

--

--	--	--	--	--

--	--	--	--

0653/61

May/June 2018

1 hour

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

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

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

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

1 A student investigates an enzyme-catalysed reaction.

- (a) Hydrogen peroxide is broken down by catalase, an enzyme found in living cells such as the cells of many types of bean.

Oxygen gas is released during the reaction.

Procedure

- The student places some bean puree into a measuring cylinder.
- He adds 10 cm³ hydrogen peroxide solution of concentration 1.5% to the measuring cylinder and then starts a stopclock. As oxygen gas is released, a foam is made in the mixture and the volume of the mixture in the measuring cylinder increases.
- He records the volume of the mixture in the measuring cylinder every 30 seconds for 5 minutes.

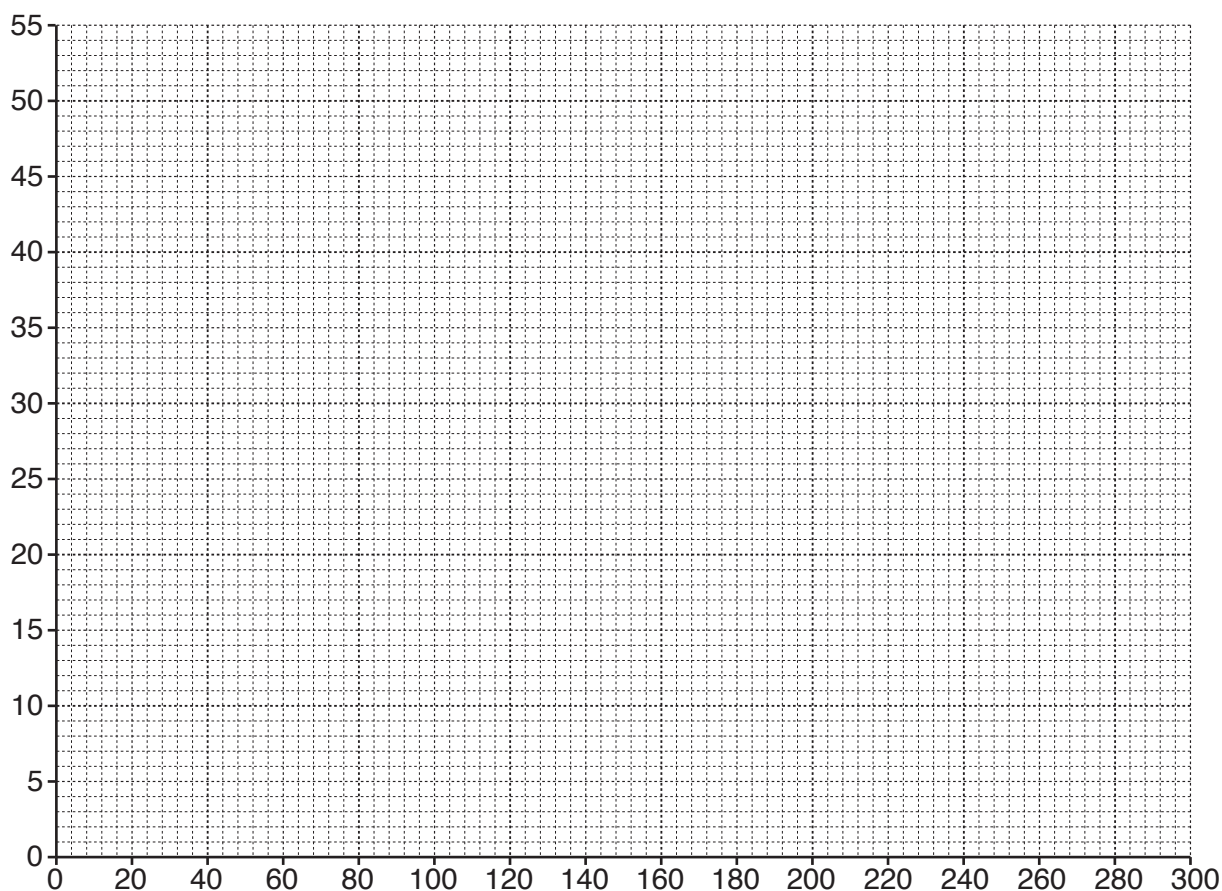
His results are shown in Table 1.1.

