



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

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COMBINED SCIENCE

0653/61

Paper 6 Alternative to Practical

May/June 2013

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 or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

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 **20** printed pages.



- 1 (a) Fig. 1.1 shows a flower seen in longitudinal section.

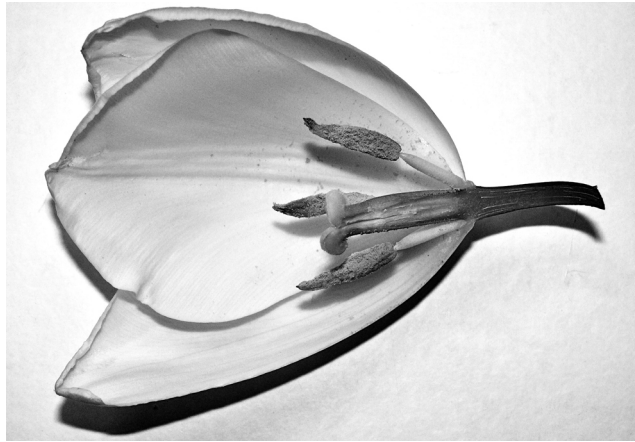


Fig. 1.1

- (i) Make a large, clear pencil drawing of this flower, in the space below.

[2]

- (ii) On your drawing, label a stamen and the carpel. Next to each of these labels, state (in brackets) whether the part is male or female. [2]

- (b) A student took a petal of a different flower and tested it for the presence of reducing sugar, using Benedict's test.

Fig. 1.2 shows the appearance of the petal before and after carrying out the Benedict's test.

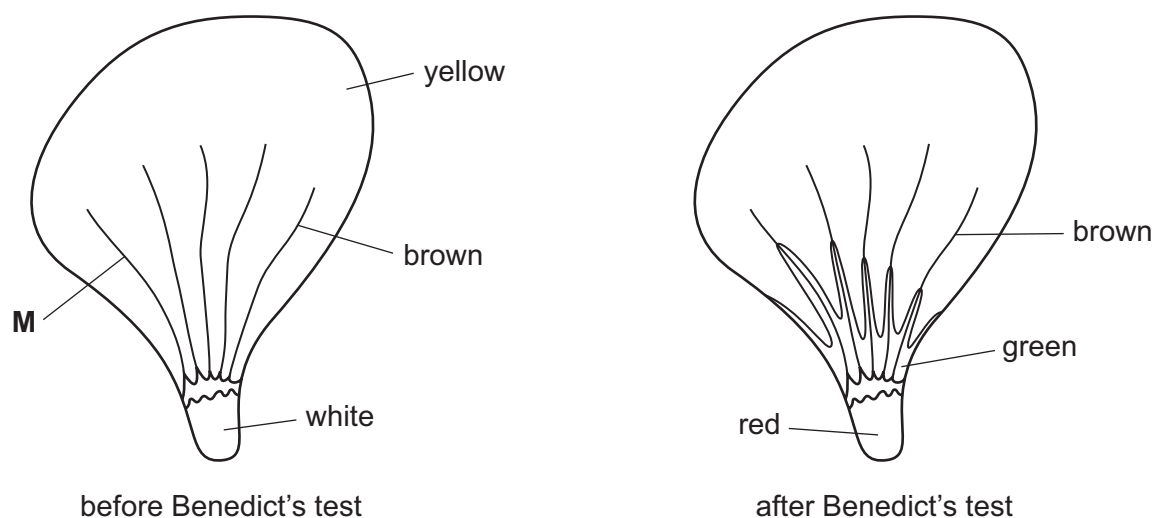


Fig. 1.2

- (i) Describe how you would carry out the Benedict's test.

.....
 [1]

- (ii) State the function of the petals of this flower.

.....
 [1]

- (iii) Suggest how the following features help the function of the flower,

the colour of the petal, before carrying out the Benedict's test,

.....

the lines and markings, labelled **M**.

.....
 [2]

- (iv) State your conclusion from the results of the Benedict's test. Explain the significance of this in relation to your answers to (ii) and (iii).

conclusion

.....

significance

..... [2]

- 2 (a) A student is making a fruit battery. She makes two small cuts in an orange and puts a small piece of copper into one of the cuts, and a length of magnesium ribbon into the other as in Fig. 2.1.

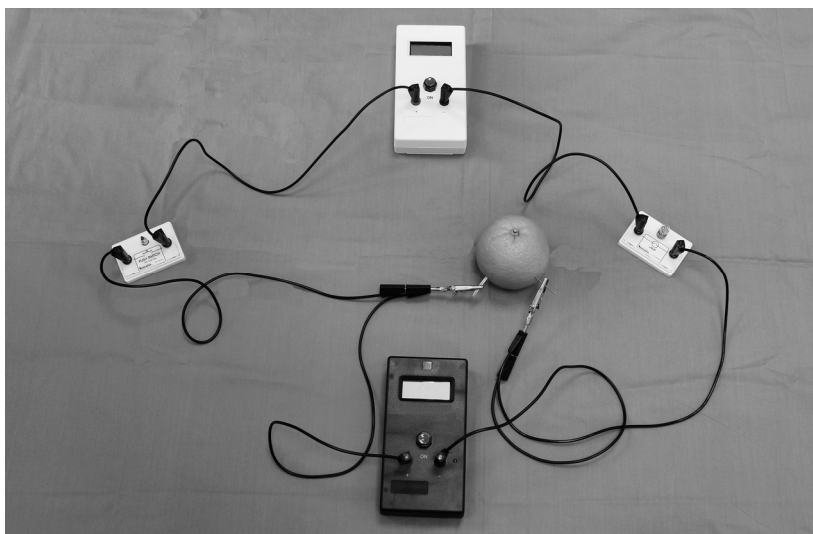


Fig. 2.1

- (i) Using a ruler, draw a circuit diagram to show the apparatus used in Fig. 2.1. Use the correct symbols to draw your diagram and label the meters.

[3]

- (ii) She notices that when the switch is closed a current flows through the circuit. Give **two** observations that would prove a current is flowing.

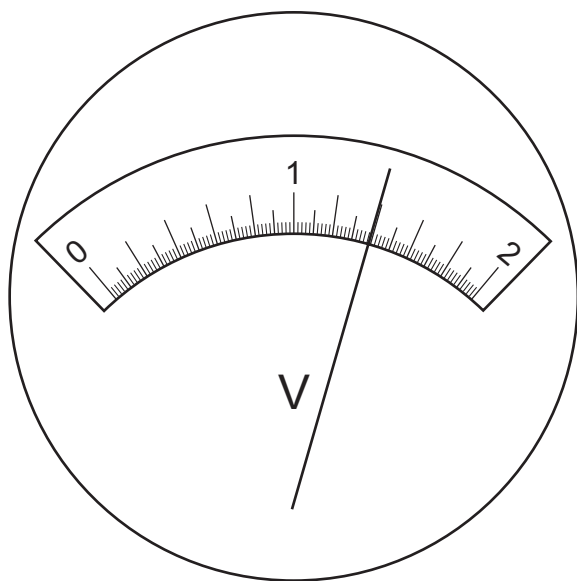
.....
 [1]

- (iii) When the electrodes are magnesium and copper the reading on the voltmeter is 1.80 V.

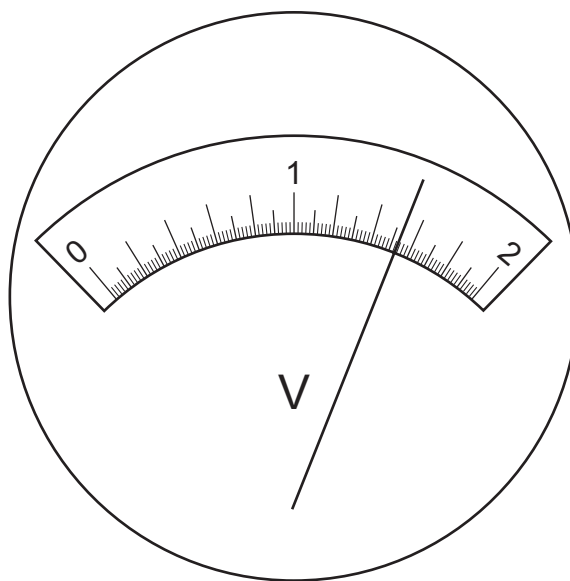
She removes the copper electrode and replaces it with a piece of aluminium. The reading changes to 1.26 V.

She keeps the magnesium electrode and replaces the aluminium first with iron and then with lead.

Read and record the values shown on the voltmeters in Fig. 2.2 in the space provided.



electrodes: magnesium
and iron



electrodes: magnesium
and lead

Fig. 2.2

..... V

..... V [2]

- (b) Use the information given in (a)(iii) and your answer to (a)(iii) to construct a table showing the voltages produced with the four sets of electrodes.

[2]

- (c) The teacher tells the student that the order of reactivity of all the metals used in the experiment can be deduced using the information from the table.

Explain how this is possible, and list the metals in order of reactivity.

explanation

.....

order of reactivity

.....

most reactive

least reactive

[2]

- 3 A student is investigating how the concentration of a reactant affects the rate of a reaction.

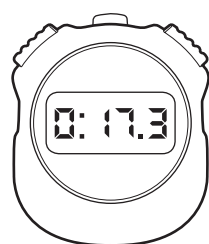
In this reaction potassium iodate reacts with a reducing agent to produce iodine. The reaction can be followed using starch solution as an indicator; it turns blue-black when iodine is present.

- (a)
- She places 10 cm^3 potassium iodate solution into a conical flask.
 - She adds 5 cm^3 starch solution to the conical flask.
 - She starts the timer as she adds 5 cm^3 of the reducing agent to the conical flask.
 - She stops the timer when the mixture goes blue-black.
 - She records the time taken, to the nearest second, for the mixture to go blue-black in Table 3.1.
 - She repeats the experiment four more times varying the volumes of potassium iodate solution and water as shown in Table 3.1.

Table 3.1

volume potassium iodate solution / cm^3	volume water / cm^3	time / s	$\frac{1}{\text{time}}$
10	0	10	0.100
8	2	13	0.077
6	4		
4	6	30	0.033
2	8		

Read the stop clocks in Fig. 3.1 and record the times to the nearest second in Table 3.1.



