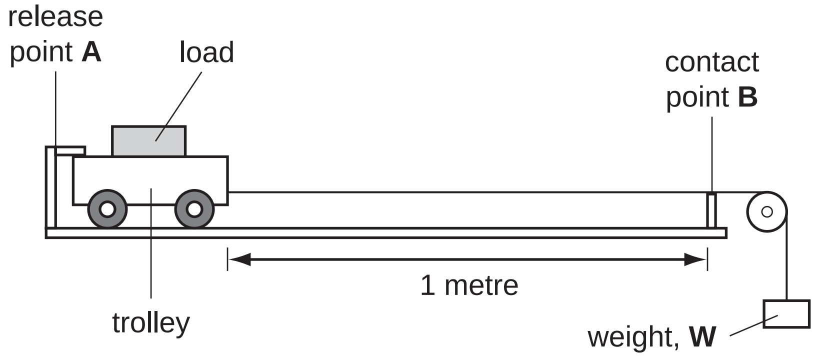

Fig. 3.1

The trolley has a mass of 100 g. It is made from a light but strong material. It can be loaded with more masses.

The weight, **W**, is a fixed mass used to accelerate the trolley along the smooth level 1 metre track.

The release mechanism at point **A** and the contact point **B** are connected to a timer.

- the student loads the trolley so that it has a total mass of 3 kg
- the trolley is released and the time taken to reach point **B** is recorded in Table 3.1
- the trolley is loaded to give a different total mass and the experiment is repeated

(a) Suggest the name of a metal or plastic that can be used to make the light, strong trolley.

.... [1]

(b) The timer displays for the two missing results are shown in Fig. 3.2.

Record the times in Table 3.1. [1]

Fig. 3.2

Table 3.1

total mass of trolley / kg	**time, *t* / s**
0.1	0.5
0.5	1.1
1.0	
2.0	
3.0	2.8

(c) (i) Plot a graph of the time taken, *t* against total mass of the trolley on the grid provided. Label the axes. Use the points to draw a smooth curve.

[3]

(ii) When the curve is extended, it does not pass through the point (0,0).

Suggest **one** reason why time, t, cannot be equal to 0.0 s.

....

....

.... [1]

(d) On the same graph grid, draw a curve that might be obtained if the mass of the weight, W, is increased. Label your curve **increased mass**. [1]

(e) (i) Name the force that causes the acceleration of the trolley.

.... [1]

(ii) State where, in the apparatus shown in Fig. 3.1, this force is acting to cause the acceleration of the trolley.

Explain your answer.

....

.... [2]

4 During digestion proteins are broken down by enzymes called proteases. This experiment is to find the effect of pH on protease activity.

- A student prepared an agar plate containing the milk protein casein. The casein makes the agar appear cloudy.
- She cut six identical wells in the agar. See Fig. 4.1.

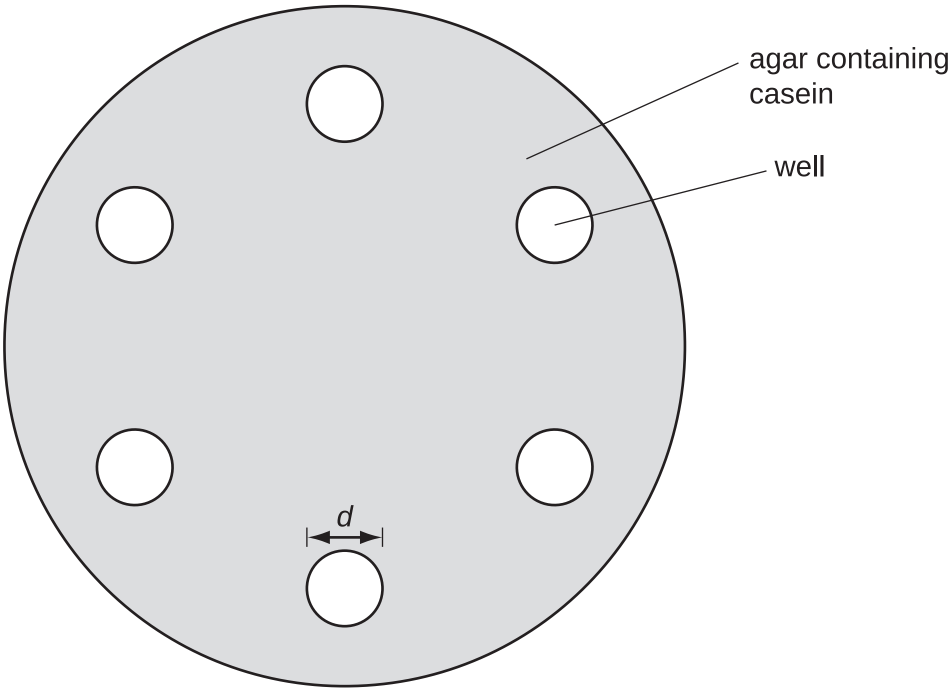

Fig. 4.1

(a) Measure the diameter, *d*, across any one of the wells.

