



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

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COMBINED SCIENCE

0653/61

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 **22** printed pages and **2** blank pages.



- 1 In an experiment to investigate some of the conditions needed for seed germination, four petri dishes were set up as shown in Fig. 1.1.

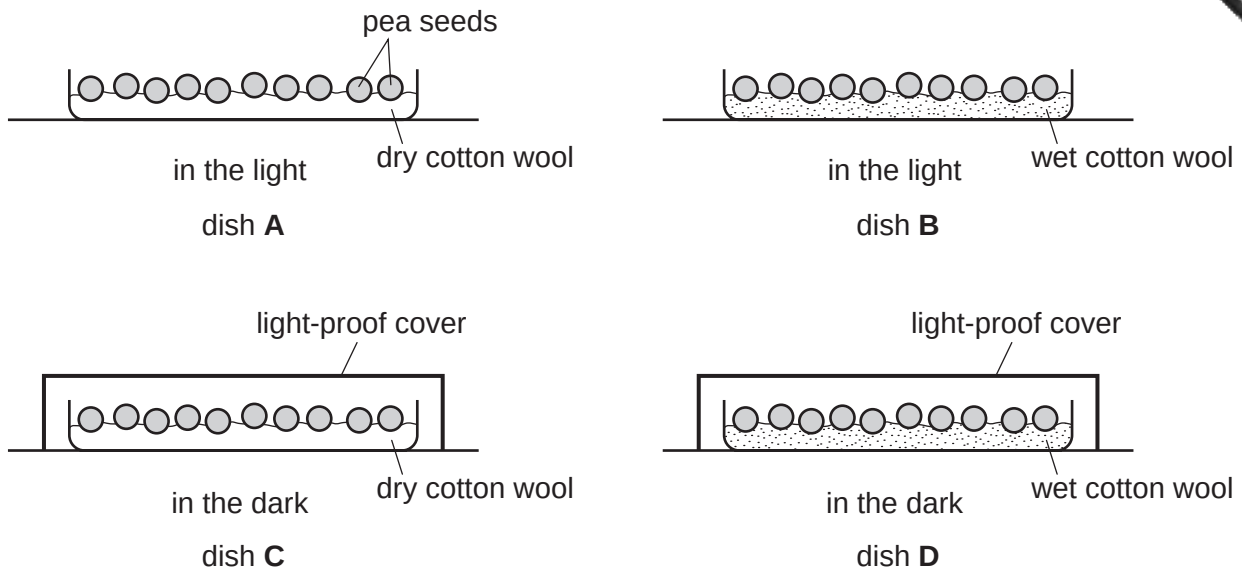


Fig. 1.1

Each petri dish contains some pea seeds. The seeds were soaked in water for 24 hours before being placed in the dishes.

The four petri dishes were treated as follows:

- Dish **A** was left in the light, with the seeds on dry cotton wool.
- Dish **B** was left in the light, with the seeds on wet cotton wool.
- Dish **C** was left in the dark, with the seeds on dry cotton wool.
- Dish **D** was left in the dark, with the seeds on wet cotton wool.

The dishes were then left for 10 days.

After 10 days, when the covers were removed, the results were as shown in Fig. 1.2.

3

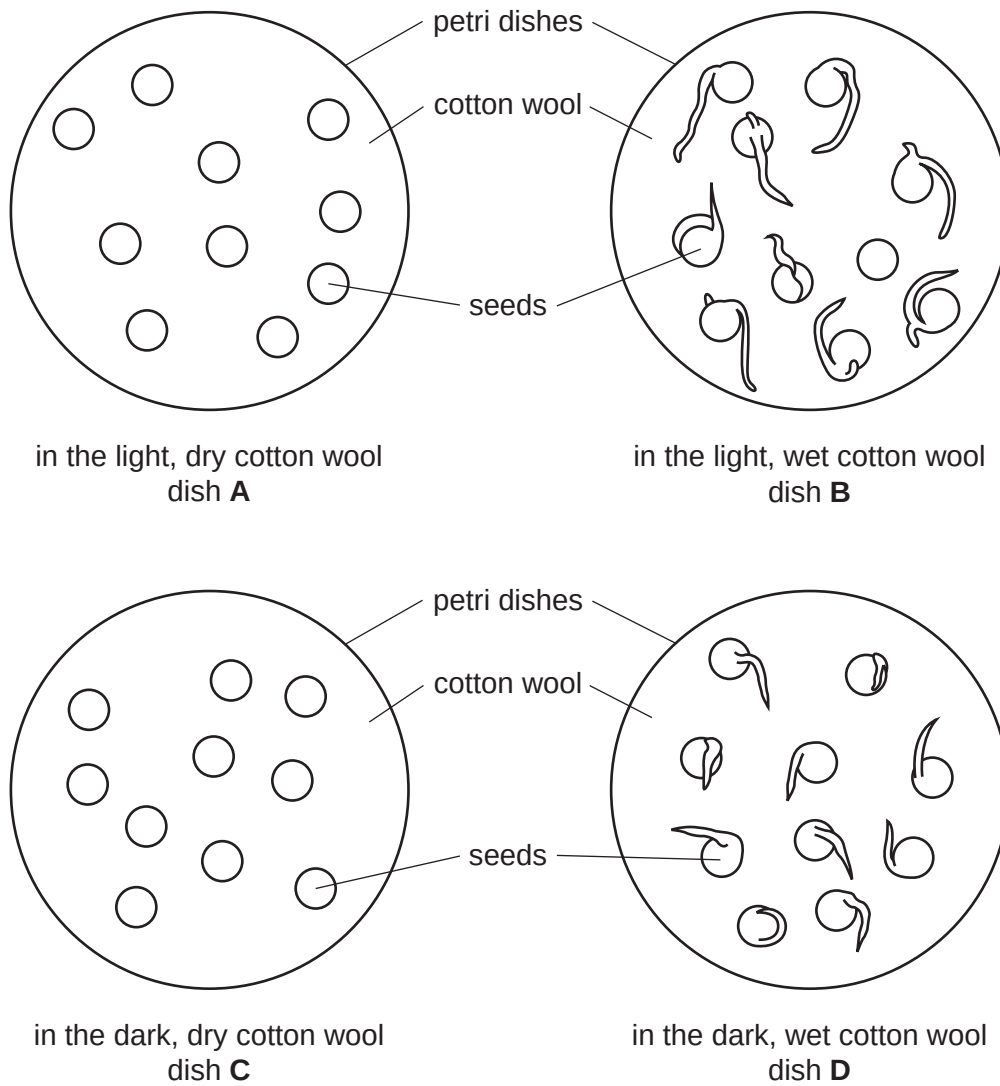


Fig. 1.2

- (a) Examine Fig. 1.2, and make a note of
- (i) the total number of seeds in each dish,
 - (ii) the number of seeds that have begun to germinate as indicated by the clear emergence of a radicle (young root) from any seed.

Record these numbers in Table 1.1.

Table 1.1

petri dish	A	B	C	D
total number of seeds in the dish				
number of germinating seeds in the dish				

- (b) Use the results to write conclusions about whether light and water are needed for germination of pea seeds.

light

.....

water

..... [2]

- (c) Explain why several seeds were placed in each dish, rather than just one seed.

.....

.....

..... [1]

- (d) Suggest **two** other environmental conditions, apart from light and water, that could be important for the germination of pea seeds.

.....

..... [2]

- (e) In a further experiment, the germinating seeds were tested for the presence of starch and reducing sugar. The radicles (roots) were cut off from the main part of the seed and the radicles and the seeds were tested separately. The results were as shown in Table 1.2.

Table 1.2

part of the seedling	radicle	seed
colour obtained with Benedict's test	orange	blue
colour obtained with iodine test	orange-brown	blue-black

State which parts of the germinating seeds contained starch, and which contained reducing sugar.

starch

.....

reducing sugar

..... [2]

- (f) Name an enzyme that could convert starch to sugar in a germinating seed.

..... [1]

- 2 A student is doing an experiment to find the mass of a metre rule. He rests the rule on a pivot at the 40 cm mark.

He hangs a 100 g load at the 10 cm mark of the ruler. He hangs a balancing mass, $m = 50$ g, on the other side of the rule so that the rule balances, see Fig. 2.1. The balancing mass is d cm from the pivot.

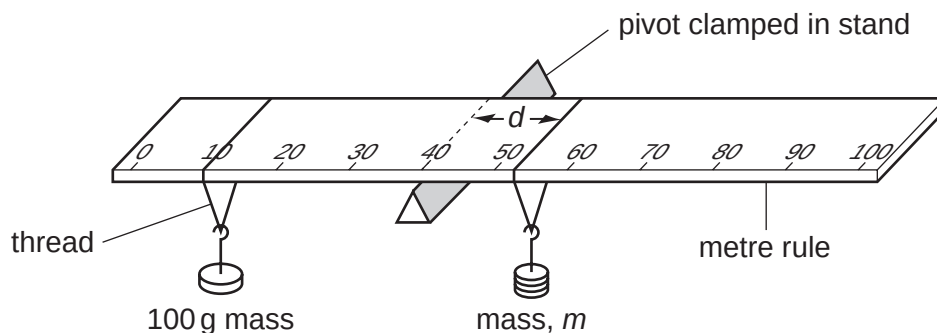


Fig. 2.1

- The student finds distance, d , and records it in Table 2.1.
- He adds 10 g to the balancing mass, m , and adjusts its position so that the rule balances.
- He finds the new distance, d , and records it in Table 2.1.
- He repeats this procedure using balancing masses, m , of 70, 80 and 90 g.

Table 2.1

mass, m/g	distance, d/cm	$\frac{1}{m} / \frac{1}{g}$
50	34.6	0.020
60	28.8	0.017
70		
80	21.9	0.013
90		

- (a) (i) Figs. 2.2 and 2.3 show the scale of the rule and the positions of the balance masses when $m = 70\text{ g}$ and $m = 90\text{ g}$.

Read and record below the scale of the rule for each mass.

scale reading for 70 g mass = ... cm

scale reading for 90 g mass = ... cm

[2]

- (ii) Use your answers to (i) to calculate the values of d for each mass.

Record your values of d in Table 2.1.

[1]