6 cm^3 potassium iodate solution



2 cm^3 potassium iodate solution

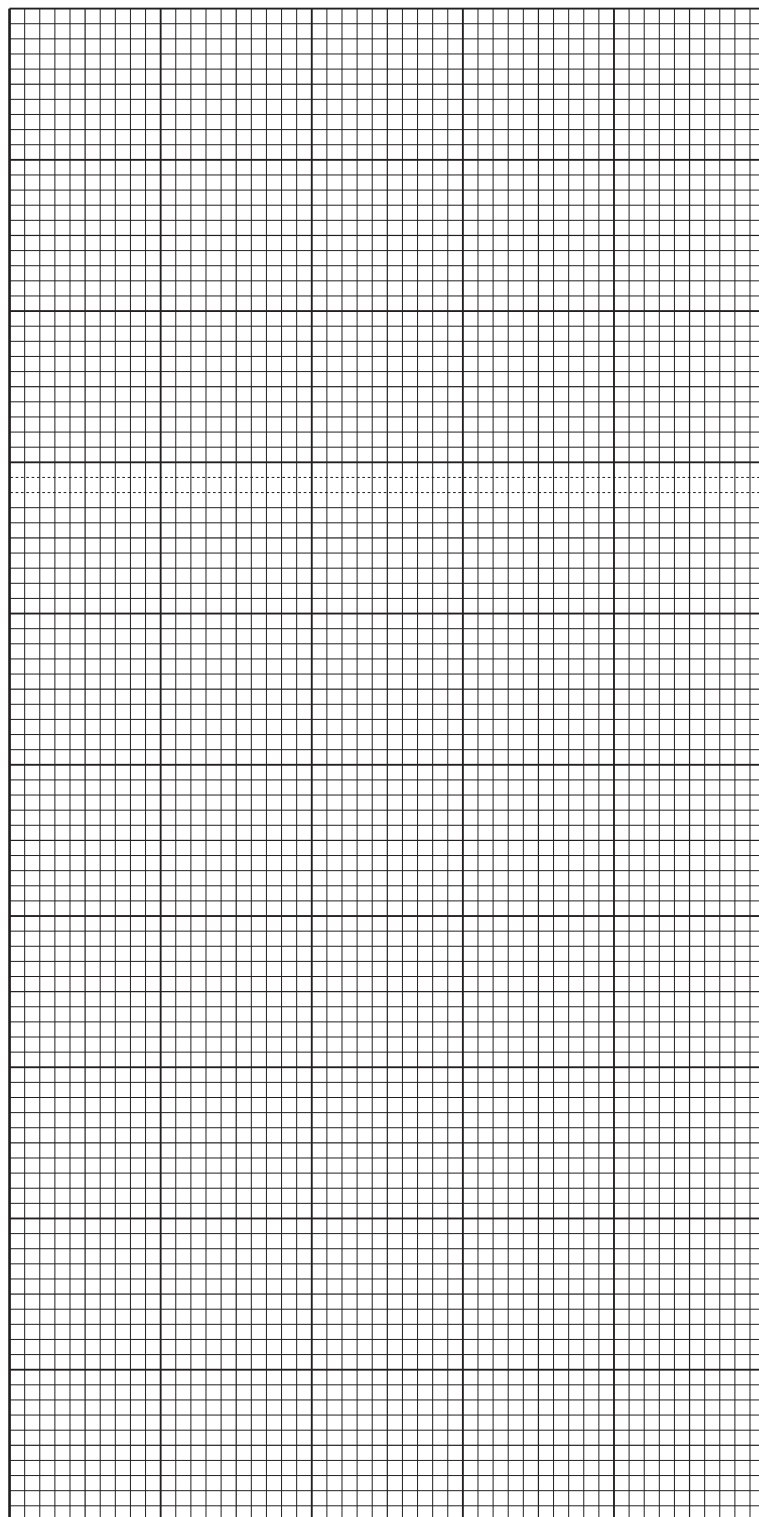
Fig. 3.1

[2]

- (b) (i) Calculate $\frac{1}{\text{time}}$ (rate) for the missing values and enter the results in the last column of Table 3.1.

[1]

- (ii) Plot a graph of $\frac{1}{\text{time}}$ (vertical axis) against the volume of potassium iodide solution / cm^3 drawing the best straight line through the origin.



[4]

- (c) (i) State what your graph tells you about how the rate of the reaction depends on the volume of potassium iodate solution present.

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

- (ii) When the potassium iodate is reduced iodine is formed. What observation made by the student confirms this?

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

- (iii) Why are different volumes of water used in each experiment?

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

Please turn over for Question 4.

- 4 The enzyme pectinase is used in the production of fruit juices. It speeds the breakdown of the walls of plant cells. This helps to release juice from the cells.

A student did an experiment in which she investigated the action of pectinase on apples. She wanted to find the optimum pH for the enzyme. This value would produce the greatest volume of fruit juice.

- The student made up solutions of enzyme at different pH values.
- She prepared small cubes of apple, all the same size, and placed equal masses of cubes into five dishes.
- She added 1 cm³ pectinase solution to the dishes of apple so that each dish contained pectinase at a different pH.
- She thoroughly mixed the enzyme and apple in each dish.
- After 10 minutes the contents of each dish were filtered.

The filtrate was the juice from the apples. It dripped into the measuring cylinder. The volume of juice produced was a measure of how reactive the enzyme was.

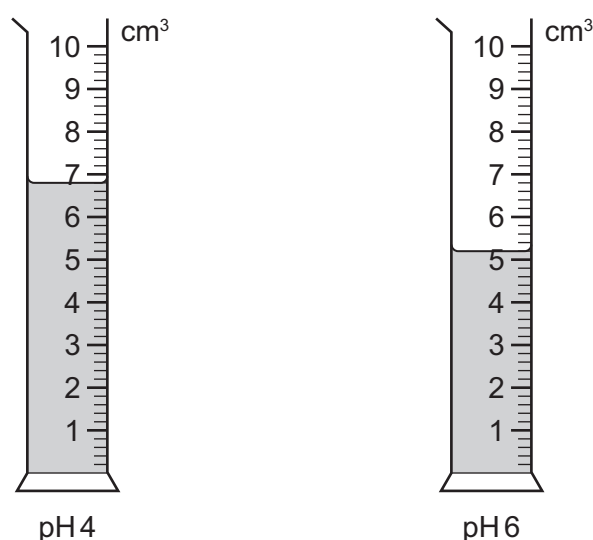


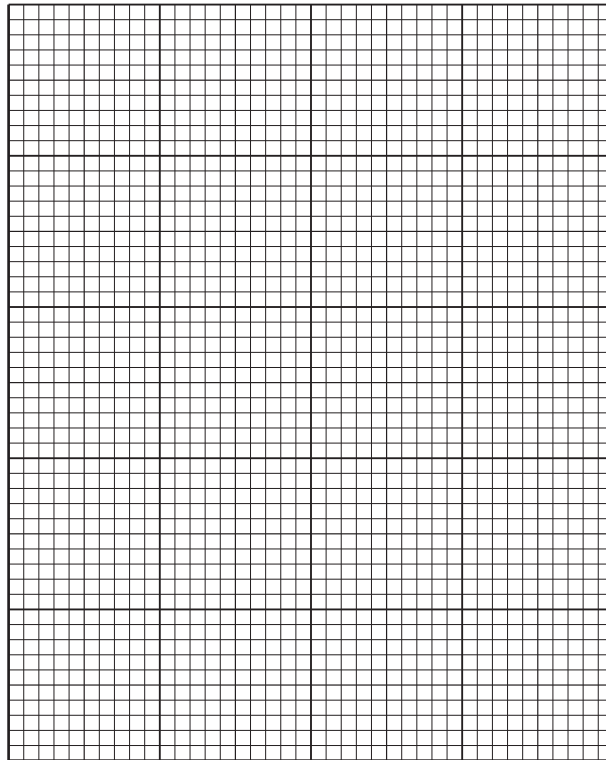
Fig. 4.1

- (a) (i) Read the scales of the measuring cylinders in Fig. 4.1 and enter the missing volumes of juice for pH values 4 and 6 in Table 4.1. [2]

Table 4.1

pH of enzyme solution	volume of juice produced / cm ³
3	4.6
4	
5	9.6
6	
7	2.2

- (ii) Plot a graph of volume of juice produced/cm³ against pH of enzyme solution using the grid provided. Draw the best curve.



[3]

- (iii) Suggest the optimum pH for the enzyme.

optimum pH = ... [1]

- (iv) Explain why you cannot be sure of the exact optimum pH value.

.....

..... [1]

- (b) Describe a control experiment the student could do to prove that the enzyme was responsible for the production of fruit juice.

.....

..... [1]

- (c) Use your knowledge of the activity of enzymes to suggest **one** different method of increasing the activity of the enzyme.

Explain why it would work.

.....

.....

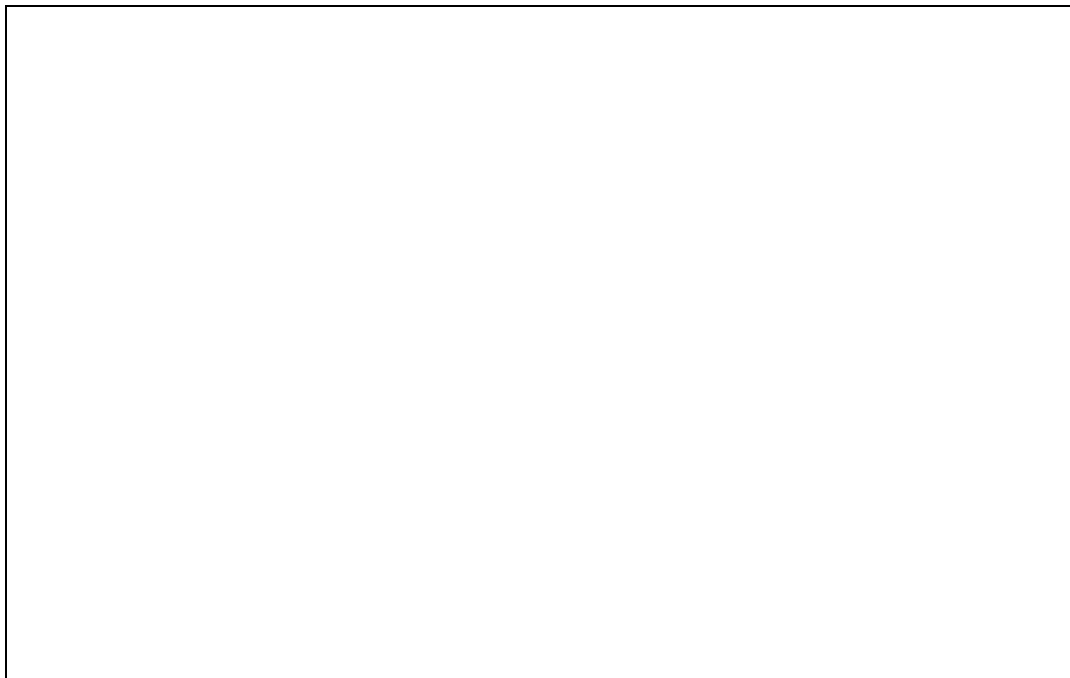
..... [2]

Please turn over for Question 5.