d = ... mm [1]

- The student then prepared enzyme solutions of different pH values and added 1 cm^3 of each solution into a different well.
- She labelled the lid of the dish with the appropriate pH values, placed the lid on the dish and left it in a warm place.
- When she looked at the plate later she saw clear areas in the agar around some wells. These areas are where the protease had broken down the casein protein.

See Fig. 4.2 on page 12.

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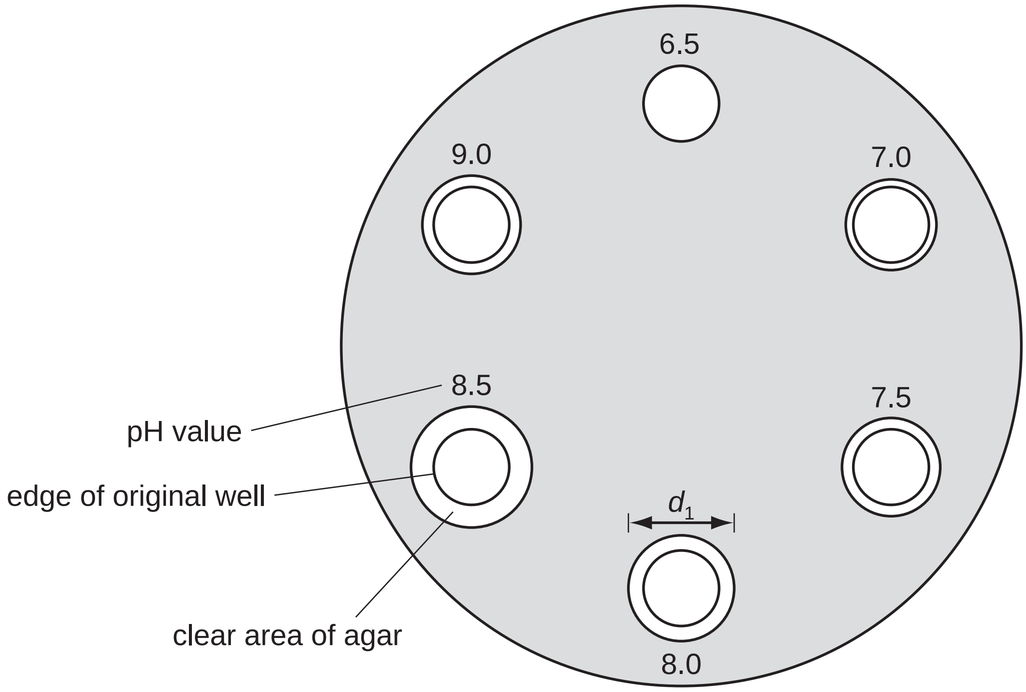


Fig. 4.2

(b) **(i)** Measure the new diameter, d_1, for each pH value as shown in Fig. 4.2.

Record your readings in the second column of Table 4.1.