Table 1.1

time/seconds	volume of mixture/cm ³
30	16
60	22
90	27
120	33
150	39
180	43
210	46
240	48
270	50
300	50

- (i) On the grid provided, plot a graph of volume of mixture (vertical axis) against time.

Label the axes.



[2]

- (ii) Draw the best-fit smooth curve.

[1]

- (b) (i) Use your graph to predict the volume of the mixture at 200 seconds.

Show on your graph how you arrived at your answer.

volume = ... cm^3 [1]

- (ii) Use your graph to state how the rate of reaction changes during the 5 minutes.

.....[1]

- (c) State **and** explain a safety precaution the student should have taken when carrying out the procedure in (a).

.....
[1]

- (d) Plan an experiment, using the same method as in (a), to investigate the effect of changing the temperature of the hydrogen peroxide solution on the volume of the mixture.

In your answer, you should include

- variables you need to keep constant,
- suggestions for values of the variable you are going to change,
- how you would present your results on a graph.

.....

.....

.....

.....

.....

.....[4]

2 A student is given three colourless solutions, **H**, **J** and **K**.

These three solutions are the halide solutions shown.

sodium bromide solution
sodium chloride solution
sodium iodide solution

The student does not know which solution is which.

He carries out tests to identify the solutions.

(a) Steps

- He places about 2 cm³ of solution **H** in a test-tube.
- He adds a few drops of silver nitrate solution.
- He then adds ammonia solution until the test-tube is nearly full.
- He stirs the mixture carefully.
- He records his observations in Table 2.1.

He repeats the above steps for solutions **J** and **K**.

Table 2.1

test	observations		
	solution H	solution J	solution K
add silver nitrate solution	white ppt.	cream coloured ppt.	pale yellow ppt.
then add excess ammonia solution and stir	ppt. dissolves to form colourless solution	ppt. dissolves slightly	ppt. remains unchanged

- (i) Use the observations in Table 2.1 to identify which solution, **H**, **J** or **K**, is sodium chloride solution.

Explain how you reached your identification.

sodium chloride solution is

explanation

[1]

- (ii) State **and** explain whether the addition of silver nitrate solution followed by excess ammonia solution can be used to distinguish between the three halide solutions, **H**, **J** and **K**.

.....

.....

.....[1]

- (iii) Nitric acid is usually added to the unknown solution before adding silver nitrate solution.

Explain why adding nitric acid first is not necessary in this test for this investigation.

.....
[1]

- (b) The student then adds chlorine water to separate samples of the three solutions, **H**, **J** and **K**.

He records his observations in Table 2.2.

Table 2.2

test	observations		
	solution H	solution J	solution K
add chlorine water	no visible change	solution becomes yellow	solution becomes very dark orange

- (i) Use the observations in Table 2.2 to suggest which **two** solutions of **H**, **J** and **K** could be sodium bromide solution.

Explain your answer in terms of the reactions which take place.

sodium bromide solution could be..... or

explanation

.....[1]

- (ii) Suggest **one** precaution that the student should take when using chlorine water.

.....
[1]

- (iii) Describe another test that could be carried out on the two solutions you identified in (b)(i) to show which solution is sodium bromide and which solution is sodium iodide.

State the expected observations for sodium bromide solution and sodium iodide solution.

.....

[2]

- (c) A sample of sodium chloride solution can be made by reacting hydrochloric acid with sodium hydroxide solution.

Sodium hydroxide solution is added slowly to 25 cm^3 of hydrochloric acid in the presence of an indicator.

When the indicator changes colour, the volume of sodium hydroxide solution which has been added is recorded.

The reaction is then repeated using 25 cm^3 of hydrochloric acid and the recorded volume of sodium hydroxide solution but without the indicator.

- (i) Name a suitable piece of apparatus for measuring the volume of the sodium hydroxide solution.

.....[1]

- (ii) Explain why the reaction is repeated without the indicator.

.....

.....[1]

- (iii) Suggest a change to the experiment which would enable the volume of sodium hydroxide solution added to be determined more accurately.

.....

.....[1]

BLANK PAGE

3 A student investigates how the length l of a spring varies when different loads L are added to it.

(a) She sets up a spring in a clamp, as shown in Fig. 3.1.