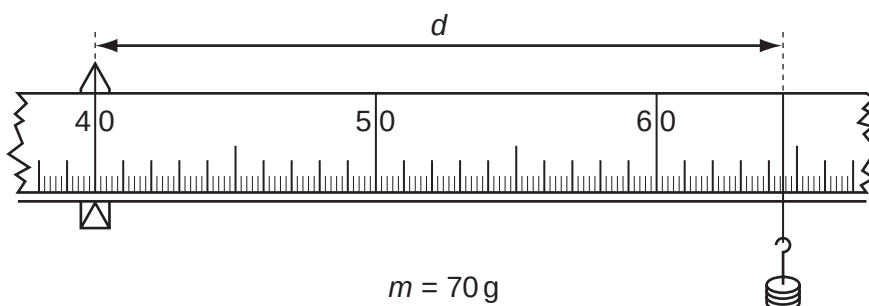


Fig. 2.2

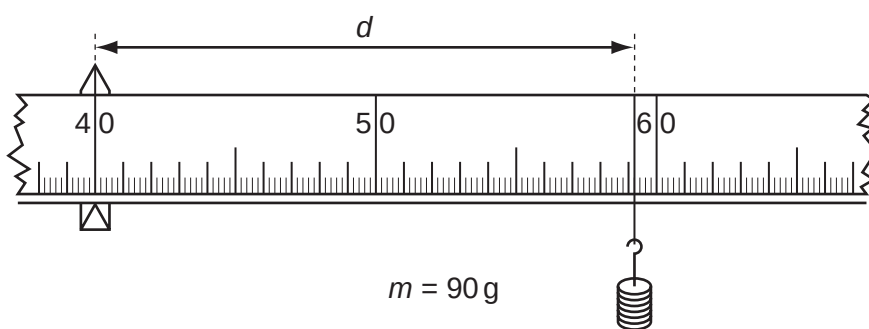


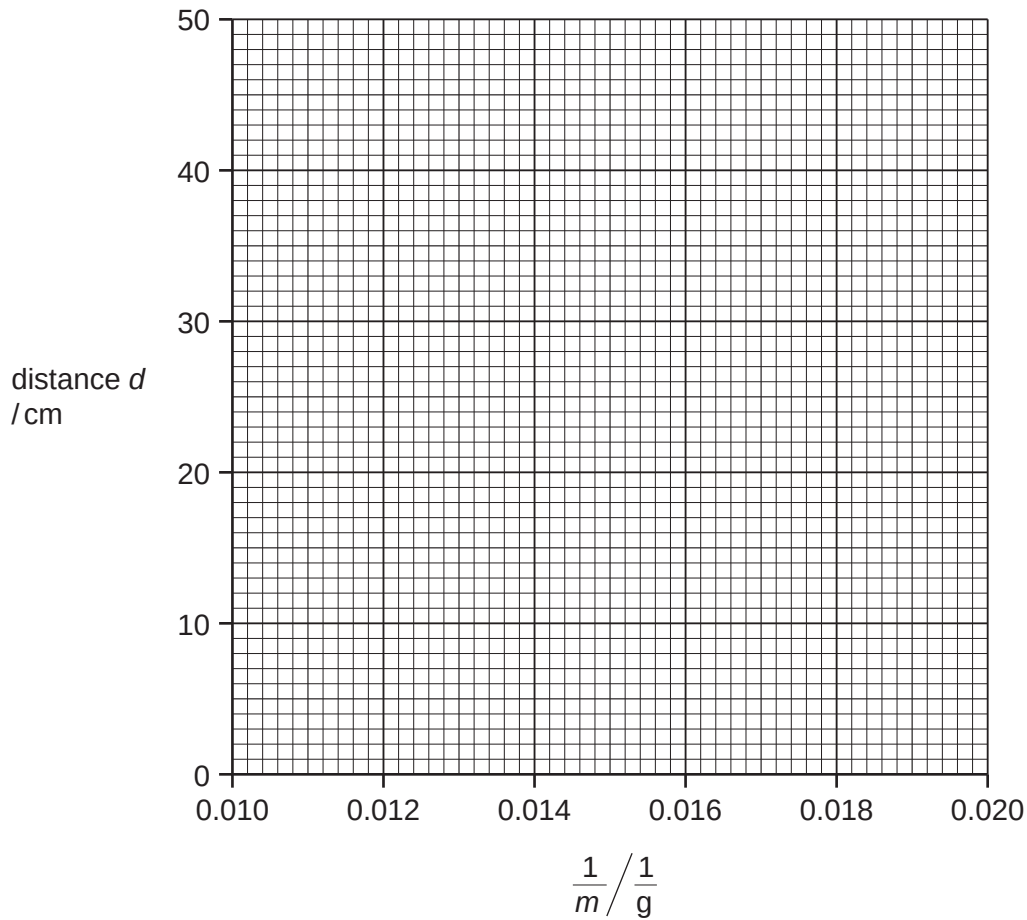
Fig. 2.3

- (iii) Calculate, to three decimal places, the values of $\frac{1}{m}$ for the masses 70 g and 90 g .
Record these values in Table 2.1.

[2]

- (b) (i) On the graph grid provided. plot distance, d , (vertical axis) against $\frac{1}{m}$.

Draw the best straight line.



[2]

- (ii) Find the gradient of the straight line you have drawn. Show clearly on the graph how you obtain the values used to calculate the gradient.

gradient = ... [2]

(c) Calculate the mass of the rule using the formula

$$\text{mass of rule} = 300 - \frac{\text{gradient}}{10}.$$

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

- 3 A farmer's bean crop is poor. He thinks that the soil in his field may be too acidic. He asks a science student three samples, **A**, **B** and **C** of the soil for testing.

There are two parts to the tests.

Part 1

The student takes some of sample **A** and mixes it with water. He separates the water from the soil by filtering the mixture. This gives soil washing **A**.

He repeats this procedure to give soil washings **B** and **C**.

- (a) Suggest **one** practical detail of this procedure that enables a fair comparison of the three soil samples.

.....

 [1]

Part 2

The student wants to find out what volume of soil washing **A** is needed to neutralise 10 cm^3 of aqueous calcium hydroxide solution. See Fig. 3.1.

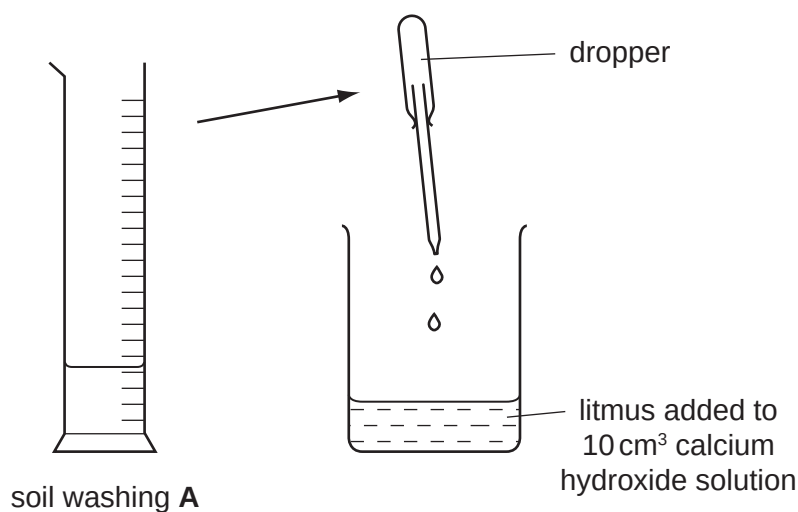


Fig. 3.1

- He places 10 cm^3 of calcium hydroxide solution in a beaker and adds a few drops of litmus.
- He places 10 cm^3 soil washing **A** in a measuring cylinder.
- He uses a dropper to add soil washing **A** from the measuring cylinder, drop by drop, to the calcium hydroxide in the beaker, until the litmus changes colour.
- He notes how much soil washing **A** is left in the measuring cylinder and records the volume in Table 3.1.
- He repeats this procedure with soil washings **B** and **C**.

(b) State the colour change of the litmus.

from to

Fig. 3.2 shows the scales of the measuring cylinder containing soil washings **A**, **B** and **C** after the litmus has changed colour.

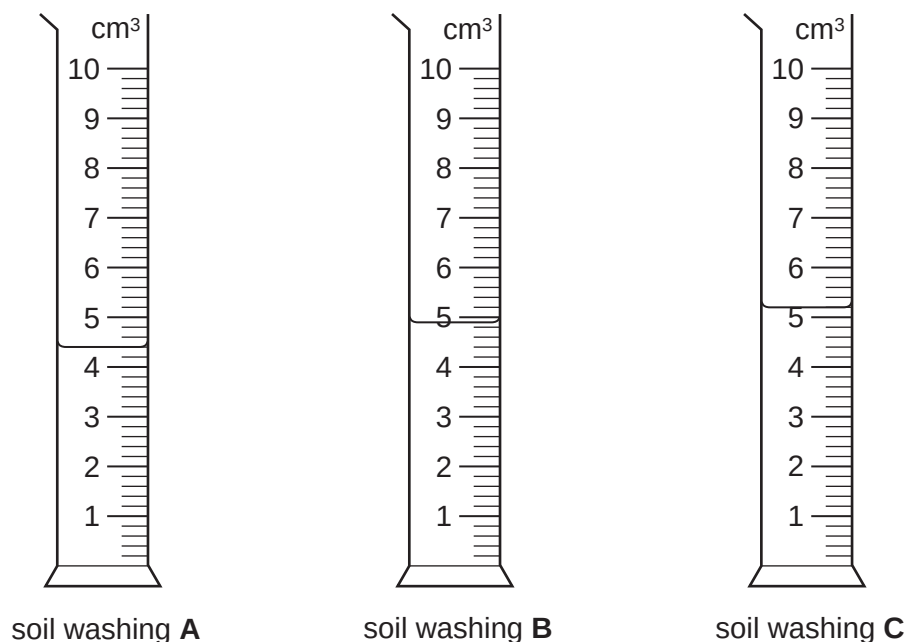


Fig. 3.2

(c) (i) Read the volumes left in the measuring cylinders and record them in Table 3.1. [3]

(ii) Calculate the volumes of soil washings **A**, **B** and **C** added to the calcium hydroxide solution. Record them in Table 3.1. [1]

Table 3.1

soil washing	volume left in measuring cylinder/cm ³	volume of soil washings added/cm ³
A		
B		
C		

Use data from the third column of Table 3.1 to calculate the average volume, V_{av} , of the soil washings added.

$$V_{av} = \dots\dots\dots \text{cm}^3 \quad [1]$$

- (d) The concentration of the calcium hydroxide solution is 0.013 mol/dm^3 .

Using the equation given, calculate the concentration of the acid in the soil washings.

$$\text{concentration of acid} = \frac{(2 \times 0.013 \times 10)}{V_{\text{av}}}$$

concentration of acid = ... mol/dm^3 [1]

The farmer can decide how much calcium hydroxide (lime) to put on his field.

If he adds too much lime so that the soil becomes alkaline, plants cannot absorb the ions of essential trace metals such as iron, magnesium and zinc because they become insoluble.

- (e) Suggest why these ions become insoluble in alkaline soils.

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

- 4 A student used the apparatus shown in Fig. 4.1 to study the transpiration rate in a shoot.

As water vapour is transpired from the leaves, water is drawn through the apparatus. The rate of movement of the small bubble along the tube is used as an indication of the rate of transpiration.

The student wanted to find which surface of the leaves lost the greater amount of water vapour.

The student did two experiments, the first with the leaves untreated and a second with grease applied to the upper surface of the leaves.

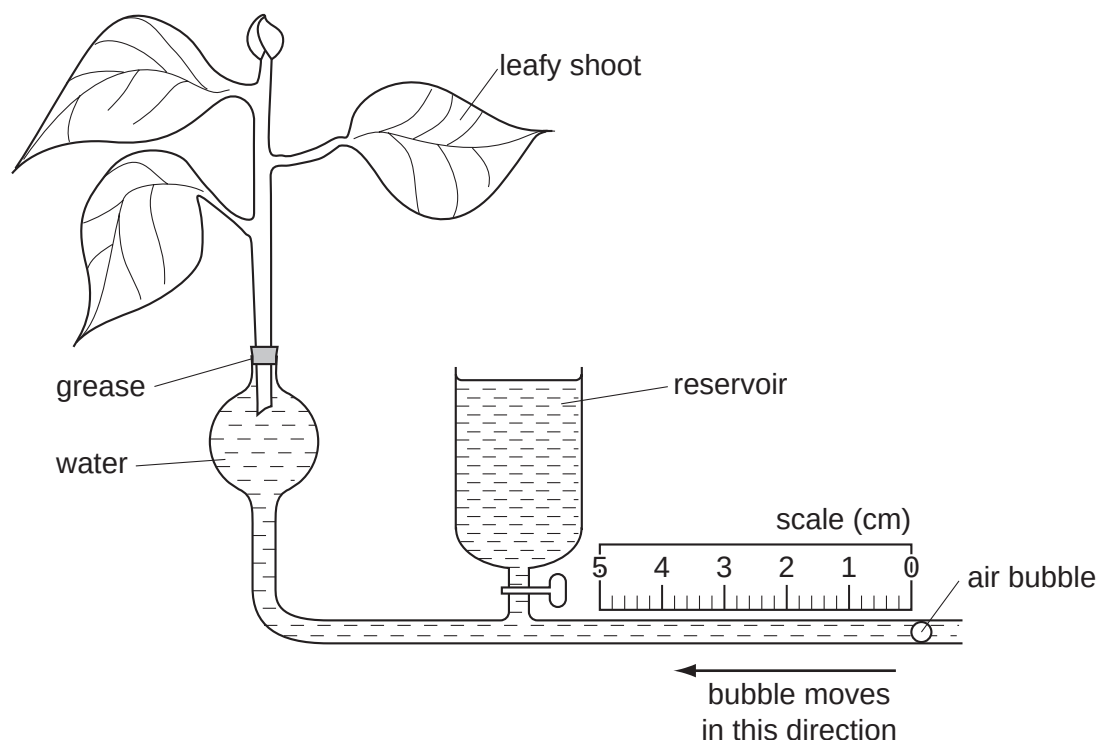


Fig. 4.1

- (a) The student prepared the shoot by cutting the stem under water.
- He placed the shoot in the rubber tubing at the top of the apparatus as shown in Fig. 4.1.
 - He added water from the reservoir to move the bubble to the zero mark.
 - He then started timing.
 - He read the position of the bubble every minute for three minutes and recorded the readings in Table 4.1.