- 5 You are going to draw labelled diagrams to show the arrangement of apparatus for the following experiments.

Large diagrams should be drawn carefully and labelled clearly.

- (a) A student separates insoluble copper oxide from a mixture of copper oxide with water.



[2]

- (b) A student separates the colours in the ink from a felt-tip (marker) pen.



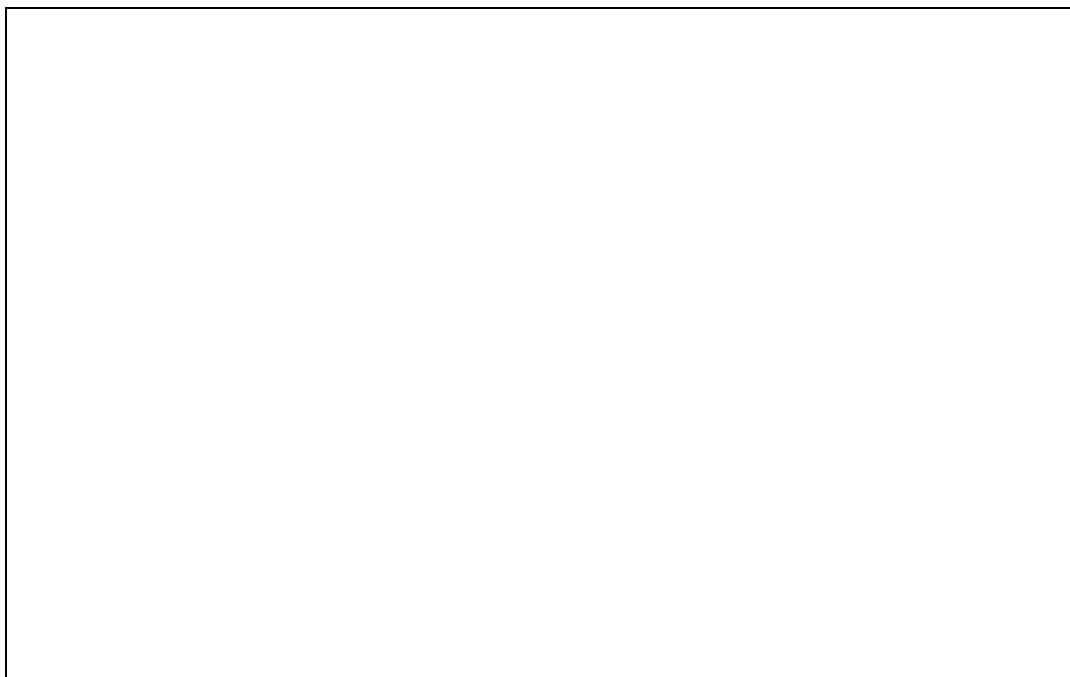
[2]

- (c) A student measures the volume of ammonia gas evolved when a mixture of two solids are gently warmed.



[2]

- (d) A student separates pure water from a salt solution.



[2]

- (e) Describe in detail how you would separate a mixture of two liquids with different boiling points.

.....

.....

.....

[2]

- 6 (a) A student is finding the value of an unknown mass, M , of a fixed load by balancing it against a range of known masses on a metre rule.

The apparatus is set up as shown in Fig 6.1.

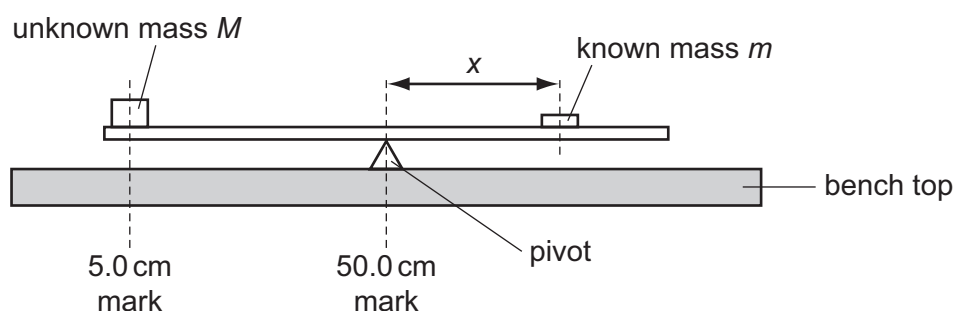


Fig. 6.1

The unknown load of mass M , is fixed at the 5.0 cm position. The student places a 60 g mass, m , on the ruler. He adjusts the position of mass m , until the ruler is balanced. He records the distance, x cm, from the 50.0 cm balance point in Table 6.1.

Table 6.1

mass m /g	distance x /cm	$\frac{1}{x}$
60	37.4	
70	31.9	
80		
90		
100	22.7	

- (i) Use Fig 6.2 to find the distance, x , for masses equal to 80 g and 90 g and complete column 2 of Table 6.1. Measure to the centre of the mass. [2]

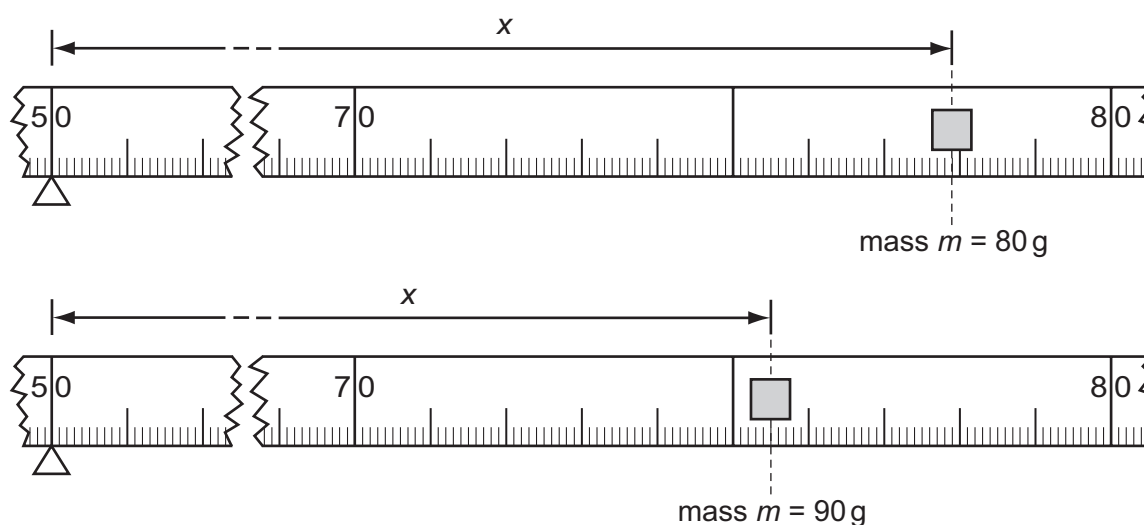
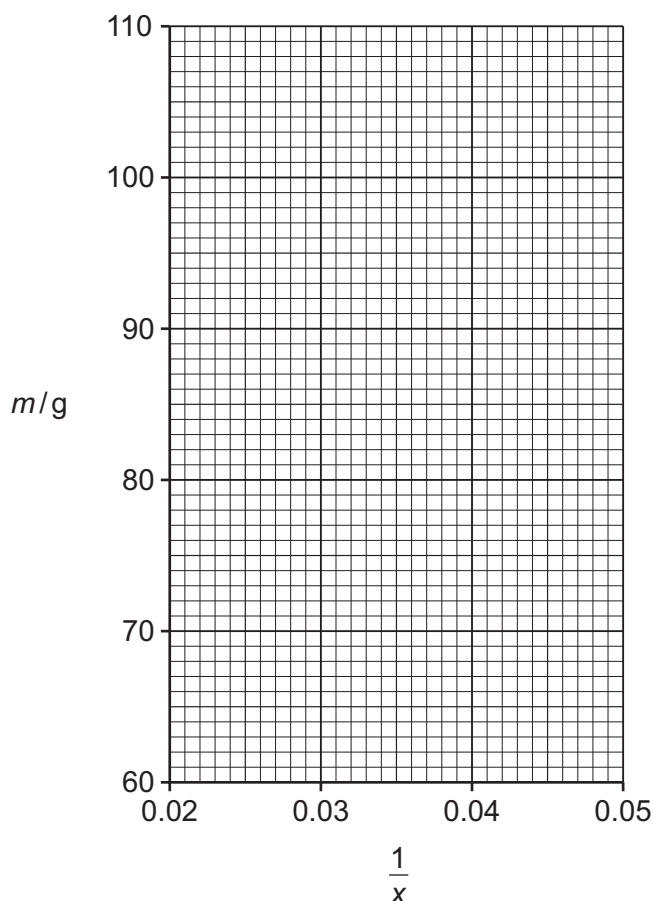


Fig. 6.2

- (ii) Calculate $\frac{1}{x}$ for each value of x and record your answers to 3 decimal places in Table 6.1. [2]

- (b) (i) On the grid provided, plot a graph of mass, m , (vertical axis) against $\frac{1}{x}$. Draw the best straight line.



[2]

- (ii) Calculate the gradient of the line. Show clearly, on the graph, how you did this.

gradient of the line [2]

- (c) Calculate the value of the unknown load of mass M , using the equation

$$M = \frac{\text{gradient}}{45}$$

$M = \dots\dots\dots$ g [1]

- (d) This method of finding unknown masses is unsuitable for very small or very large masses.

Suggest a reason for either of these.

..... [1]



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1	
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Total	

This document consists of **18** printed pages and **2** blank pages.



- 1 A student did an experiment with two potted plants, each of which had been enclosed in a transparent polythene bag for a period of two days. During this time, the plants were exposed to bright light.

In one of the polythene bags there was a chemical which absorbs carbon dioxide.

Both plants had parts of their leaves covered with black paper, as shown in Fig. 1.1.