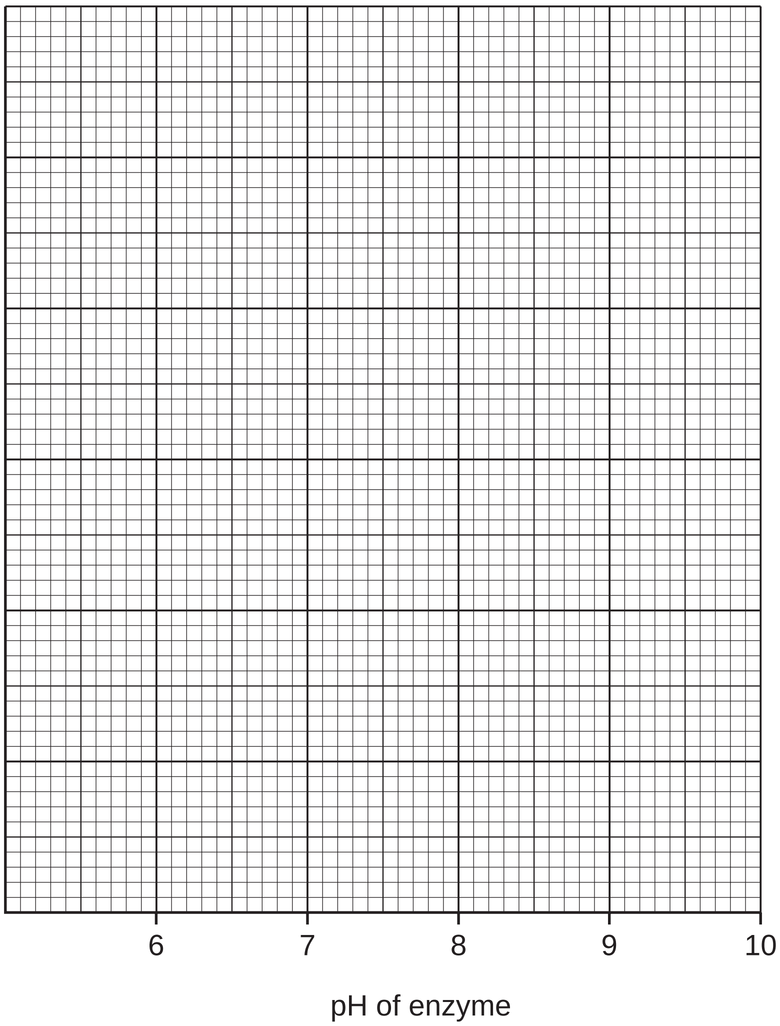
Table 4.1

pH of enzyme	d_1 (new diameter of clear area) / mm
6.5	
7.0	
7.5	
8.0	
8.5	
9.0	

[2]

(ii) Plot a graph of new diameter, d_1, against pH on the grid provided. Insert the scale and label for the vertical axis.

Draw a smooth best-fit curve.



[3]

(iii) From your graph estimate the optimum pH of the enzyme.

optimum pH = ... [1]

(iv) Describe how the student could find a more accurate value for optimum pH.

....

....

.... [2]

(c) Suggest where this protease enzyme is found in the digestive system.

.... [1]

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5 The teacher has given a student five flasks containing the solutions **A**, **B**, **C**, **D** and **E**. In the flasks are **hydrochloric acid**, **nitric acid**, **sulfuric acid**, **sodium hydroxide** solution and **ammonia** solution.

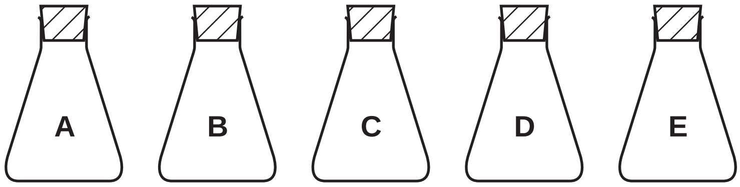

Fig. 5.1

The student must use the Test Plan, Fig. 5.2, shown on page 16 to identify the solutions. She carries out four tests on the solutions, records her observations and then names each of the solutions.

Study the Test Plan and then answer the questions on page 17.

Do not write anything on page 16.