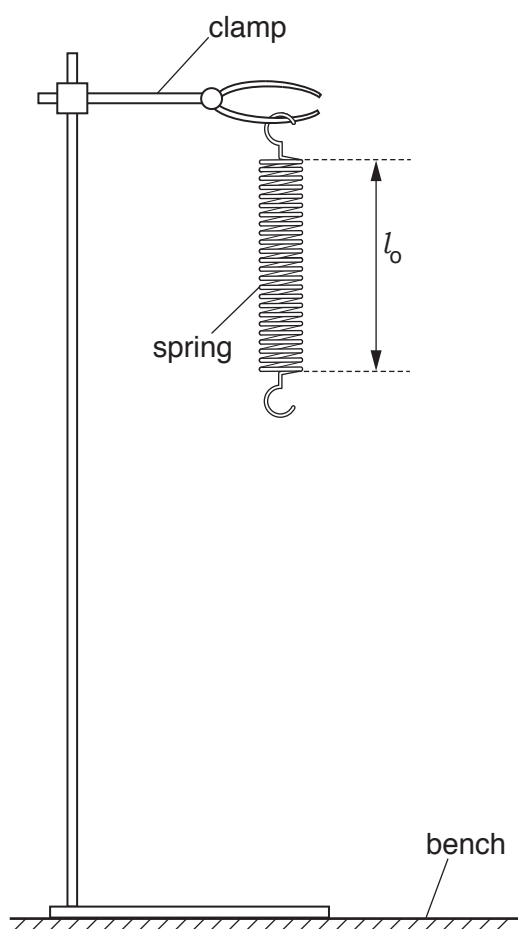


Fig. 3.1

(i) Measure and record the length l_0 of the unstretched spring to the nearest millimetre.

$l_0 = \dots\dots\dots$ mm [1]

(ii) State **one** precaution that the student takes to avoid a parallax (line-of-sight) error when measuring the length of the spring.

.....

.....[1]

- (b) She hangs a load L of 1.0 N on the spring and measures, to the nearest millimetre, the new length l of the spring using a metre rule.

Part of the rule is shown in Fig. 3.2.

Use the rule in Fig. 3.2 to measure the new length l of the spring.