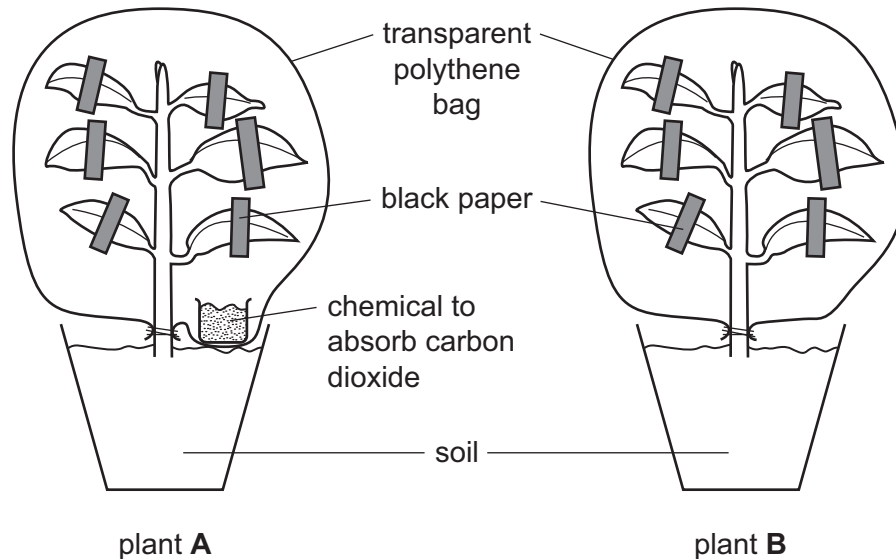


Fig. 1.1

One leaf was removed from each plant, and labelled drawings of the two leaves were made as shown in Fig. 1.2.

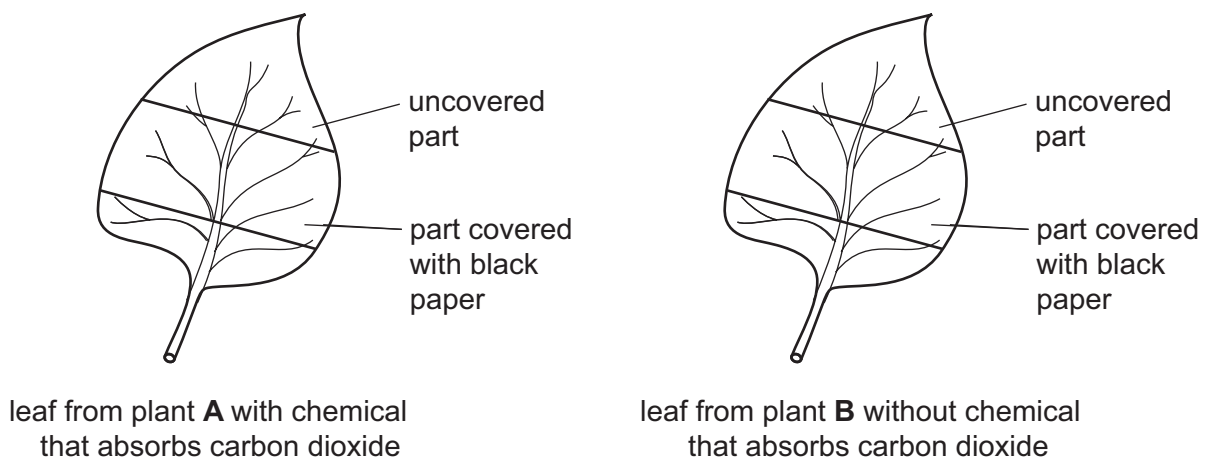


Fig. 1.2

Both leaves were then tested for starch.

- The black paper was removed from each leaf.
- The leaves were placed in hot water for two minutes.
- The leaves were removed from the hot water, and placed in a test-tube of hot alcohol for five minutes.
- The leaves were dipped briefly back into the hot water.
- The leaves were spread out on a white tile, and covered with iodine solution.

(a) On Fig. 1.2, on page 2, label the different areas of each leaf to show the colour you would expect to see after each leaf had been treated with iodine solution.

(b) In the starch test, explain the reasons for

(i) placing the leaf in the hot water at the beginning,

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

(ii) placing the leaf in hot alcohol.

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

(c) (i) The purpose of the experiment with the black paper was to see if light is needed for photosynthesis. However, another student criticised this experiment, saying that the black paper might have prevented photosynthesis by preventing gas exchange.

Suggest a modification of the experiment that would overcome this criticism.

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

(ii) Another modification of the experiment would be to use just one plant, and enclose different part-covered leaves on this plant with and without the chemical that absorbs carbon dioxide.

Explain why this might be considered to be a better experiment.

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

(d) Describe an experiment that you could do to show that chlorophyll in a leaf is needed for photosynthesis.

.....
.....
.....
.....
.....
..... [3]

- 2 In this experiment a student is investigating the period of a simple pendulum.

The *period* is the time for one complete oscillation of the pendulum.

The experiment is set up with the point of support 55.0 cm from the bench as in Fig. 2.1.

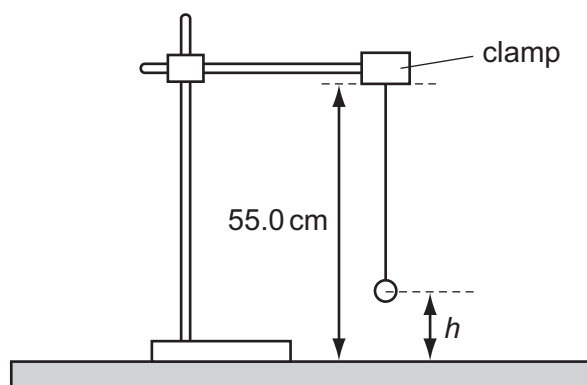


Fig. 2.1

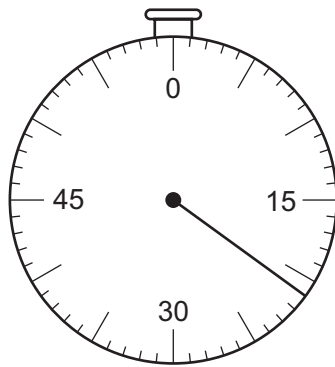
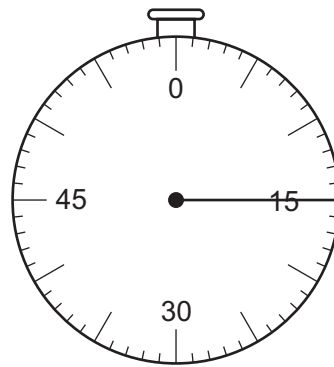
- (a) The student adjusts the height, h , of the bob so that it is 10.0 cm above the bench. He gently starts the bob oscillating and starts the stopwatch. He counts 20 complete oscillations, stops the stopwatch and records the time in Table 2.1.

Table 2.1

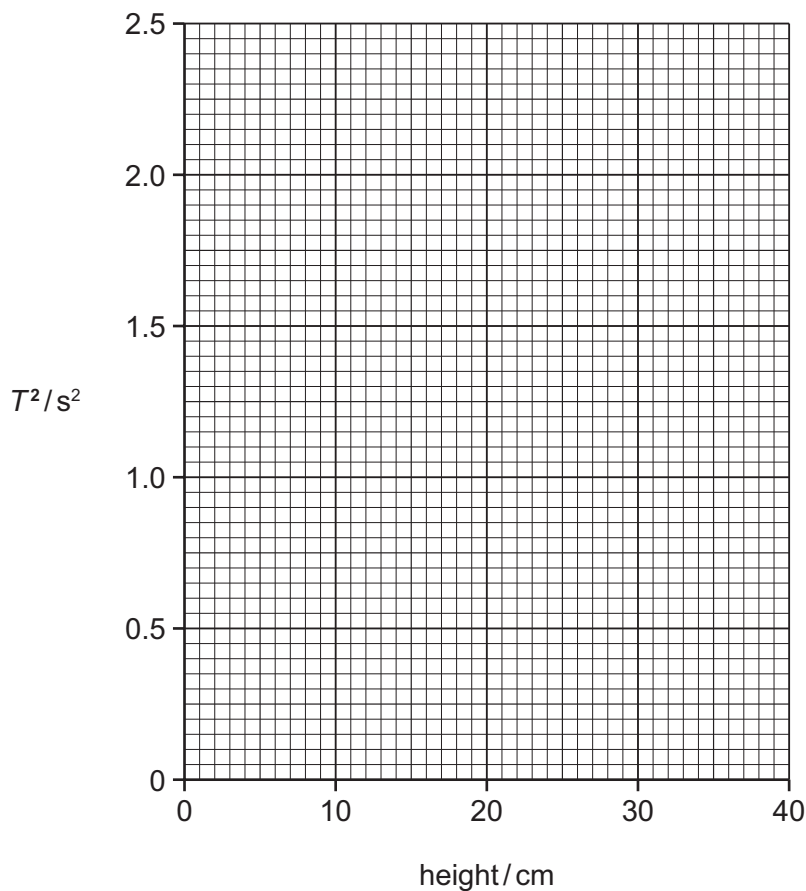
height, h / cm	time for 20 oscillations / s	time, T for one oscillation / s	T^2 / s ²
10.0	26	1.30	1.69
20.0	23	1.15	1.32
25.0			
30.0	19	0.95	0.90
40.0			

- (i) He alters the height, h , of the bob so that it is 20.0 cm above the bench. He times 20 complete oscillations and records it in Table 2.1. He repeats the experiment at several different heights, h .

Read the stopwatches in Fig. 2.2 and record the times for the 20 complete oscillations, in the appropriate spaces in Table 2.1. [2]


 $h = 25.0 \text{ cm}$

 $h = 40.0 \text{ cm}$
Fig. 2.2

- (ii) Using the results for 20 oscillations, in Table 2.1, calculate the time taken for one oscillation, T , for each height, h , in (a)(i) and complete the third column in Table 2.1. [1]
- (iii) Calculate the values of T^2 for each value of h , in (a)(i) and record them in the final column of Table 2.1. [1]
- (b) (i) On the grid provided plot a graph of T^2 against height. Draw the best fit straight line. [2]



- (ii) Calculate the gradient of the line, showing on your graph how you do this.

gradient = ... [2]

- (iii) Extend the line you have drawn until it cuts the vertical axis.

Read off the value of T^2 when the height, $h = 0$.

$T^2 = \dots \text{ s}^2$ [1]

- (iv) Calculate the height of the support of the bob above the bench by dividing the value of T^2 found in **(b)(iii)** by the gradient found in **(b)(ii)**.

height = ... cm [1]

- 3 A student carries out five tests on each of the solutions sodium hydroxide, aqueous ammonia, hydrochloric acid and sulfuric acid.

Write in each blank box in Table 3.1 the observations you would expect to make. If you think nothing happens, write 'no change'.

There should be a statement in each blank box.

Table 3.1

		aqueous sodium hydroxide	aqueous ammonia	dilute hydrochloric acid	dilute sulfuric acid	
(a)	3 drops of Universal Indicator are added					[2]
(b)	an equal volume of silver nitrate solution is added	brown precipitate	no change		no change	[2]
(c)	an equal volume of barium chloride solution is added	no change	no change		white precipitate	[1]
(d)	copper sulfate solution is added slowly until the test-tube is half full			no change	no change	[3]
(e)	a 2 cm length of magnesium ribbon is added and any gas evolved tested with a lighted splint					[2]

- 4 A student carried out an experiment to study osmosis in dandelion stalks.