Table 4.1

condition of leaves	time / minutes	reading on scale / cm	distance moved by bubble per minute / cm	average distance moved by bubble per minute / cm
untreated	1			
	2			
	3			

(i) Take the readings from the scales illustrated in Fig. 4.2 and record them in Table 4.1. Read the value from the left side of the bubble. [1]

(ii) Calculate the distance moved by the bubble during each minute and enter the values in column 4 of Table 4.1. [1]

(iii) Using the three values found in (a)(ii) calculate the average distance moved by the bubble per minute and enter this value in column 5 of Table 4.1. [1]

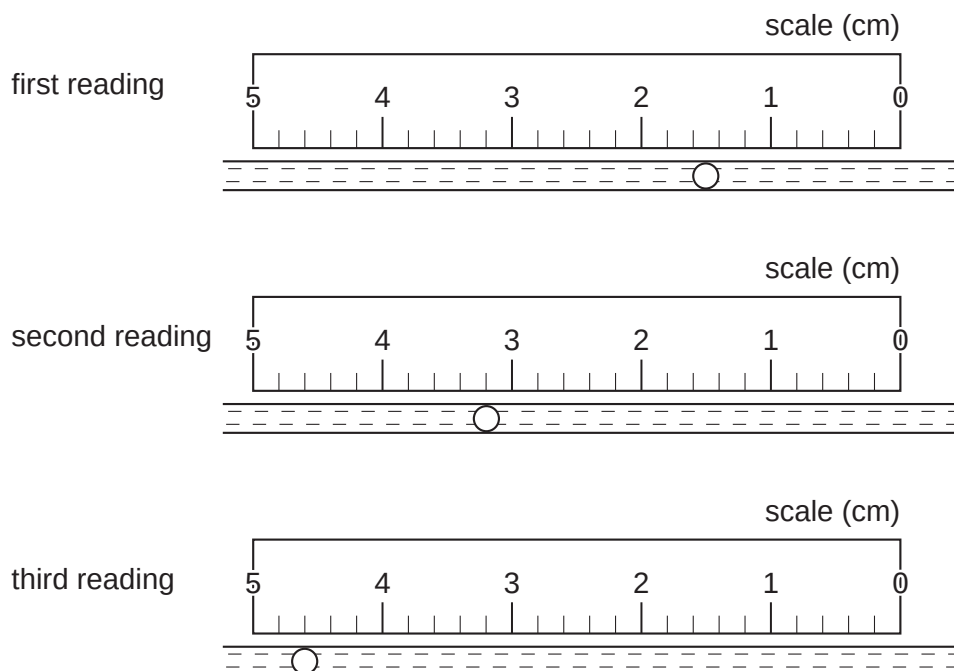


Fig. 4.2

- (b) The student then applied grease to all of the upper surfaces of the leaves to prevent loss of water vapour.
- He added water from the reservoir to return the bubble to zero.
 - He repeated the procedure as in part (a) and calculated a new average distance moved by the bubble per minute.

This new value was 1.2 cm.

- (i) Use the average value from (a)(iii) and the average value given in (b) to calculate the percentage of water vapour loss that took place from the lower surface of the leaf.

percentage loss from lower surface [2]

- (ii) The student concluded that the rest of the water vapour was lost from the upper surface of the leaf.

Describe what the student could do to confirm this.

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

- (c) Study column 4 of Table 4.1. The three values for the distance the bubble moved per minute are not identical to each other.

Suggest **two** environmental conditions that could cause the differences.

first condition

.....

second condition

..... [2]

- (d) (i) Explain why the student cut the stem of the leafy shoot under water before putting it into the apparatus.

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

- (ii) 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]

- 5 A student was given five bottles, labelled **A – E**. Each bottle contains one of the following solutions: sodium carbonate, sodium chloride, sodium hydroxide, sodium nitrate or sodium sulfate.

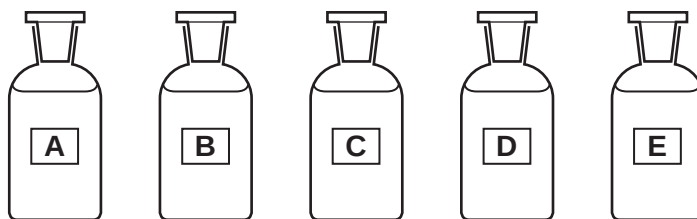


Fig. 5.1

The student used the Test Plan, Fig. 5.2, shown on page 18 to identify the solutions. He carried out four tests on the solutions, recorded his observations and named the solutions.

On the Test Plan, some of the student's work has been deleted.

Study the Test Plan over the page and then answer the questions that follow it.

Do not write anything on page 18.

Do not write anything on this page.

TEST PLAN

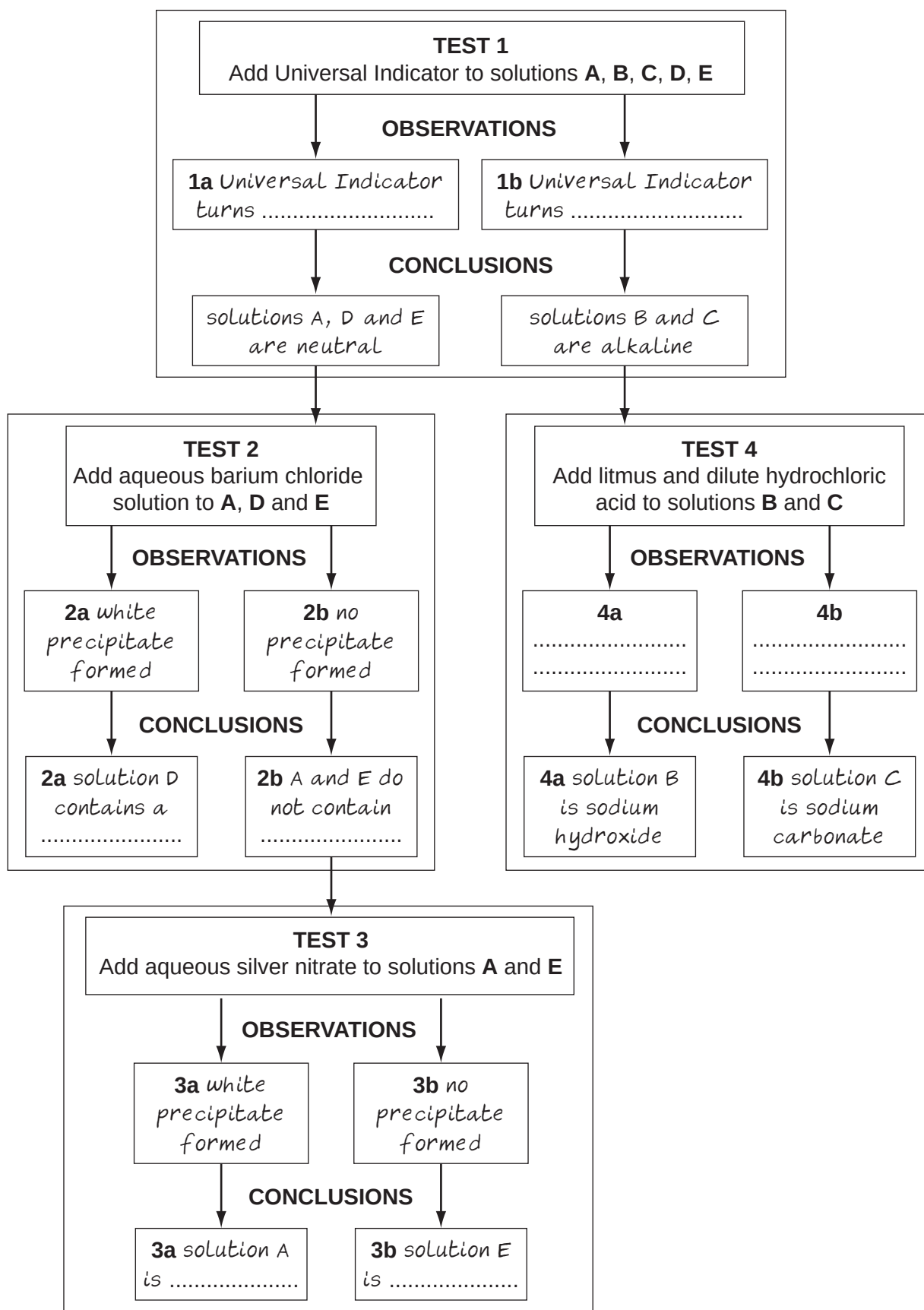


Fig. 5.2

- (a) The student added Universal Indicator to the five solutions. Use the conclusions from **Test 1** in the test plan to help you to write **observations 1a** and **1b**.

observation 1a: Universal Indicator turned

observation 1b: Universal Indicator turned [2]

- (b) In **Test 2**, the student added aqueous barium chloride solution to solutions **A**, **D** and **E**. He recorded **observation 2a** and **observation 2b**. Then he named liquid **D**.

Suggest the name of liquid **D** [1]

- (c) In **Test 3**, the student added aqueous silver nitrate to solutions **A** and **E**. He recorded **observation 3a** and **observation 3b**. These observations helped him name solutions **A** and **E**.

Suggest the name of solution **A**

Suggest the name of solution **E** [2]

- (d) In **Test 4** the student added litmus solution followed by dilute hydrochloric acid to solutions **B** and **C** until there was no further reaction. He recorded **observation 4a** and **observation 4b**.

He concluded that solution **B** is sodium carbonate, and solution **C** is sodium hydroxide.

- (i) What did the student record for **observation 4a**?

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

- (ii) What did the student record for **observation 4b**?

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

- (e) (i) Name the white precipitate seen in **Test 2**.

white precipitate [1]

- (ii) Explain what is meant by a *precipitate*.

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

- 6 The science teacher has given a student a filament lamp that is made for use 240 volt electricity supply.

The filament of the lamp is made from tungsten, a metal that has a very high melting point. The filament glows white hot when current passes through it using a 240 volt supply.

The resistance of tungsten metal is altered when its temperature is changed.

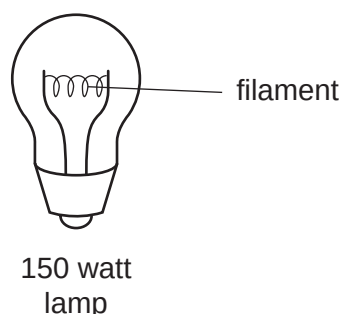


Fig. 6.1

- (a) (i) Complete the sentence to show the main energy changes that occur when the lamp is switched on.

electrical energy → and [2]

- (ii) What gas is contained in the lamp to prevent the filament burning out when it becomes very hot?

..... [1]

The student connects the lamp in the circuit shown in Fig. 6.2. An ammeter, **A**, is used to find the current and a voltmeter, **V**, is used to find the applied voltage.

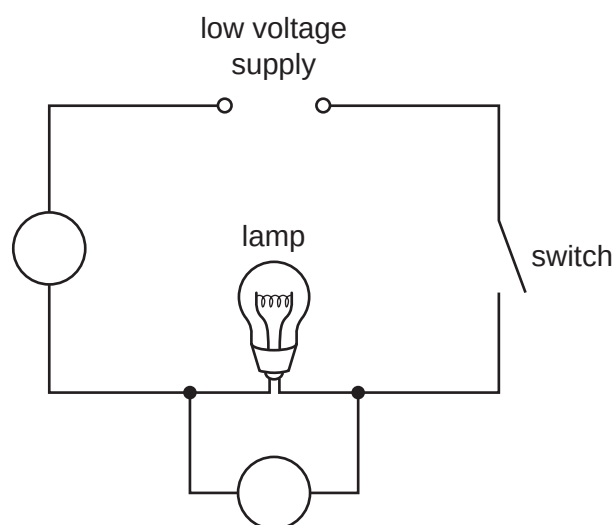


Fig. 6.2

- (b) To show where the ammeter and voltmeter should be placed in the circuit, write **A** and **V** in the correct places on Fig. 6.2. [1]

The student closes the switch. The lamp does not light up, but the meters show readings. The ammeter reading immediately reaches a maximum.