TESTS ON FIVE SOLUTIONS, A – E
DO NOT WRITE ANYTHING ON THIS PAGE

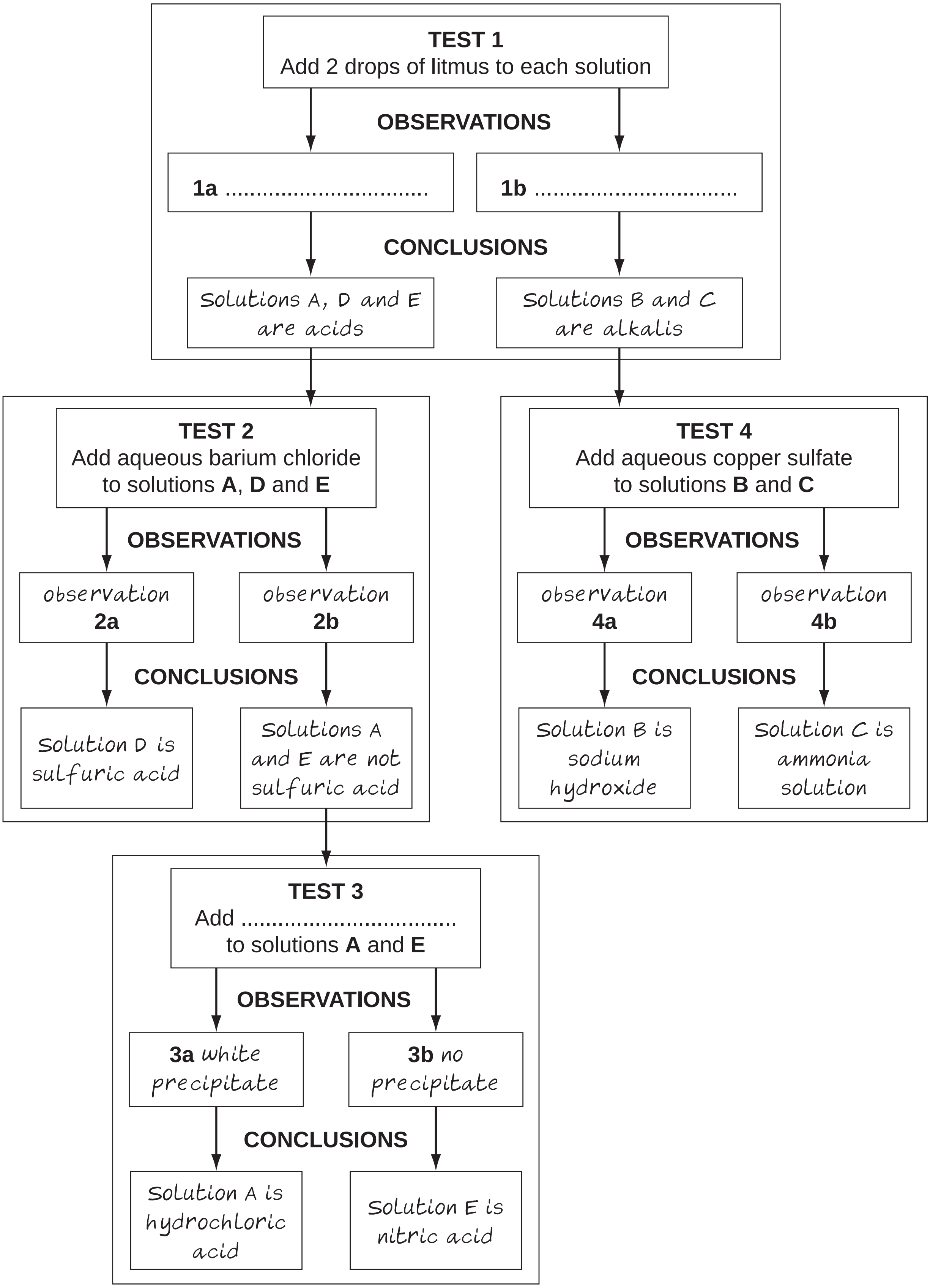

Fig. 5.2

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(a) Test 1
The student adds 2 drops of litmus to each of the five solutions.

Suggest **observations 1a** and **1b**.

1a ....

1b .... [2]

(b) Test 2
She adds aqueous barium chloride solution to solutions **A**, **D** and **E**.

Suggest **observations 2a** and **2b**.

2a ....

2b .... [2]

(c) Test 3
After she adds a reagent to solutions **A** and **E**, she sees a white precipitate and concludes that solution **A** is dilute hydrochloric acid.

Name the reagent that she has added.

.... [1]

(d) Test 4
She adds aqueous copper sulfate to solutions **B** and **C**. She concludes that solution **B** is sodium hydroxide solution and solution **C** is ammonia solution.

Suggest **observations 4a** and **4b**.

4a ....

4b .... [2]

(e) The teacher asks the student to find out which solution is more concentrated, the hydrochloric acid or the nitric acid.

Explain how she can do this, using any of the substances that she has already used in the four tests.

....

....

....

.... [3]

6 The science class is carrying out experiments on waves. They are using a long shallow tank of water.

A student dips a wooden bar into the water at one end of the tank. A wave moves along the tank. This is shown in Fig. 6.1.