Osmosis is the movement of water from a region of high water concentration (a dilute solution) to a region of lower water concentration (a more concentrated solution).

She cut a piece of stalk from the dandelion and cut it lengthwise to produce 6 identical pieces. The dandelion plant and a piece of cut stalk are both shown in Fig. 4.1.

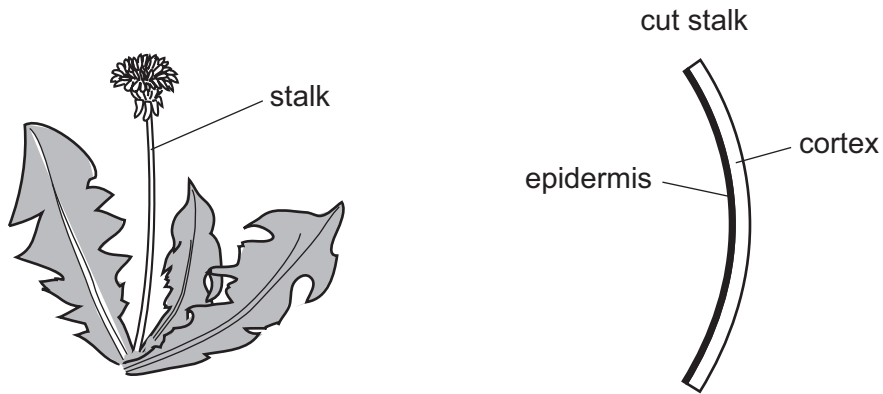


Fig. 4.1

The stalk curved after cutting because the epidermis cells are strong and covered with a thick cuticle. The cortex cells are packed very tightly and they expand a little when the stalk is cut.

No water enters or leaves the pieces of stalk through the epidermis.

- The student had six sucrose solutions of different concentrations. She immersed one strip of cut stalk into each solution.
- She left the strips for 20 minutes then removed them. The strips had changed shape.
- The results are shown in Fig. 4.2, on page 10.

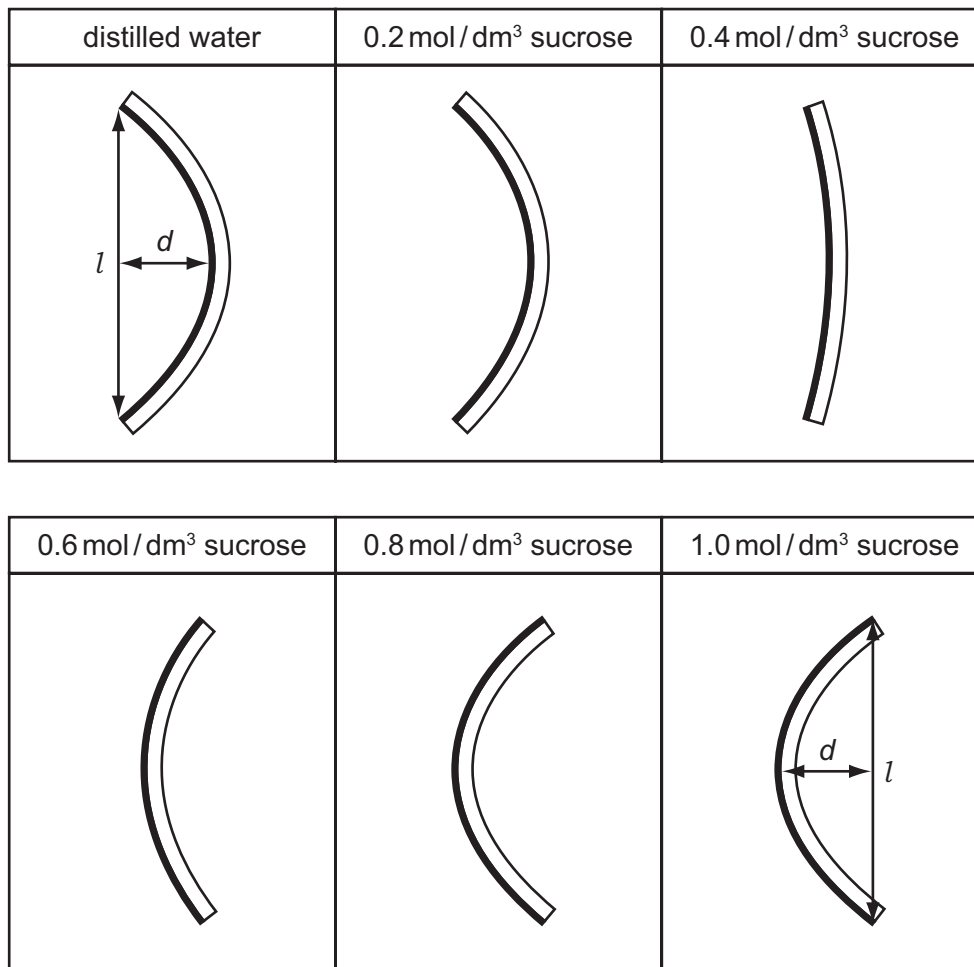


Fig. 4.2

The student measured how much each dandelion stalk had curved.

She drew a straight line, l , between both ends of the epidermis, and then measured the perpendicular distance, d , from the centre of the line to the **left edge** of the epidermis. The way she did this is shown on two diagrams in Fig. 4.2. She entered four of the readings in Table 4.1.

Table 4.1

concentration of sucrose solution in mol / dm ³	d / mm
0 (distilled water)	12
0.2	
0.4	3
0.6	-7
0.8	
1.0	-12

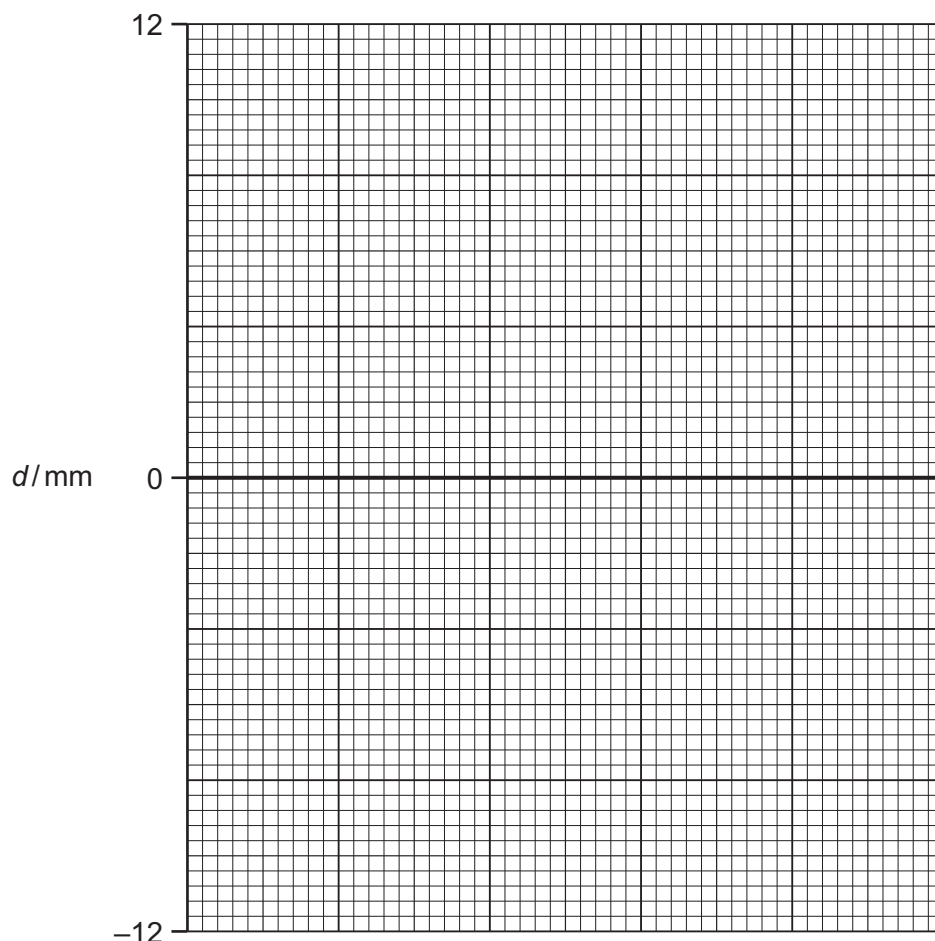
- (a) (i) Use the diagrams in Fig. 4.2 to measure, to the nearest millimetre, the value of d for solutions of concentrations of 0.2 and 0.8 mol/dm³.

Enter the measurements in Table 4.1. Note that when the stem curves to the left the value of d is positive. When the stem curves to the right the value is negative.

[2]

- (ii) Plot the values of d against concentration of sucrose solution on the grid provided. Label the horizontal axis, showing the units. Draw a smooth curve.

[3]



- (iii) Use Fig. 4.1, on page 9, to find the value d of the stalk before immersion.

$d =$ mm [1]

- (iv) Using your value from (a)(iii) and the graph, find the concentration of sucrose solution that would produce no change in shape of the cut stalk.

Show on the graph how you do this.

concentration of sucrose solution = ... mol/dm³ [2]

- (b) In terms of osmosis explain what has happened to the cortex cells of the dandelion stalks during immersion in the 1.0 mol/dm^3 sucrose.

.....

.....

.....

[2]

Please turn over for Question 5.

- 5 (a) A student is copper plating a metal key by the electrolysis of aqueous copper chloride. He uses the following apparatus:

battery made up of three cells,
switch,
lamp,
large beaker of aqueous copper chloride,
copper electrode,
metal key,
sufficient leads and connectors.

- (i) Using a ruler where necessary, draw a circuit diagram to show how he should set up the apparatus.

[2]

- (ii) The teacher said that if the electrolysis was allowed to continue for a long time the copper electrode would disappear.

The student decides to find out how long it would take.

He takes a new copper electrode. He measures its mass as 20.05 g and records it in Table 5.1.

Table 5.1

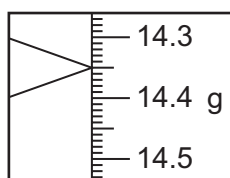
time / hours	0	1	2	3	4
mass / g	20.05	17.42			8.91

He closes the switch. After 1 hour he opens the switch, and quickly removes, dries and weighs the electrode. He records the new mass in Table 5.1. He replaces the electrode in the circuit and closes the switch. He repeats the process after 2, 3, and 4 hours.