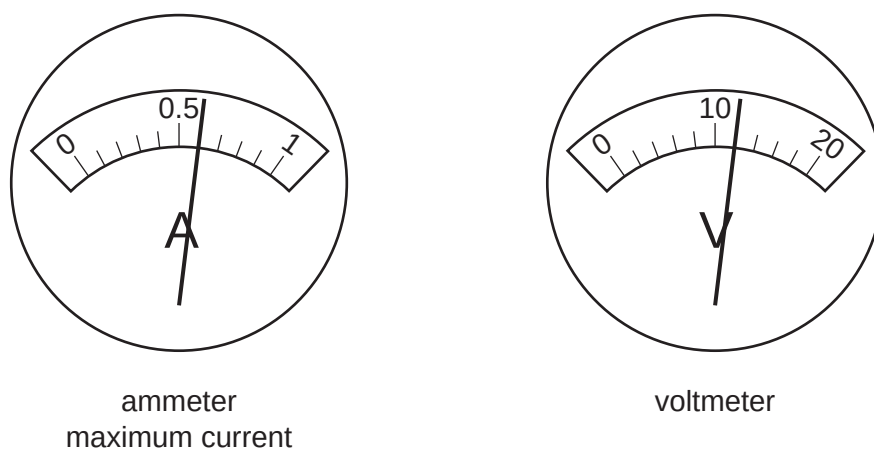


Fig. 6.3

- (c) Read the meters in Fig. 6.3 to the nearest 0.1 amp and 1 volt and record the readings in Table 6.1. [2]

Table 6.1

maximum current / A	applied voltage / V

- (d) (i) The lamp uses 150 watts of power when 240 volts is applied and the lamp is shining brightly.

Calculate the current passing through the lamp when it shines brightly.

Use the formula

$$\text{current in amps} = \frac{\text{power in watts}}{\text{applied voltage}}$$

current passing through the lamp = ... A [1]

- (ii) Compare the voltage and current shown in Table 6.1 and your answer to (d)(i).

Suggest how the resistance of the tungsten filament changes when the filament is glowing brightly.

.....
 [1]

- (e) European governments do not allow shops to sell filament lamps for use in homes. This is because more efficient lamps are available, such as fluorescent lamps.

Explain why the use of filament lamps is an inefficient way to produce light and how their use contributes to global warming.

.....

 [2]



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COMBINED SCIENCE

0653/62

Paper 6 Alternative to Practical

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For Examiner's Use	
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Total	

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



- 1 (a) Fig. 1.1 shows drawings of a holly leaf and a grass leaf. Both are drawn to the same scale.

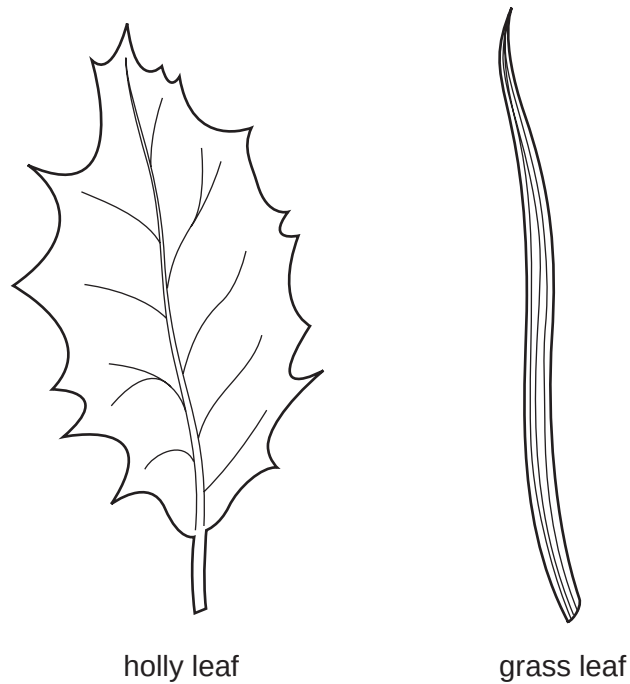


Fig. 1.1

- (i) The **actual** length of the holly leaf, from the tip to the base, not including the stalk, was 45 mm.

Measure the length of the **drawing** of the holly leaf from tip to base, not including the stalk.

length of drawing mm

Calculate the magnification of the drawing.

Show your working.

magnification [2]

- (ii) State **two visible** differences between the two leaves in Fig.1.1, other than difference in size.

1

.....

2

..... [2]

- (b) Leaves contain air-spaces. If a leaf is placed in hot water, the air in these spaces expands, and so some of the air can be seen escaping from the stomata of the leaf as bubbles.

A student placed a holly leaf and a grass leaf into hot water, and compared the amount of air bubbling out of the upper and lower surfaces of each leaf. The results are shown in Table 1.1.

Table 1.1

holly leaf		grass leaf	
bubbles from upper surface	bubbles from lower surface	bubbles from upper surface	bubbles from lower surface
no bubbles	large numbers of bubbles	very small numbers of bubbles	small numbers of bubbles

- (i) The main function of the leaves of a plant is to carry out photosynthesis.

Explain how having air inside the leaves helps with this function.

.....

..... [1]

- (ii) Explain, in terms of leaf structure, the differences in the results from the upper and lower surfaces of the holly leaf.

.....

.....

..... [1]

- (iii) Suggest why the structural difference between the two sides of the holly is important.

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

- (iv) Compare the results from the holly and grass leaves, and suggest a reason for any differences.

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

- 2 A student is investigating forces acting at different angles. He is using the apparatus in Fig. 2.1.

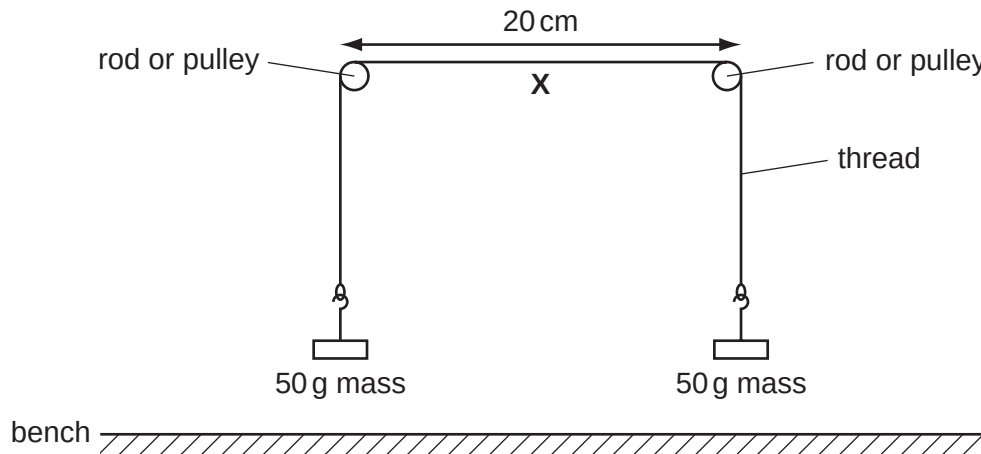


Fig. 2.1

- He hangs a 20 g mass, m , half way between the pulleys, at point **X**.
- He places a protractor behind point **X** so that angle θ can be measured, as in Fig. 2.2.
- He measures angle θ and records it in Table 2.1.
- He repeats the experiment using masses of 40, 60 and 80 g for mass, m .

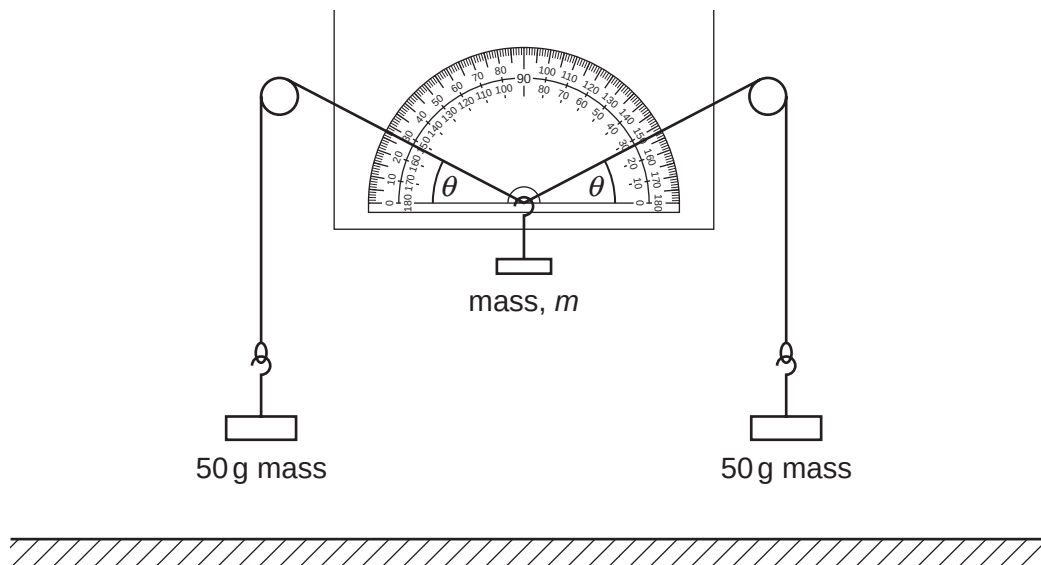


Fig. 2.2

Table 2.1

mass, m/g	angle $\theta/^\circ$	sine θ
0	0	0.00
20	11	0.19
40	22	0.37
60		
80		

(a) (i) Fig. 2.3 and 2.4 show the angles at point X for the masses $m = 60\text{ g}$ and $m = 80\text{ g}$.

For each diagram, read angle θ and record it in Table 2.1.

[2]

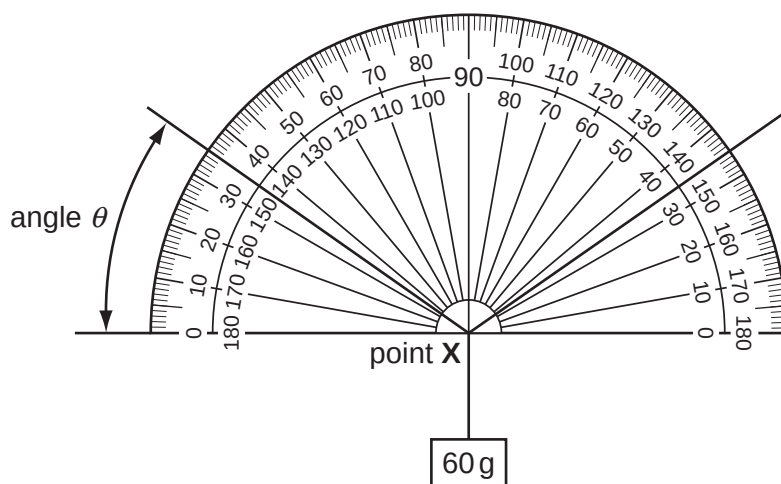


Fig. 2.3

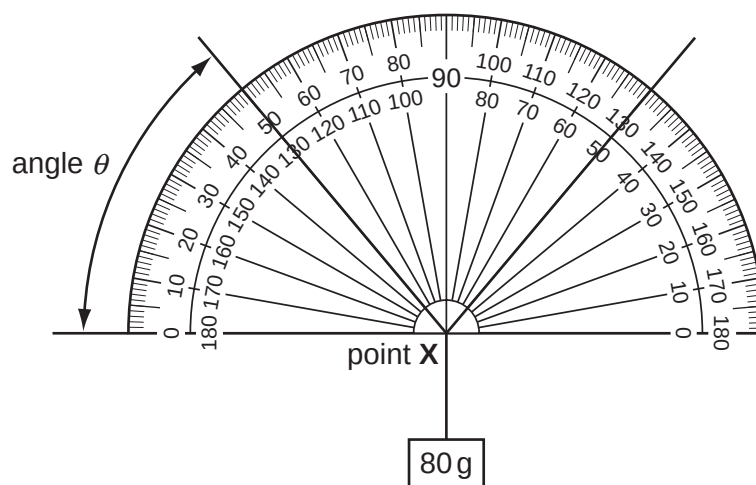


Fig. 2.4

- (ii) Use Table 2.2 to find the sines of the angles you have recorded in column 1 of Table 2.1.