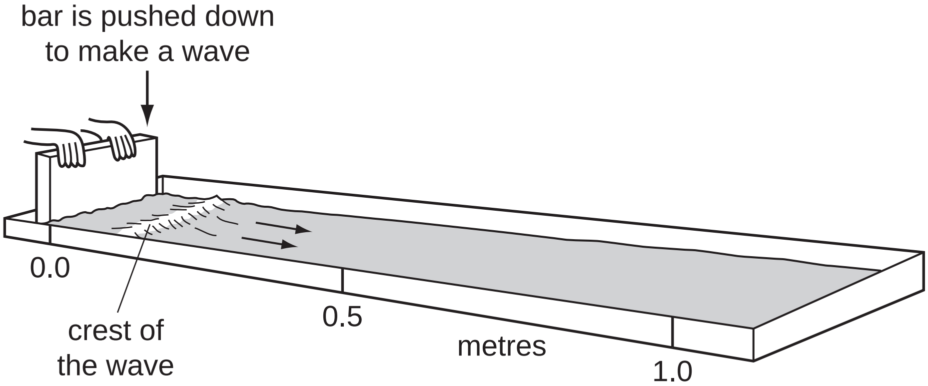

Fig. 6.1

(a) experiment 1

A timer makes a loud "tick" sound every 0.5 seconds. The student dips the bar into the tank in time with the "tick" sounds. Waves move along the tank.

A diagram of the waves as observed from above is shown in Fig. 6.2.

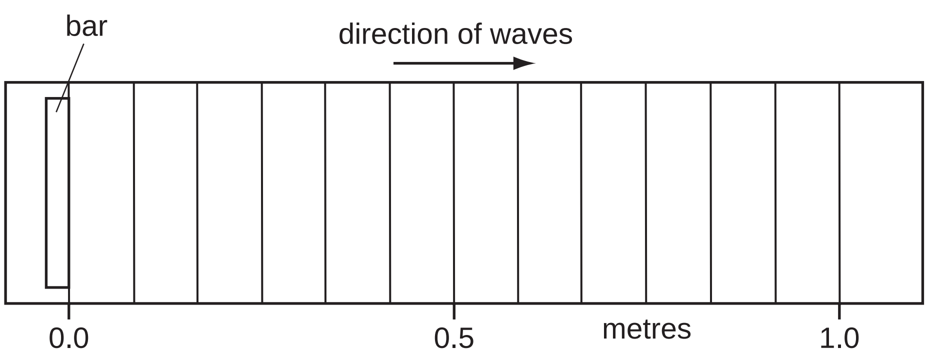

Fig. 6.2

(i) Count the number of waves in 1 metre (100 cm) of the tank.

number of waves = ... [1]

(ii) Calculate the wavelength of a wave in centimetres and convert this to metres.

wavelength = ... cm

= .... m [2]

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(iii) State the number of "ticks" that the student hears after a wave is made and while it is travelling to the 1.0 m mark.

number of "ticks" = ... [1]

(iv) State the time taken by one wave to travel 1.0 metre.

time = ... s [1]

(v) Calculate the velocity of the wave in metres per second.

velocity = ... m / s [1]

(vi) Calculate the frequency of the waves in Hertz.

frequency = ... Hz [1]

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(b) experiment 2

A barrier is placed across the tank at 45° to the side. The student watches the waves as they hit the barrier. Fig. 6.3 shows waves **1** and **2** being reflected by the barrier.

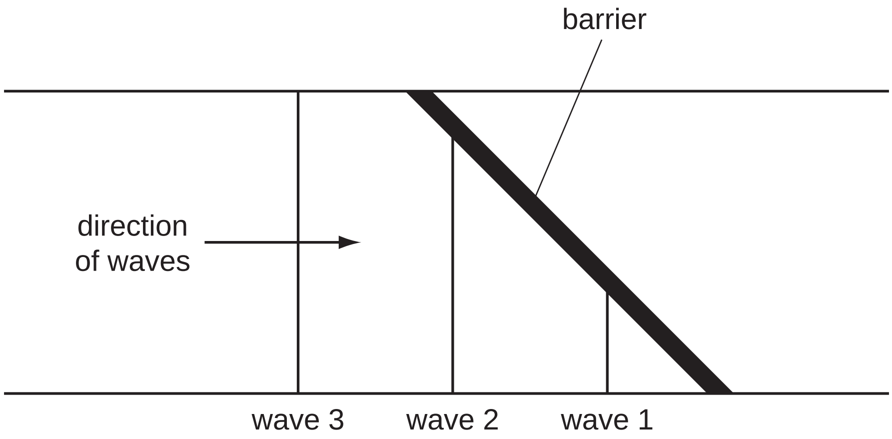

Fig. 6.3

The reflected parts of the waves **1** and **2** are missing from the diagram. On Fig. 6.3, draw the missing parts of waves so that their lengths and direction of travel are accurately shown. [2]

(c) The student thinks that the waves in the tank are like other wave forms such as light and sound. Complete Table 6.1 to show the comparison between waves in the tank, light waves and sound waves.

Table 6.1

wave form	type of wave
light waves	transverse
sound waves	longitudinal
waves in the tank	

[1]