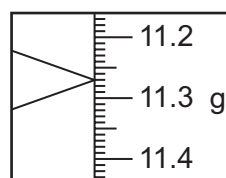
Use Fig. 5.1 to read the mass of the electrode after 2 and 3 hours.

Record the masses in Table 5.1.

[2]



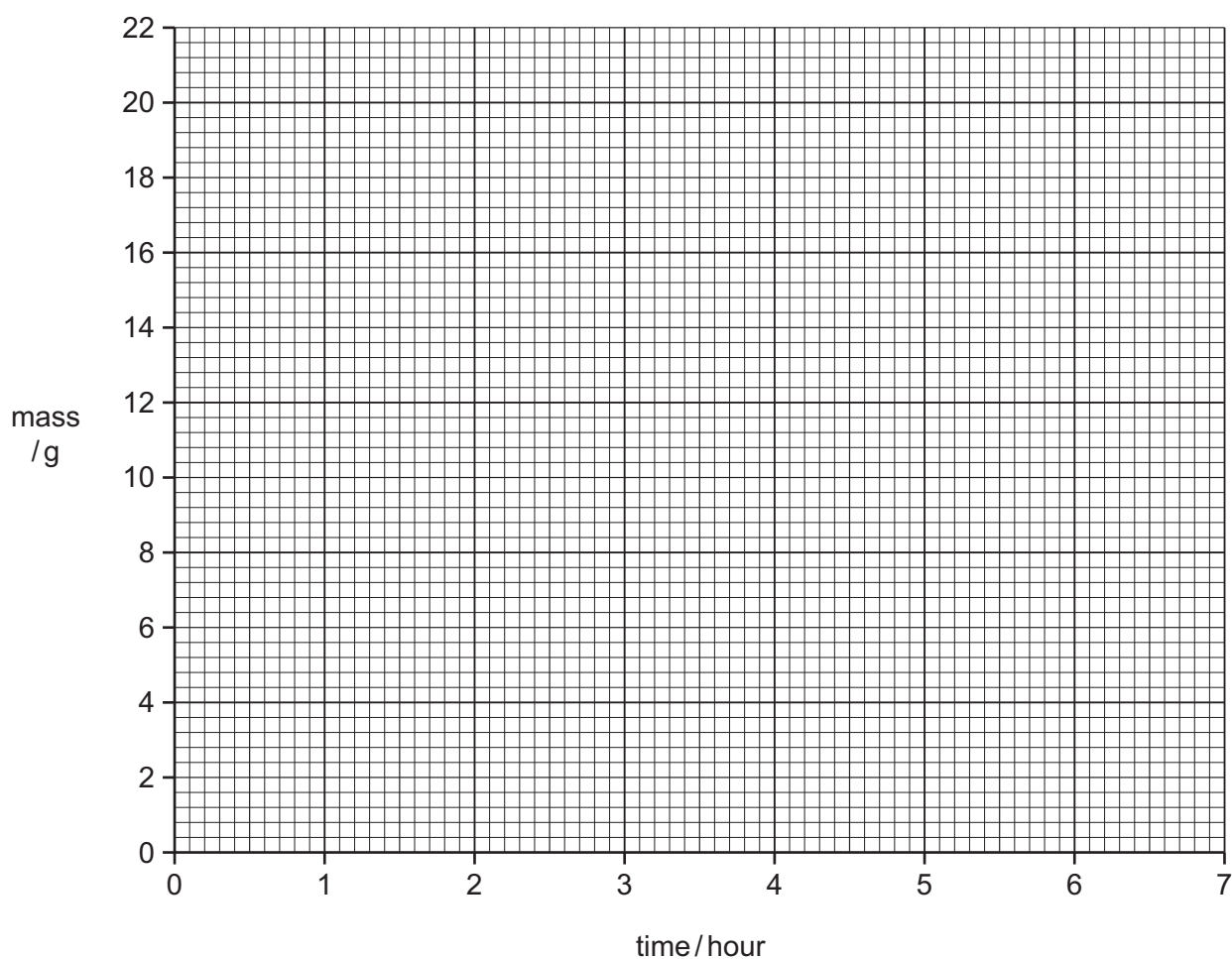
time = 2 hours



time = 3 hours

Fig. 5.1

- (iii) On the grid plot a graph of mass/g against time/hour. Draw the best fit straight line. [2]



- (iv) The student kept the experiment going overnight and the next morning found the electrode had disappeared completely.

Find how long it took to dissolve fully by continuing your graph to the x-axis and read off the time taken.

time taken to disappear completely = ...hours [1]

- (b) The student carries out a second electrolysis, this time using carbon electrodes in aqueous copper chloride.

Explain why the colour of the copper chloride solution changes during this experiment.

..... [1]

- (c) Explain why aqueous copper chloride conducts electricity but solid copper chloride does not.

.....

.....

..... [2]

Please turn over for Question 6.

- 6 (a) Fig. 6.1 shows words and phrases about gas tests, cut from a page of a student's book.

Use a ruler to construct a table, showing each gas with its test and the positive result to identify it.

relights
oxygen
carbon dioxide
Limewater
pops
glowing splint
white precipitate
lighted splint
hydrogen

Fig. 6.1

- (b)** Carbon dioxide can be formed by adding an acid to a carbonate.

Name a suitable acid and carbonate for this reaction.

acid

carbonate

[1]

- (c)** In the space below draw the apparatus you would use to carry out the experiment with your chosen acid and carbonate in order to measure the volume of gas evolved.

Label your diagram.

[4]

- (d)** Hydrogen gas can be produced by adding a metal to an acid.

Name a suitable metal that can be added to an acid to produce hydrogen safely.

..... [1]



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COMBINED SCIENCE

0653/63

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May/June 2013

1 hour

Candidates answer on the Question paper.

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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 pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

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 A student did an experiment to investigate the effect of temperature on the rate of respiration of yeast. This was done by measuring the rate at which the yeast produced bubbles of carbon dioxide. Yeast is able to respire, and produce carbon dioxide, even in the absence of oxygen.

Apparatus was set up as shown in Fig. 1.1.

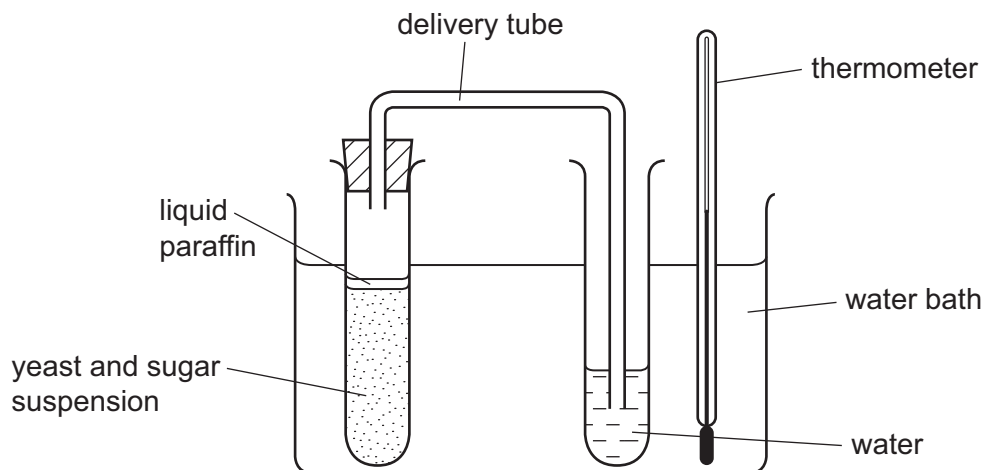


Fig. 1.1

The student made sure that the temperature of the water bath was 20 °C, and then waited for three minutes. After this time, the number of bubbles produced was counted each minute for three minutes.

The procedure was then repeated at 30 °C, at 40 °C, at 60 °C, and finally at 80 °C.

The results are shown in Table 1.1.

Table 1.1

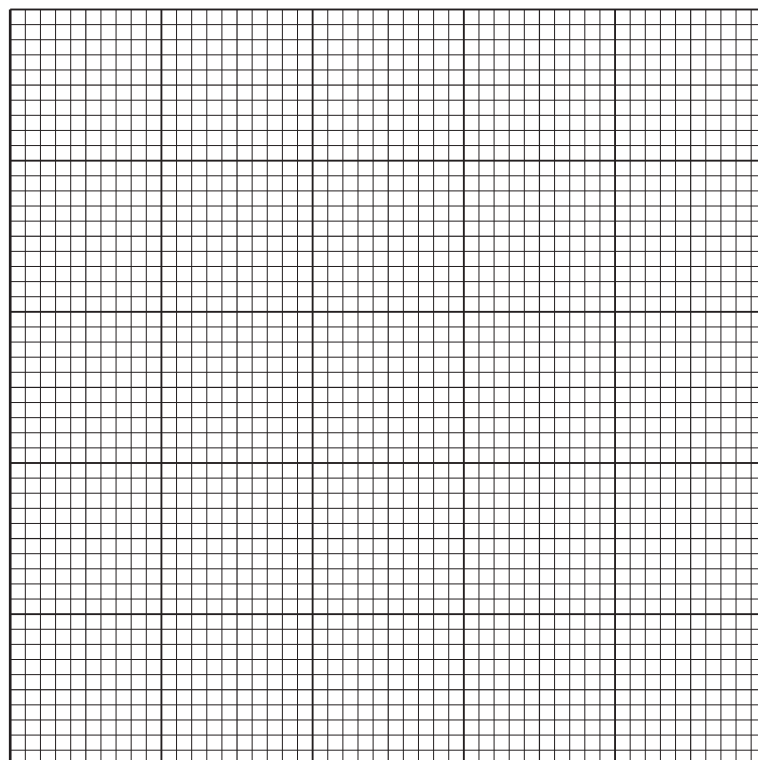
temperature / °C	number of bubbles in one minute			
	1 st minute	2 nd minute	3 rd minute	average
20	3	5	4	4
30	10	7	7	
40	15	13	19	
60	15	16	14	
80	0	0	0	0

- (a) Complete Table 1.1, by working out the average numbers of bubbles produced per minute at 30 °C, 40 °C, and 60 °C giving each of your answers to the nearest whole number. [1]

- (b) On the grid below, plot the average number of bubbles per minute against temperature.

Join your points with straight lines.

average
number bubbles
per minute



temperature / °C

[2]

- (c) Suggest explanations for

- (i) the change in rate of bubble production between 20 °C and 40 °C,

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

- (ii) the result obtained at 80 °C.

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

(d) Explain why

(i) the student waited three minutes before taking readings at each temperature,

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

(ii) three readings were taken at each temperature,

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

(iii) the experiment at 80 °C was done last.

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

(e) Suggest how this experiment could be modified to show that the bubbles of gas given off contain carbon dioxide.