Record them in column 3 Table 2.1.

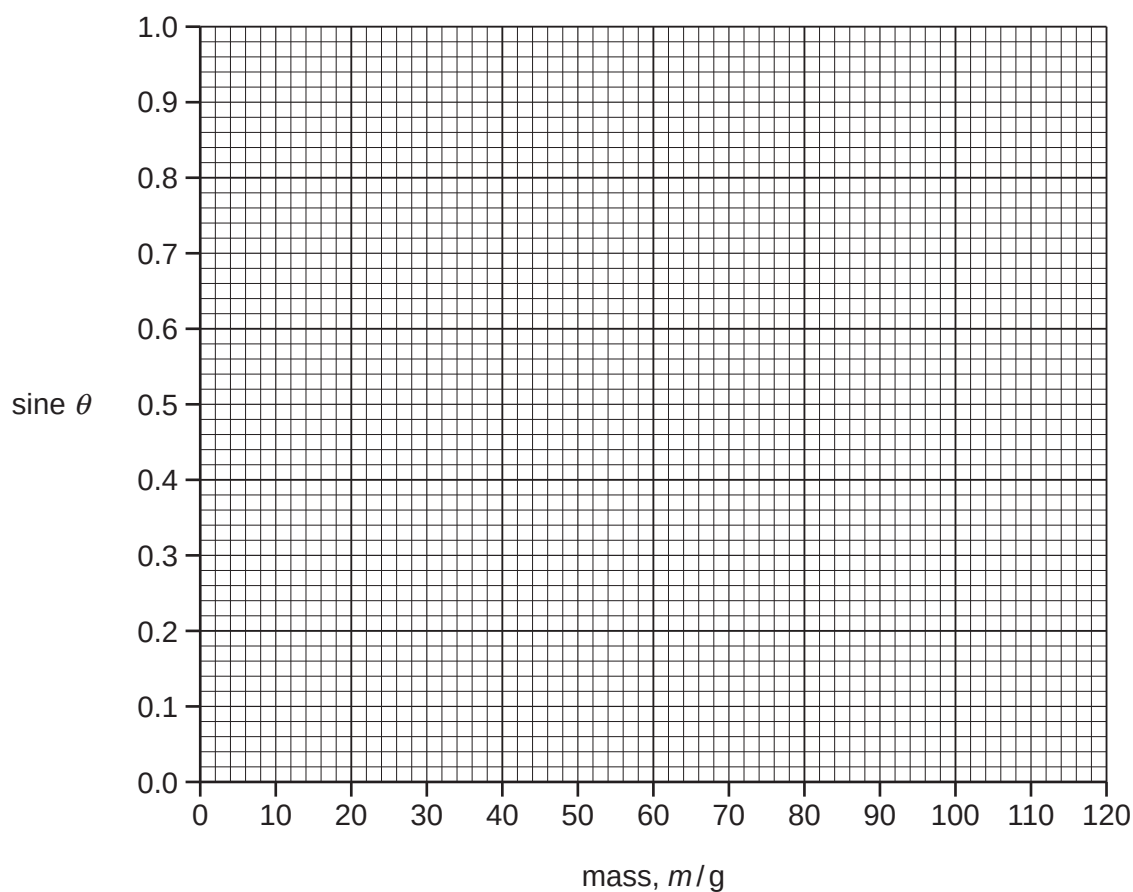
[2]

Table 2.2

angle $\theta / ^\circ$	sine θ	angle $\theta / ^\circ$	sine θ	angle $\theta / ^\circ$	sine θ
0	0.00	35	0.57	70	0.94
5	0.09	40	0.64	75	0.97
10	0.17	45	0.71	80	0.98
15	0.26	50	0.77	85	1.00
20	0.34	55	0.82	90	1.00
25	0.42	60	0.87		
30	0.50	65	0.91		

- (b) (i) Plot a graph of sine θ (vertical axis) against mass, m on the grid below.

Draw the best straight line. Extend it to the value of sine $\theta = 1.0$.



[3]

- (ii) Read and record the value of mass, m , when $\sin \theta = 1.0$.

When $\sin \theta = 1.0$, mass $m = \dots\dots\dots$ g [1]

- (iii) In theory, m , from (b)(ii) should equal the sum of the two masses on the ends of the thread (= 100 g). In practice it is rarely equal to the sum of the two masses.

Suggest another force, acting in the apparatus, which could cause the difference.

.....
 [1]

- (c) Suggest how the results of this experiment will compare if the experiment is carried out on the surface of the Moon, where the acceleration due to gravity is much smaller than on Earth.

Explain your answer.

.....

 [1]

- 3 The science class is analysing **solid A** and aqueous **solution B**. **Solid A** is an element in the form of a grey powder. **Solution B** contains one cation and one anion. It is a yellow colour.

Complete Table 3.1 showing the tests (a) – (d), observations and conclusions.

Table 3.1

test	observation	conclusion
(a) Place a spatula load of solid A in a test-tube. Add dilute hydrochloric acid. Test the gas with a lighted splint.	 [2]	Solid A is a metal. The gas given off is [1]
(b) To 2 cm ³ of solution B add 2 cm ³ of aqueous sodium hydroxide.	The yellow solution turns to a precipitate. [1]	The cation in solution B is iron(III), Fe³⁺.
(c)(i) To 10 cm ³ of solution B in a large test-tube add a spatula full of solid A . Stir the mixture and allow the solid to settle to the bottom.	The yellow solution turns to a [1] colour.	The Fe³⁺ ions have been changed to Fe²⁺ ions.
(ii) Filter the mixture from (c)(i). To 2 cm ³ of the filtrate add 2 cm ³ of aqueous sodium hydroxide.	A precipitate is formed which has a [1] colour.	The name of the precipitate is [1]
(d) To 2 cm ³ of solution B add dilute nitric acid then aqueous silver nitrate.	 [1]	Solution B contains the chloride ion.

(e) Suggest the identity of the metal in **solid A**. [1]

(f) Write the formula of the compound in **solution B**.

..... [1]

- 4 A student did an experiment to compare the amount of reducing sugar in different flowers. Reducing sugar is found in nectar which is produced in nectaries inside some flowers. Insects are attracted to the sugary solution and as they enter the flowers their bodies pick up pollen.

The student used Benedict's solution to compare the amounts of reducing sugar. Benedict's solution can produce a range of colours that indicate different amounts of reducing sugar as shown in Table 4.1.

Table 4.1

colour	blue	green	yellow	orange	brick-red
relative concentration of reducing sugar	none	low → increasing concentration high			

The flowers that were tested are shown in Fig. 4.1. The diagrams are not drawn to scale.

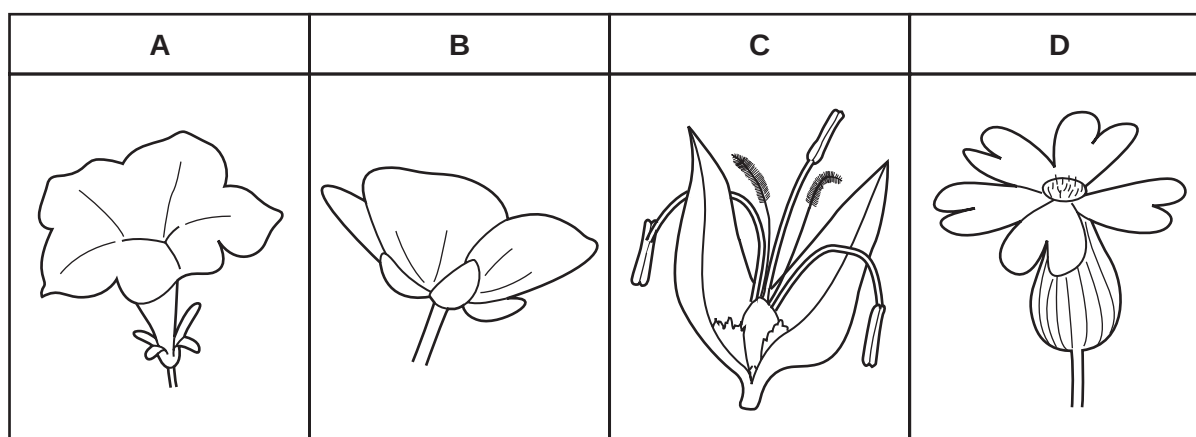


Fig. 4.1

- (a) (i) All of the flowers used in this experiment were pale-coloured.

Suggest why.

.....
 [1]

- (ii) Which one of the flowers is wind-pollinated?

Explain your answer.

.....
 [1]

- (b) (i) Describe how the student tested the flowers for reducing sugar. In your answer include

1 how she prepared a suitable solution from the flowers,

.....

.....

.....

2 how she carried out the test using Benedict's solution.

.....

..... [3]

- (ii) Describe **two** things the student did to make a fair comparison of the amount of reducing sugar in the flowers.

.....

.....

..... [2]

Table 4.2 shows the results of the Benedict's test with the four flowers.

Table 4.2

flower	colour of Benedict's solution
A	red
B	green
C	blue
D	orange

- (iii) Put the letters of the flowers in the spaces provided to indicate the order of increasing amount of reducing sugar in the flowers.

least

.....

.....

greatest

[1]

- (c) The student prepared one slide of pollen from an insect-pollinated flower and a slide of pollen from a wind-pollinated flower.

The view under the microscope of the two slides is shown in Fig. 4.2. The microscope was set at the same magnification for both slides.

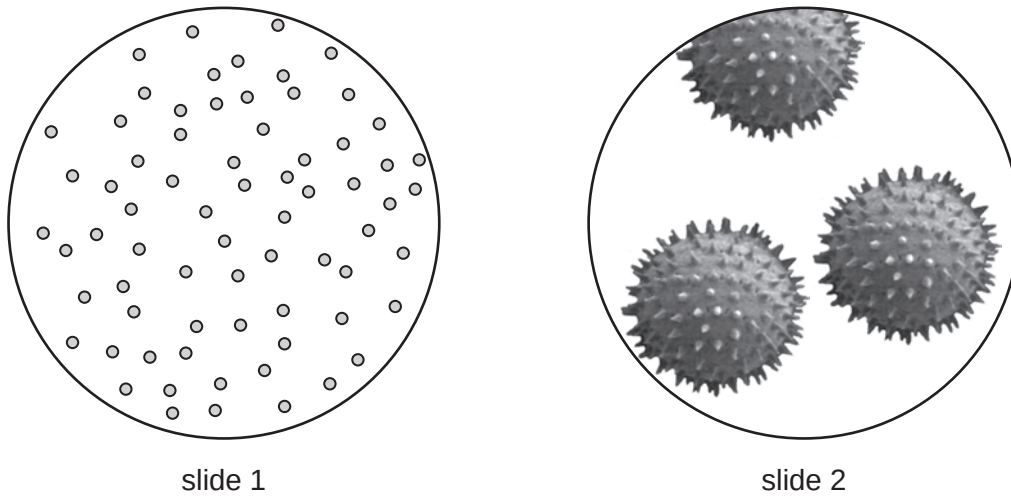


Fig. 4.2

Choose **one** of the slides in Fig. 4.2 and state if it comes from a wind or insect-pollinated flower.

slide method of pollination

Describe **one** feature of the chosen pollen and explain its importance to the method of pollination

feature

.....

importance [2]

Please turn over for Question 5.

- 5 A student wants to find out how the change of temperature of dilute acid affects the reaction. She uses ethanoic acid and a marble chip in the apparatus shown in Fig. Bubbles of carbon dioxide are seen in the tube of water.

- she takes the temperature of the dilute acid
- she places a marble chip in the test-tube, adds 20 cm^3 of the acid and replaces the delivery tube
- she starts the clock
- she makes a mark in Table 5.1 every time she sees a bubble coming out of the end of the tube
- after 20 seconds, she stops making the marks
- she warms a new sample of the acid to the next temperature and repeats the procedure

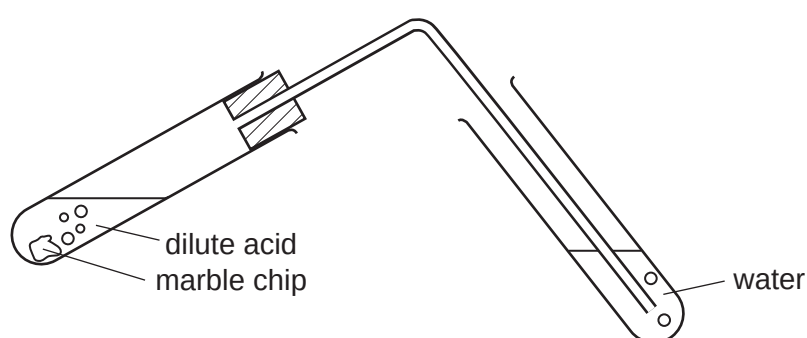


Fig. 5.1

Table 5.1 shows the number of bubbles that the student sees in 20 s at each temperature.

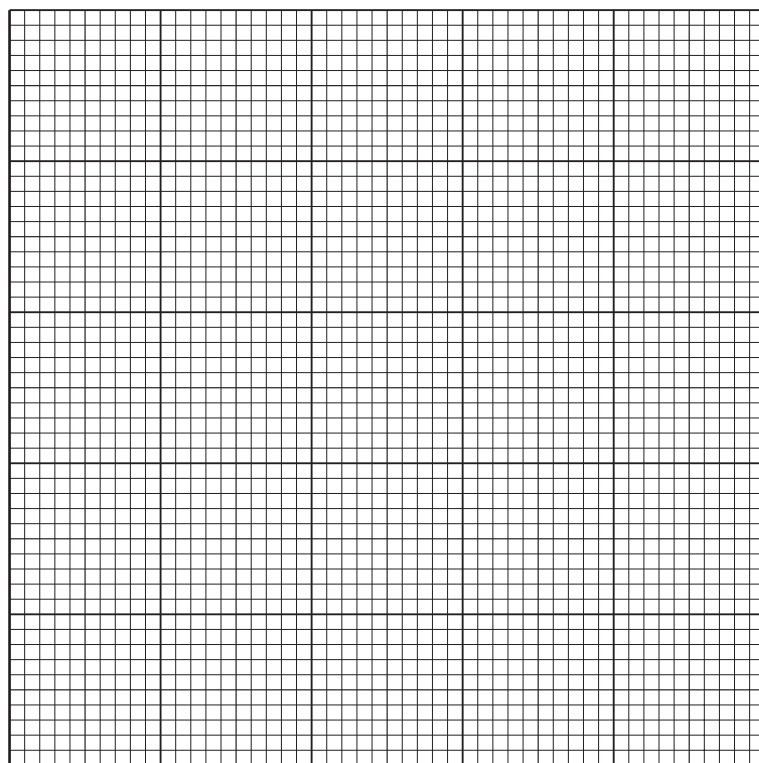
Table 5.1

temperature $^{\circ}\text{C}$	bubbles given off in 20 s	number of bubbles in 20 s
18	/////	5
30	////////////////	
42	////////////////////////////////////	
49	////////////////////////////////////	

- (a) Count the numbers of marks in each row of column 2 and complete column 3 in Table 5.1. [1]

- (b) Plot a graph of number of bubbles (vertical axis) against temperature.

Draw a smooth curve.



- (c) (i) Suggest why it will be difficult for the student to use a higher temperature for this experiment.

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

- (ii) Explain, in terms of the behaviour of the reacting particles, why more carbon dioxide is given off when the temperature of the acid is raised.

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

- (d) (i) The student adds some limewater to the water through which the gas has been bubbled. The mixture turns milky.

Write a word equation for this reaction.

..... [2]

- (ii) Explain why this reaction causes the limewater to turn milky.

.....

..... [1]

- 6 (a) The science teacher is doing an experiment to find the density of ice. He has cooled the apparatus and chemicals to a temperature of -5°C in a freezer, to prevent the ice from melting.

He has made ice cubes in the freezer. He places 4 ice cubes in a weighed beaker and weighs the beaker.

- (i) Fig. 6.1 shows the balance window. Read the scale to the nearest 0.1 g and record the mass in Table 6.1. [1]

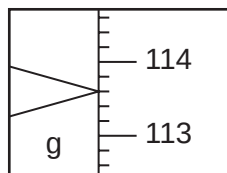


Fig. 6.1

Table 6.1

mass of beaker + ice / g	
mass of beaker / g	75.8
mass of ice / g	

- (ii) Calculate the mass of ice and complete Table 6.1.

[1]

- (b) The teacher pours 50 cm^3 of the hydrocarbon hexane, C_6H_{14} , into a 100 cm^3 measuring cylinder. Then he adds the ice cubes. This is shown in Fig. 6.2.

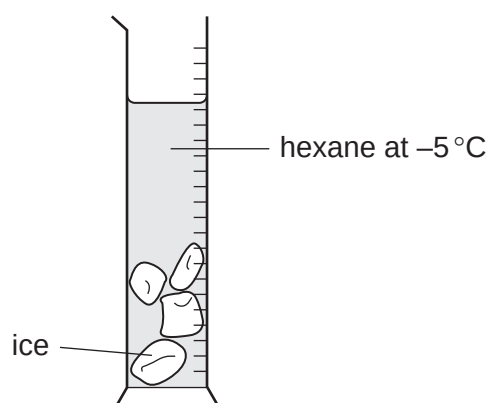


Fig. 6.2

- (i) Fig. 6.3 shows the scale of the measuring cylinder after the ice cubes have been added to the hexane.

Read the scale to the nearest 1 cm^3 and record the total volume in Table 6.2. [1]

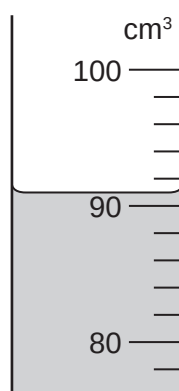


Fig. 6.3

Table 6.2

volume of hexane + ice / cm^3	
volume of hexane / cm^3	50
volume of ice / cm^3	

- (ii) Calculate the volume of the ice and complete Table 6.2.

[1]

- (c) Use data from Table 6.1 and Table 6.2 to calculate the density of ice in g/cm^3 .

density of ice = ... g/cm^3 [2]

- (d) State **two** properties of hexane that make it a suitable liquid to use in this experiment. Fig. 6.2 will help you to do this.

1
2 [2]

- (e) Fig. 6.4 shows a polar bear.

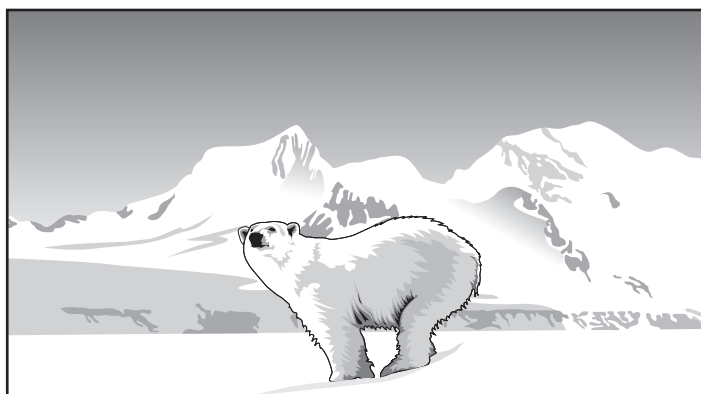


Fig. 6.4

- (i) A large part of the Arctic Ocean around the North Pole is covered by ice. Explain why it is important for animals such as the polar bear that the density of ice is lower than the density of sea-water.

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

- (ii) Considering your answer to (e)(i), how might global warming badly affect animals such as the polar bear?

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



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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.



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

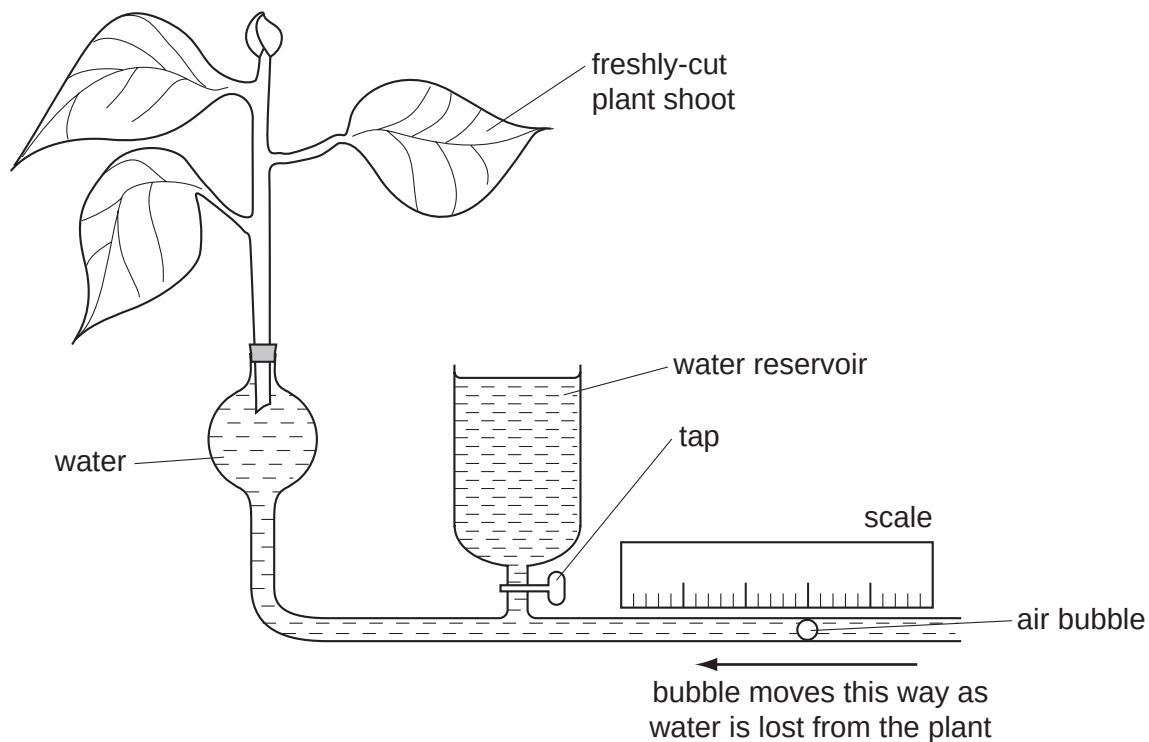


Fig. 1.1

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

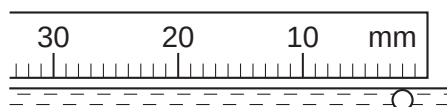
experiment	position of bubble in moving air		
	start/ mm	after 5 mins / mm	distance moved / mm
4	1	8	7
5	3	9	
6			
average			

- (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]

experiment 6
in moving air
at start



experiment 6
in moving air
after 5 minutes



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]

- (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]

- 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]

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

Read the volumes and record them in Table 2.1.