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

(f) Suggest a suitable control experiment for this investigation.

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

- 2 A student is investigating the characteristics of a converging lens by two different methods.

A converging lens is a lens that is thicker in the middle. It bends rays of light together so that they can form an image on a screen, as shown in Fig. 2.1.

Method 1

She sets up a converging lens so that light from a distant object produces a sharp image on a screen as shown in Fig. 2.1.

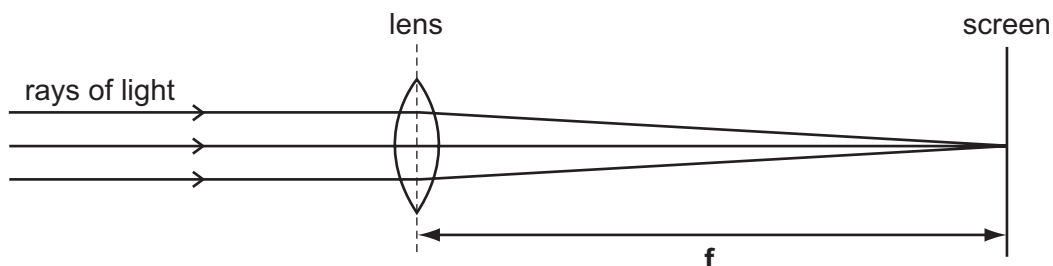


Fig. 2.1

- (a) The distance f , from the screen to the lens, is called the focal length. Use a ruler to measure the distance f .

$f =$ cm [1]

Method 2

The student sets up the apparatus shown in Fig. 2.2. The light shines through the hole and the screen can be moved until a sharp image of the illuminated object is formed.

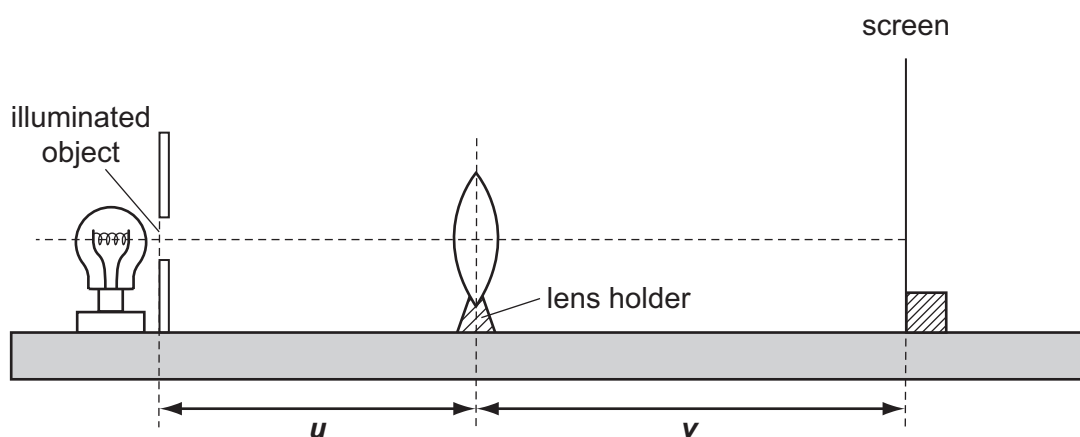


Fig. 2.2

She moves the lens so that distance, u , is 50.0 cm. She moves the screen until a sharp image is seen. She measures distance, v , and records the value in Table 2.1. She repeats this for different values of u .

Table 2.1

u /cm	v /cm	$u+v$ /cm	uv /cm ²
20.0	59.8	78.8	1196
30.0	30.1	60.1	903
40.0			
45.0	22.7	67.7	1021
50.0	21.5	71.5	1075

Fig. 2.3 shows a diagram of the apparatus when distance $u = 40.0$ cm.

The diagram is drawn to the scale of 1 to 10. That means that 1 cm in the diagram is actually 10 cm.

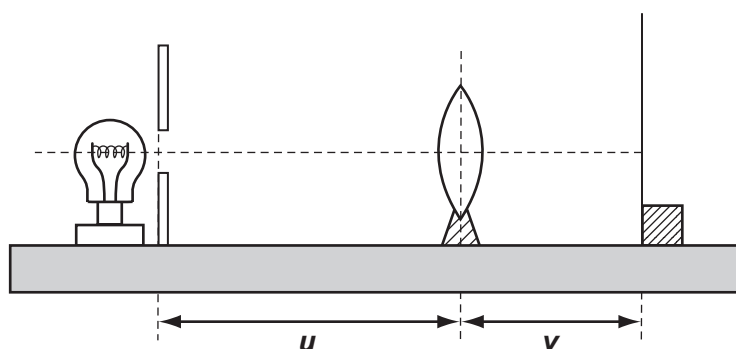


Fig. 2.3

- (b) (i) Use a ruler to measure the distance for v in Fig. 2.3, to the nearest 0.1 cm.

distance = ... cm [1]

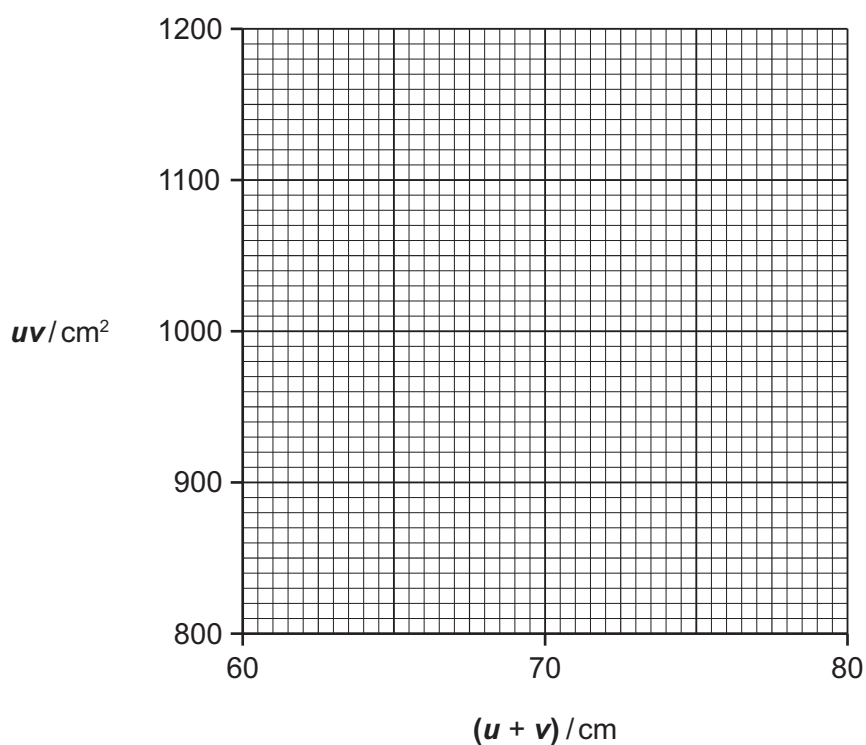
- (ii) Convert this measurement to the actual value of v and complete the second column of Table 2.1. [1]

- (iii) Complete column 3 of Table 2.1 by adding u and v . [1]

- (iv) Complete the final column of Table 2.1 by multiplying u and v . [1]

- (c) (i) On the grid provided plot a graph of uv against $u + v$.

Draw the best straight line.



[2]

- (ii) Find the gradient of your line.

Show clearly on the graph how you did this.

gradient = ... [2]

- (d) Your answer to (c)(ii) is the focal length of the lens.

Compare this to your answer in (a) and suggest the scale that Fig. 2.1 is drawn to.

.....
 [1]

- 3 In this experiment a student is investigating how the rate of the reaction between magnesium and acid is affected by the surface area of the solid. She sets up the apparatus as in Fig. 3.1.

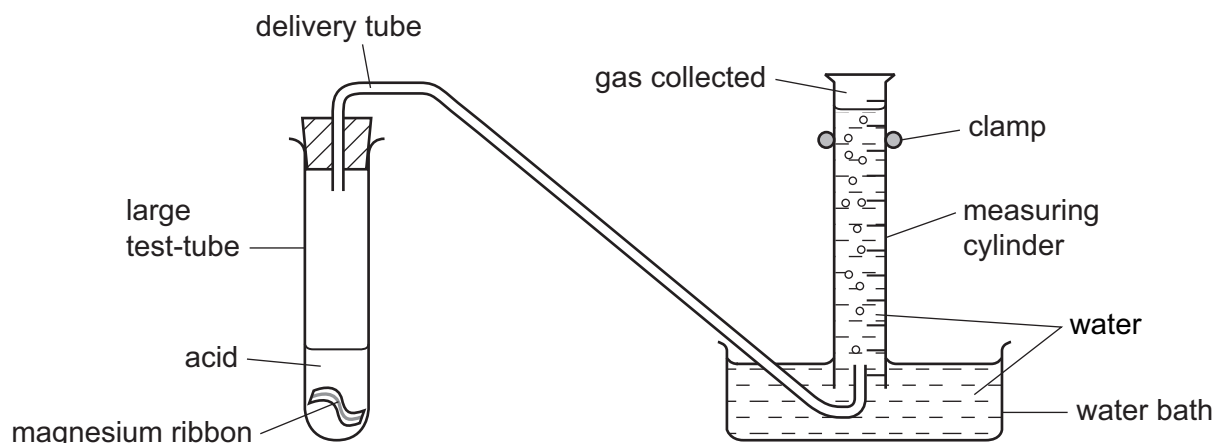


Fig. 3.1

- She removes the bung from the large test-tube and places 1 cm of magnesium ribbon in the bottom of the test-tube.
- She measures out 10 cm^3 acid.
- She starts the stopclock.
- When the time on the stopclock reaches 10 seconds, she adds the acid to the test-tube and quickly replaces the bung as tightly as possible.
- She stops the clock when the volume of gas collected in the inverted measuring cylinder is 10 cm^3 .
- She subtracts 10 seconds from the time displayed on the clock, then records the result in Table 3.1.

Table 3.1

length of magnesium/cm	time/s	rate/ cm^3 per s
1	37.5	
2	19.0	
3		
4		

She repeats the above steps using 2 cm of magnesium ribbon. She subtracts 10 seconds from the time shown on the clock and records the result in Table 3.1.

- (a) Fig. 3.2 shows the stopclock readings for lengths of magnesium 3 cm and 4 cm.

Subtract 10 seconds from each and record the result in Table 3.1.