[2]

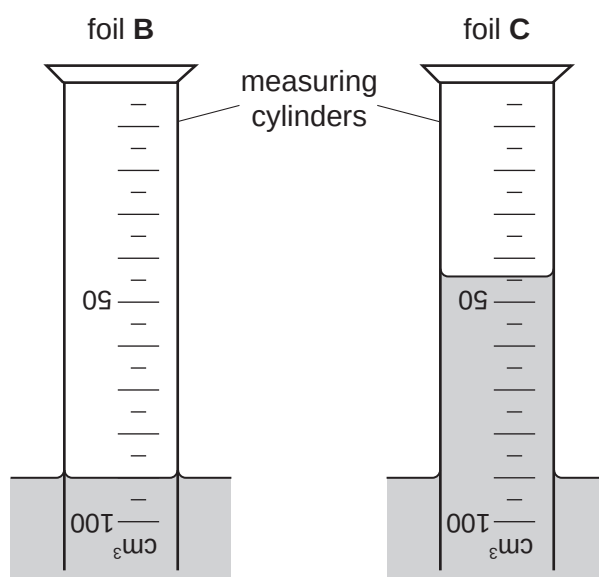


Fig. 2.1

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.

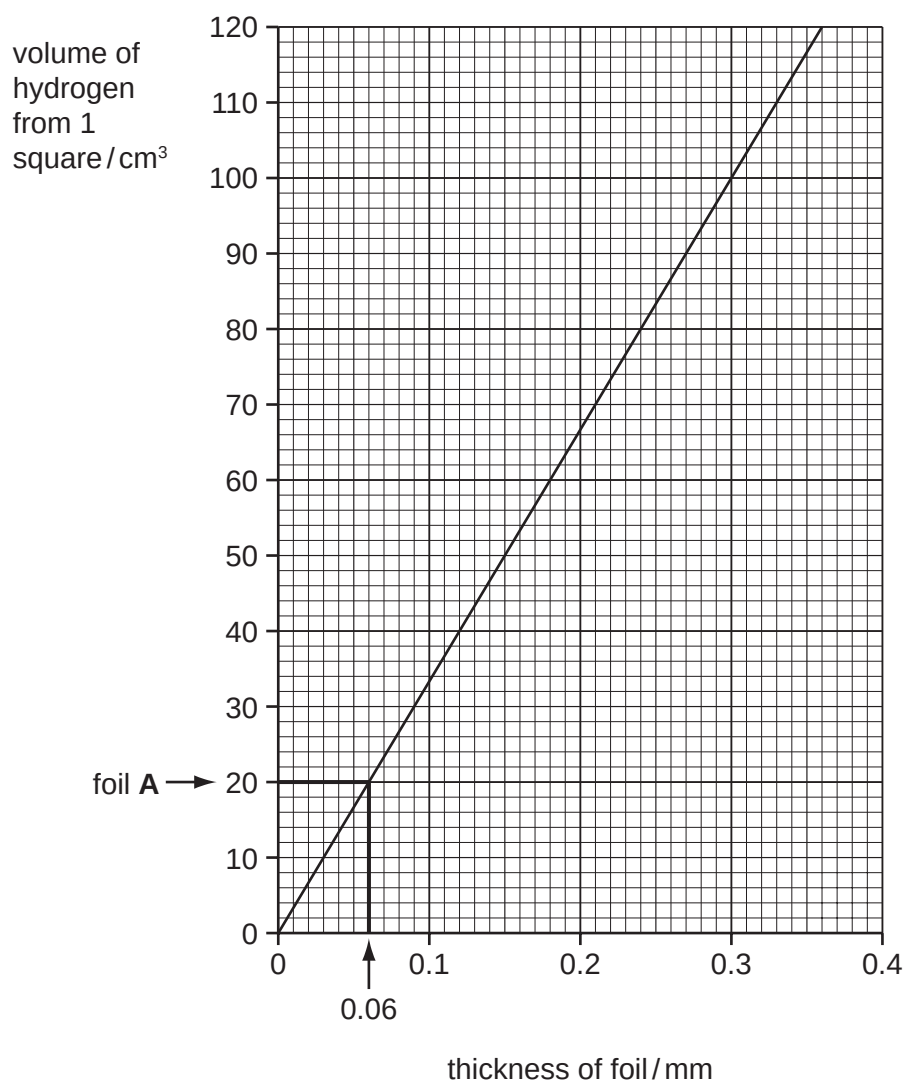


Fig. 2.2

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.

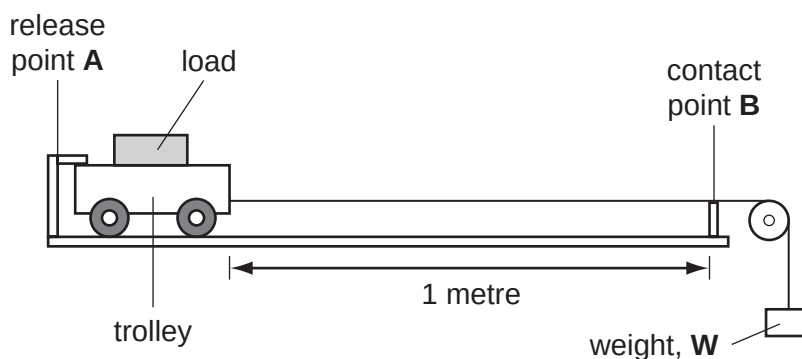


Fig. 3.1

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]

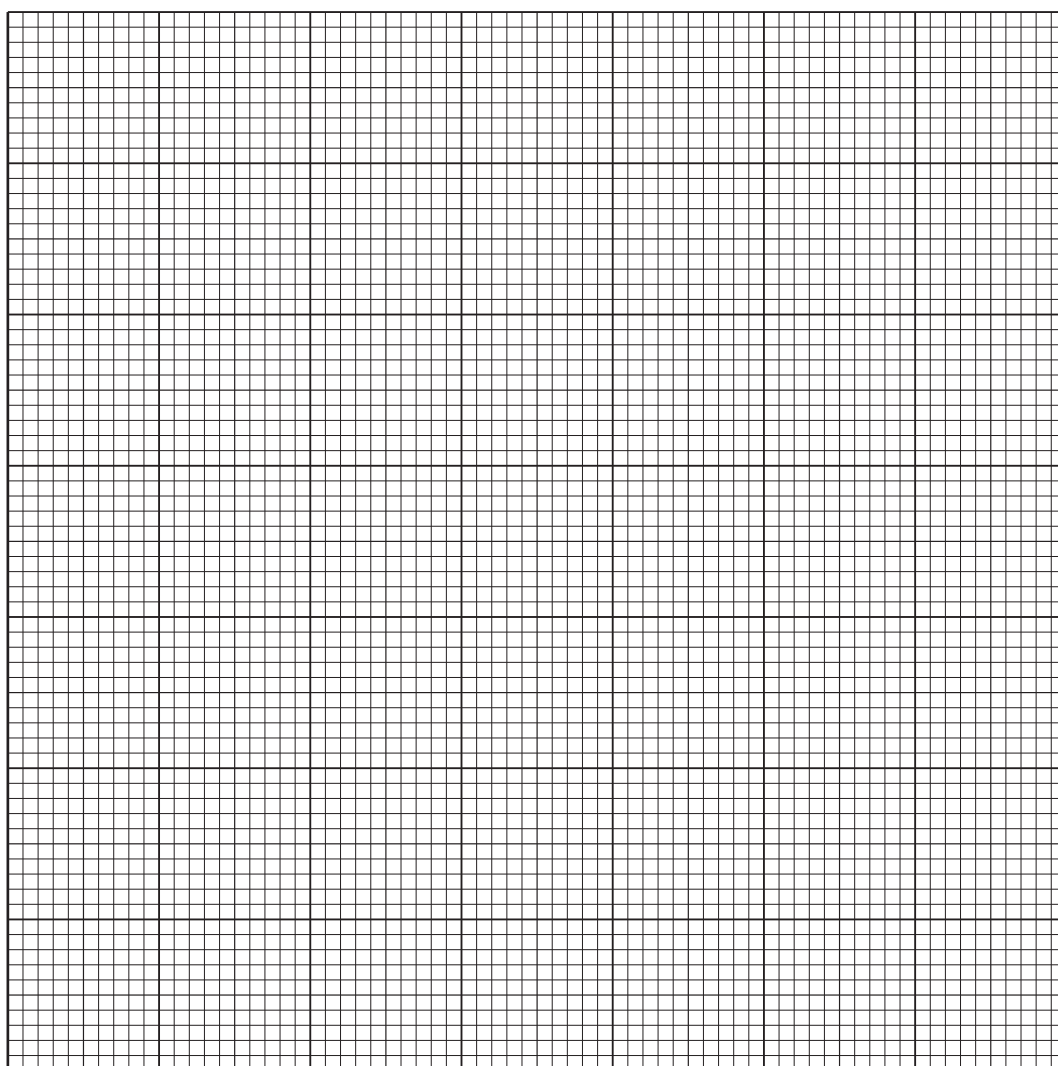


Fig. 3.2

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.



- (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.

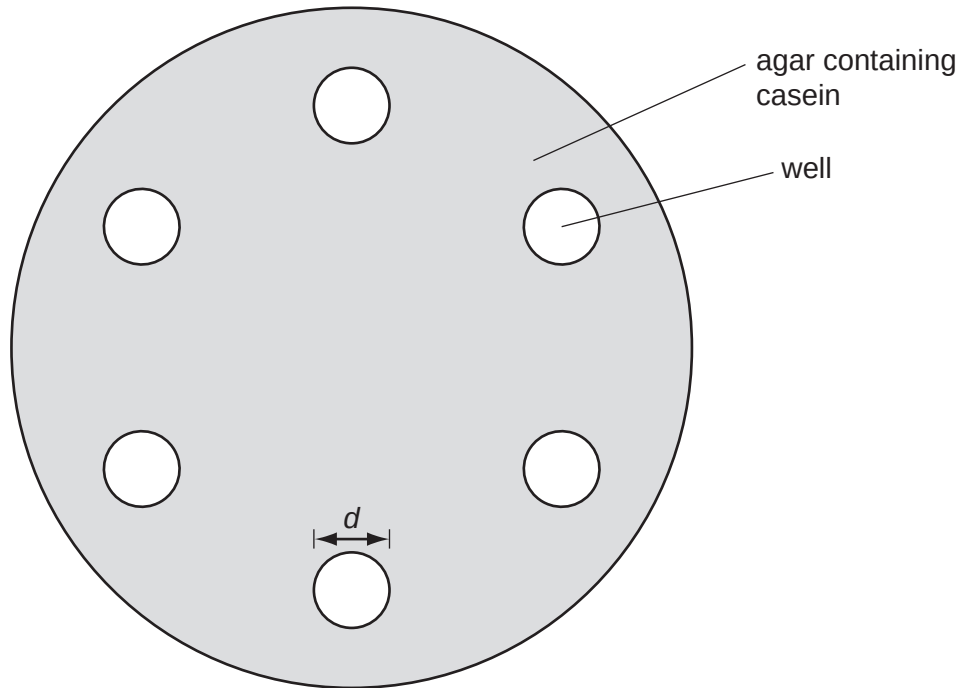


Fig. 4.1

- (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.

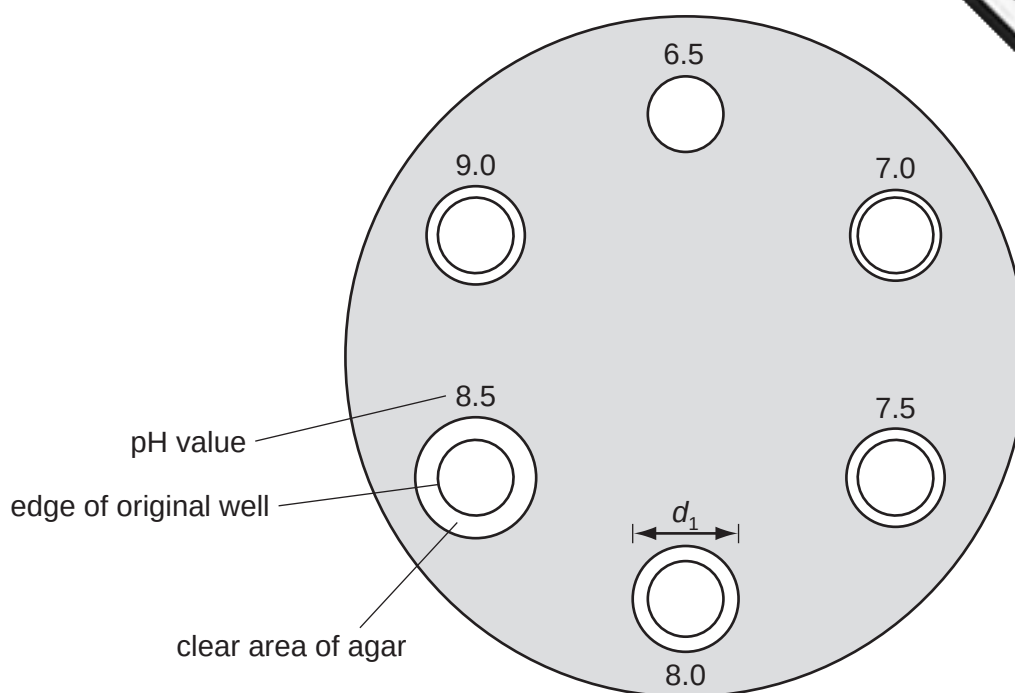


Fig. 4.2

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

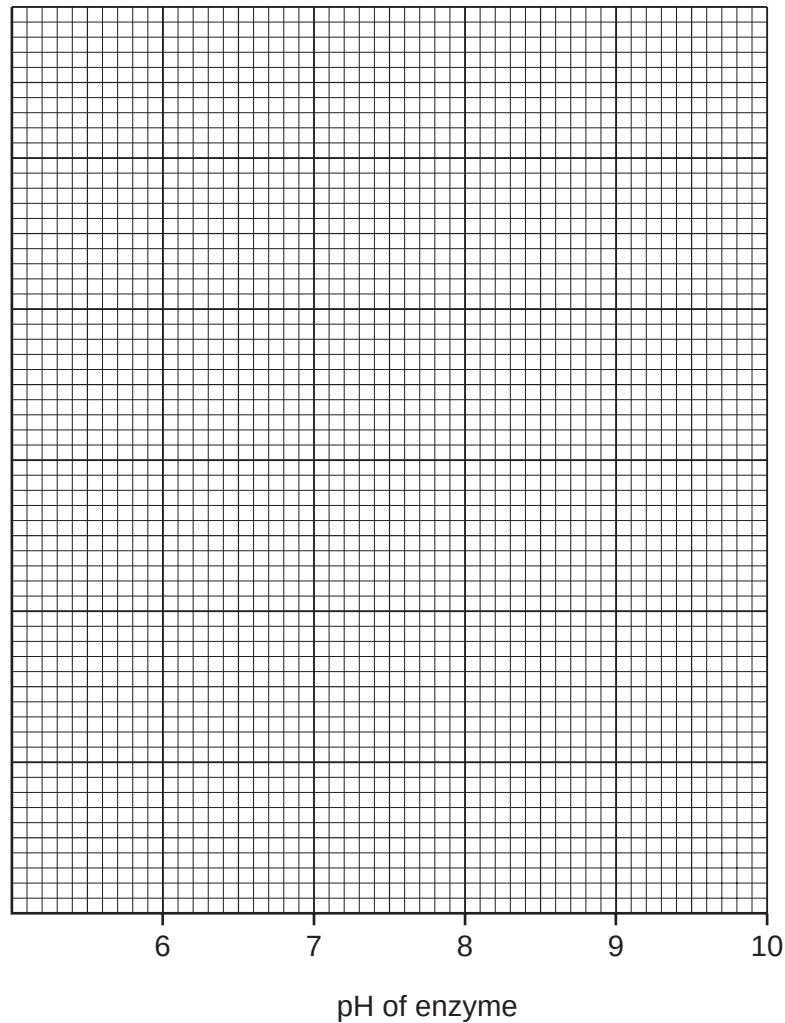
Record your readings in the second column of Table 4.1.

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	

- (ii) Plot a graph of new diameter, d_1 , against pH on the grid provided. Insert the title 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]

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

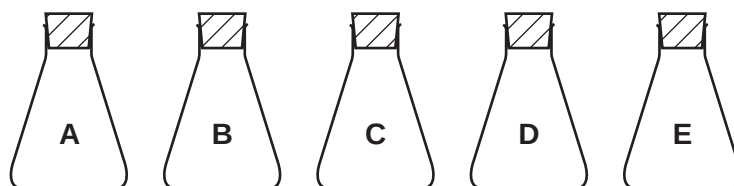


Fig. 5.1

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

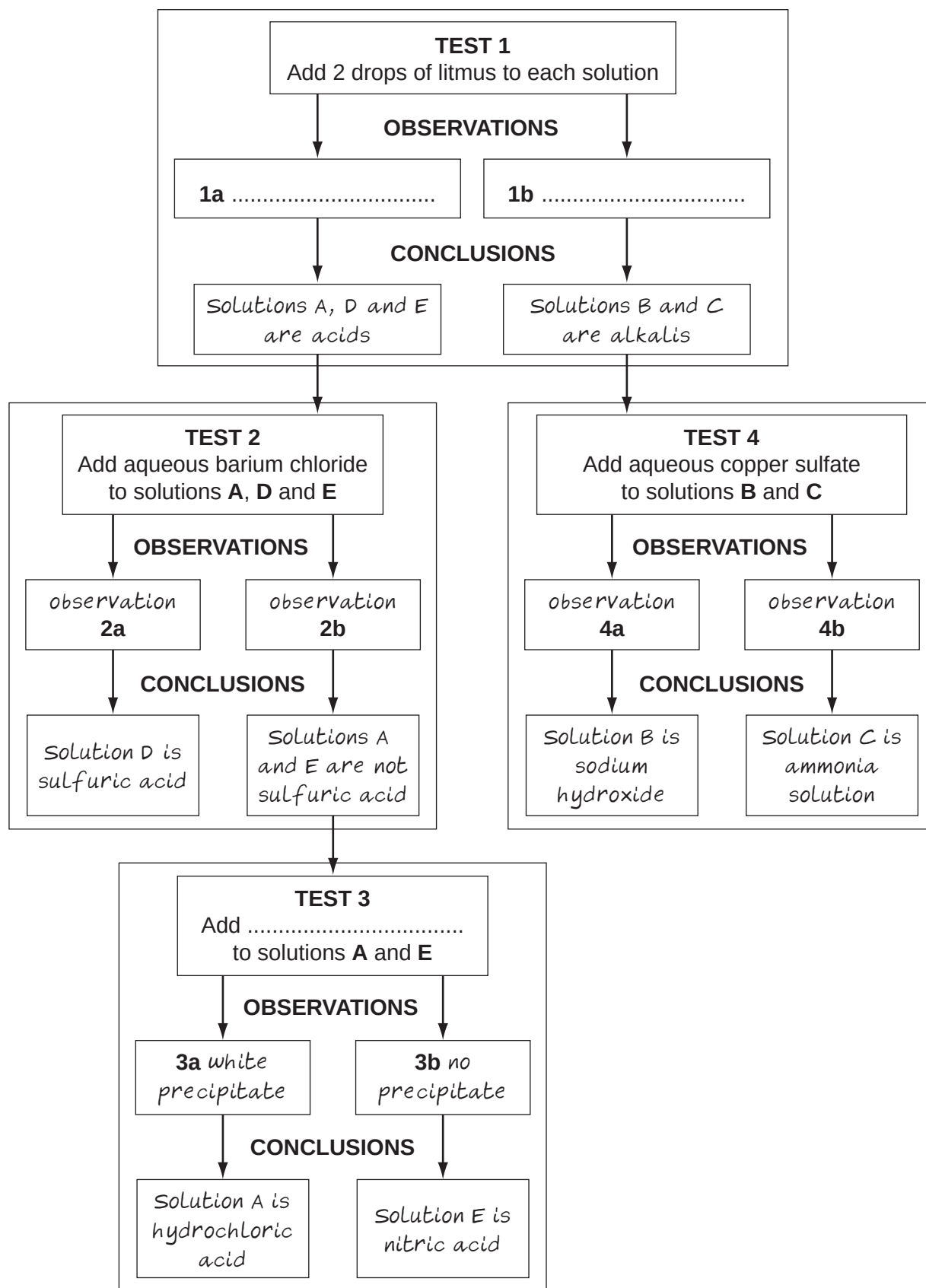


Fig. 5.2

(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 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.

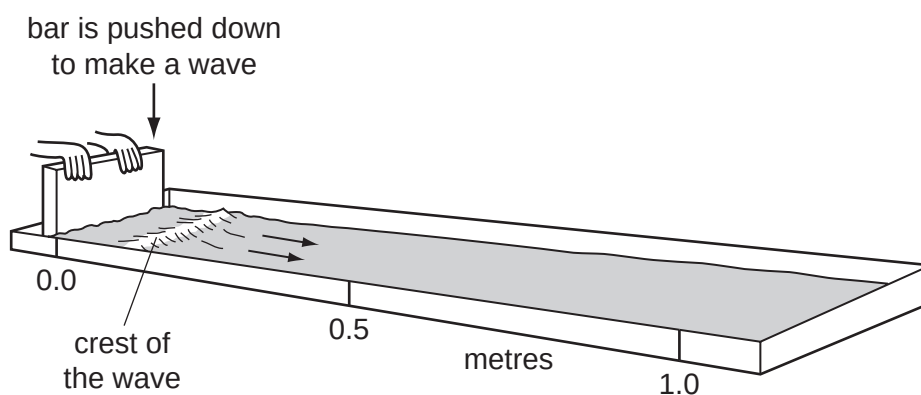


Fig. 6.1

(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.

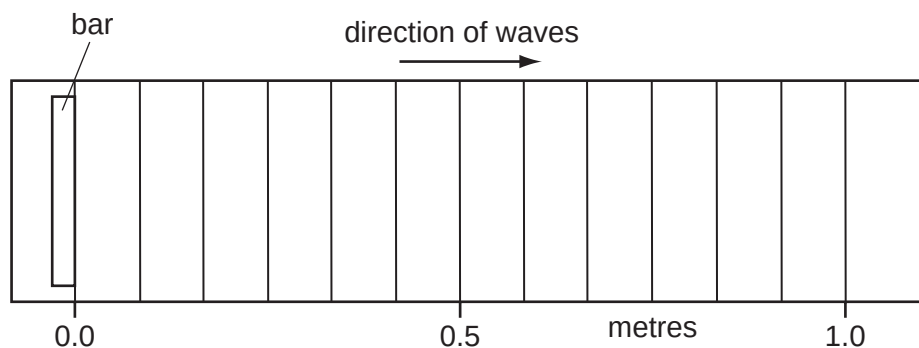


Fig. 6.2

- (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]

- (iii) State the number of “ticks” that the student hears after a wave is made and 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.

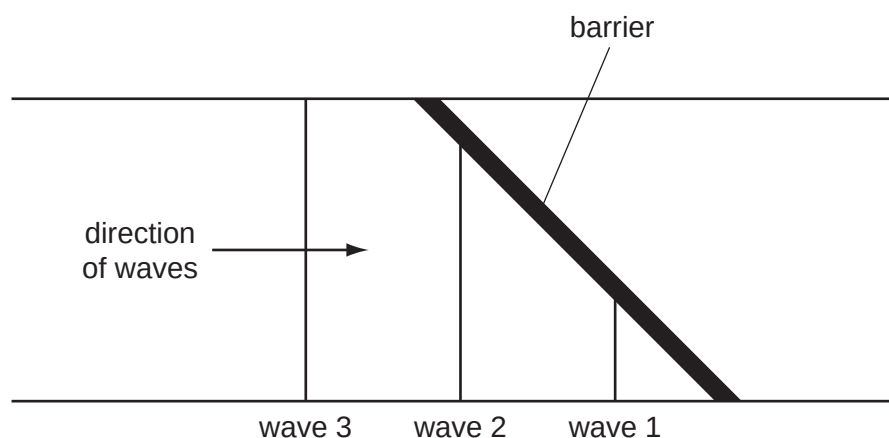
velocity = ... m/s [1]

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

frequency = ... Hz [1]

(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	<i>transverse</i>
sound waves	<i>Longitudinal</i>
waves in the tank	

[1]