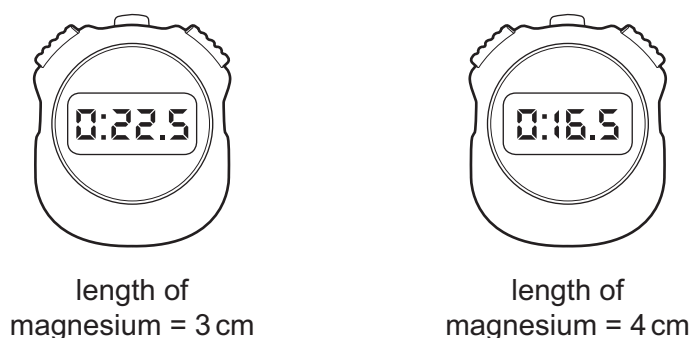


Fig. 3.2

[2]

- (b) (i) For each length of magnesium, complete column 3 of Table 3.1 by calculating the rate of the reaction using the formula

$$\text{rate} = \frac{10}{\text{time}}$$

[1]

- (ii) How does the rate of the reaction between magnesium and acid vary with the length of magnesium ribbon?

.....
 [1]

- (iii) Since the magnesium ribbon is thin, doubling the length of the ribbon approximately doubles the surface area.

How does the rate of the reaction between magnesium and acid vary with the surface area of the magnesium ribbon?

.....
 [1]

- (iv) The teacher said '*The rate of reaction doubles when the length of the magnesium ribbon is doubled*'.

State whether the results show that the statement is correct or incorrect. You must show which results support your statement.

.....

.....

.....

.....

..... [3]

- (c) Suggest why she waited 10 seconds before adding the acid.

.....

..... [1]

- (d) The student suspects that the gas collected in the reaction is hydrogen.

Suggest how the student should test the gas collected in this experiment to show that it is hydrogen.

.....

..... [1]

- 4 The enzyme pectinase is used in industry for preparing fruit juices. Pectinase speeds release of fruit juice from plant cells by breaking down the cell walls.

A student used apples as the source of the plant cells. He wanted to produce a clear fruit juice.

- He placed some apple pieces and a little water in a blender and used this to produce a smooth apple paste.
- He then placed equal volumes of apple paste in each tube.
- He then placed pectinase and water in the tubes as shown in Table 4.1.
- He incubated the tubes at the temperatures indicated for ten minutes.

Table 4.1

tube number	apple paste/cm ³	pectinase/cm ³	water/cm ³	temperature/°C
1	5	1	0	20
2	5	0	1	20
3	5	1	0	40
4	5	0	1	40

Results

appearance at start	appearance after incubation			
				
all tubes	tube 1	tube 2	tube 3	tube 4

Fig. 4.1

- (a) (i) Pectinase was not included in tubes **2** and **4**.

Explain why tubes **2** and **4** were included in the experiment.

.....
 [1]

- (ii) Explain why both tubes **2** and **4** were used for this purpose.

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

The student looked carefully at tube **3** after incubation. The apple paste had become less cloudy than in the other tubes.

- (iii) Compare the appearance after incubation of tube **1** with the appearance of all tubes at the start and record your observation.

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

- (iv) Compare the appearance after incubation of tube **3** with the appearance of tube **1** after incubation and record your observation.

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

- (v) Explain the difference between tube **1** and tube **3** after incubation.

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

Although fruit juice had been produced in tube **3** the juice was still rather cloudy. The student suspected that starch from the broken apple cells was suspended in the juice.

- (b) (i) Suggest a test he could carry out on the contents of tube **3** to find out if starch is present.

Describe the test and a positive result.

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

- (ii) The student found that starch was present. Name an enzyme he could use that could break down the starch.

name of enzyme [1]

- (iii) The student modified his original experiment to make the fruit juice as clear as possible.

Describe in detail what he did and how he could prove that the enzyme named in (b)(ii) was effective.

.....

.....

.....

.....

.....

..... [3]

- 5 (a) A motor manufacturer is testing his new electric car.

The driver is given instructions on how to drive over a set distance on a special test track, as shown in Fig. 5.1.

Poles are placed 10 m apart and a photograph of the position of the car is taken every second.

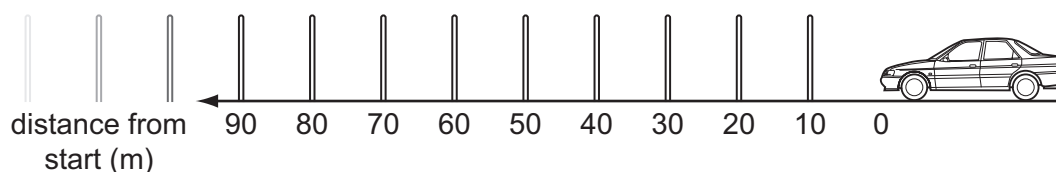


Fig. 5.1

The distances for one test run are recorded in Table 5.1.

Table 5.1

time / s	0	1	2	3	4	5	6	7	8	9	10
distance / m	0	8	18	34	52		99		161	199	239

- (i) Use Fig. 5.2 to record in Table 5.1 the distances travelled after 5 and 7 seconds.

Take your measurement from the front of the car.

[2]

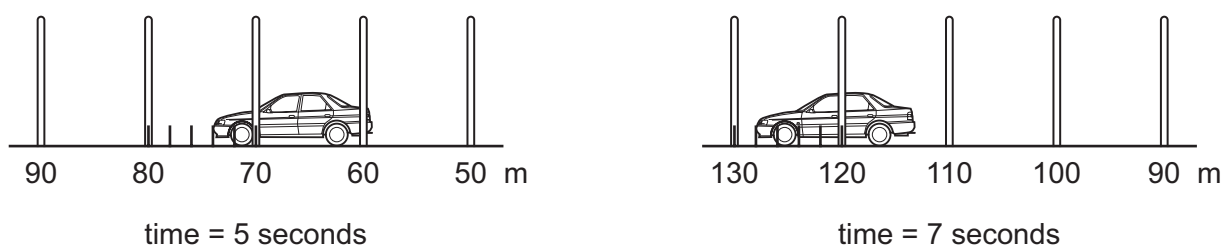
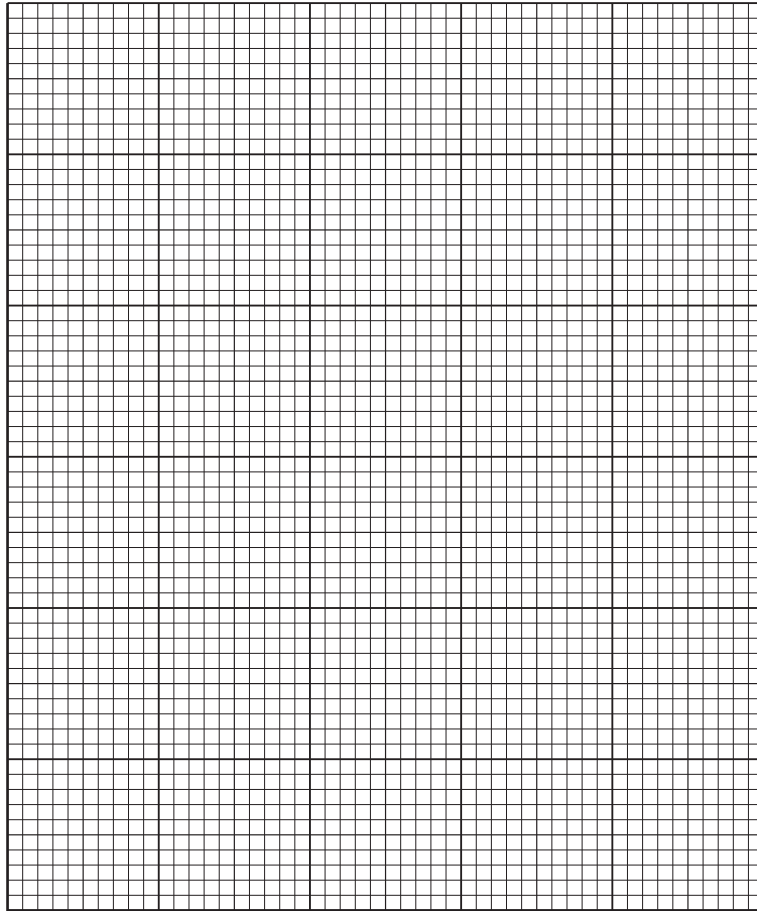


Fig. 5.2

- (ii) On the grid provided plot a graph of distance / m (vertical axis) against time / s (horizontal axis). For
 Examiner's

Draw a smooth curve of best fit.



[3]

- (iii) Explain what the shape of the graph tells you about the motion of the car.

[1]

- (iv) Calculate the average speed of the car over the first six seconds.

[1]

Fig. 5.3 shows sketch graphs of 3 more tests runs.

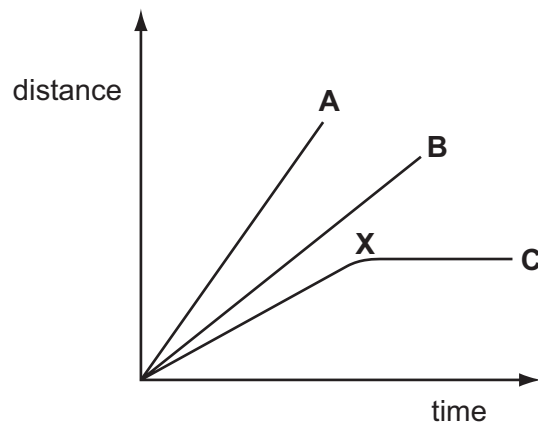


Fig. 5.3

(b) (i) State in what ways test runs **A** and **B** are similar and different.

similar

.....

different

..... [2]

(ii) Suggest what may have happened at point **X** in test run **C**.

.....

..... [1]

Please turn over for Question 6.

- 6 (a) Fig. 6.1 shows words and phrases about different anion tests cut from a page in a student's note book.

Use a ruler to construct a table, showing each anion, test reagent and result which identifies the anion.

chloride	barium chloride	carbonate
bubbles	white precipitate	yellow precipitate
dilute hydrochloric acid		silver nitrate

Fig. 6.1

[4]

- (b) (i)** The teacher asks the student to make a dry sample of copper sulfate crystals using sulfuric acid and powdered copper oxide.

The student begins by using these chemicals to prepare a solution of copper sulfate.

Describe in detail how the student prepares this solution.

.....

 [3]

- (ii)** She leaves the copper sulfate solution prepared in **(b)(i)** in a warm place to remove the water.

Name this process by which the water leaves the solution.

process [1]

- (iii)** She washes and dries the crystals from **(b)(ii)**.

What colour are the crystals?

colour [1]

- (c)** Copper oxide is an example of a base.

Copper sulfate, barium chloride and silver nitrate are all examples of another group of chemicals.

Name this group.

name [1]