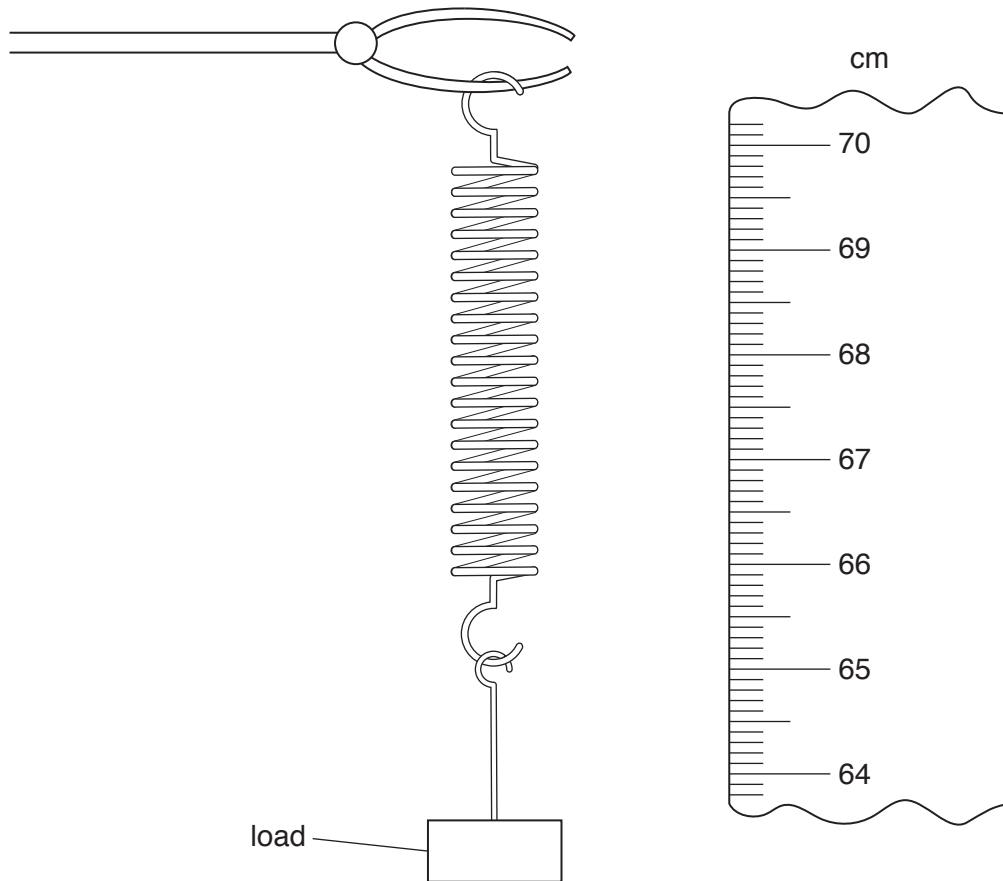


Fig. 3.2

Record this length in Table 3.1.

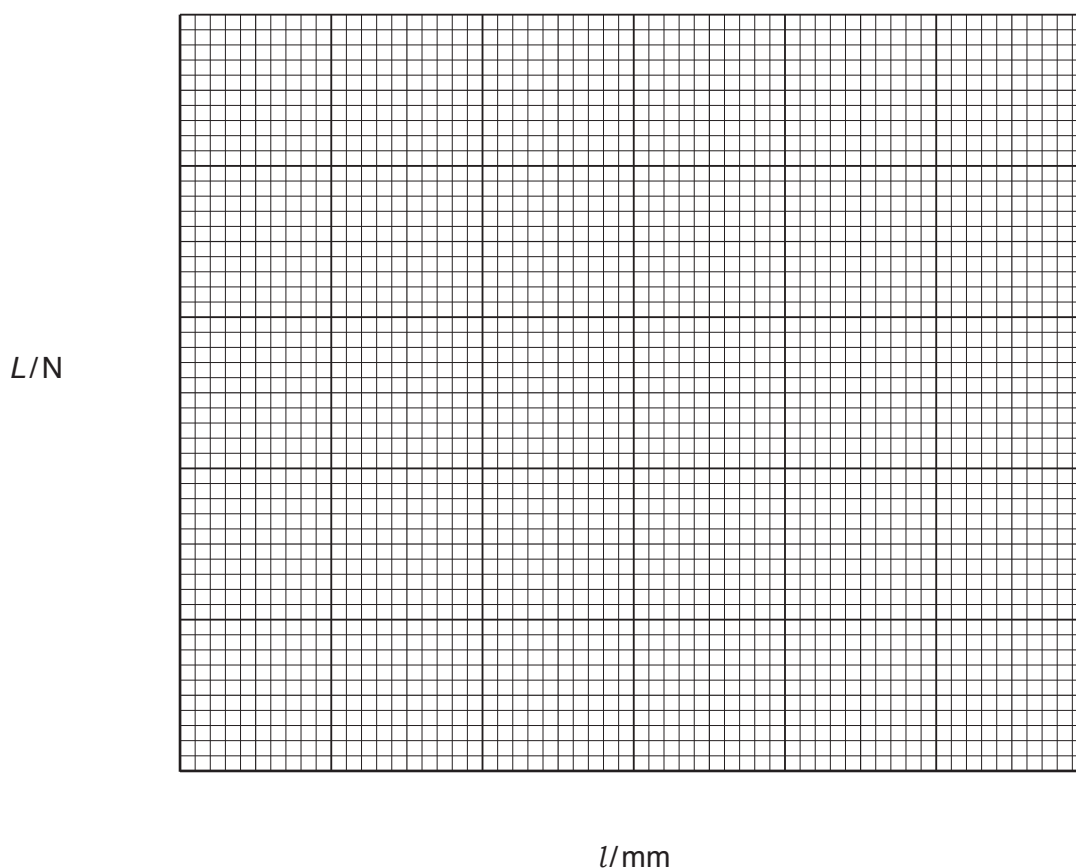
[2]

- (c) She repeats (b) using loads of 2.0 N, 3.0 N, 4.0 N and 5.0 N and completes Table 3.1.

Table 3.1

load L / N	spring length l / mm
1.0	
2.0	50
3.0	60
4.0	73
5.0	82

- (i) On the grid provided, plot a graph of L against l . Start both axes from the origin (0, 0).



[2]

- (ii) Draw the best-fit straight line.

[1]

- (iii) Use your graph to determine the length l_0 of the unstretched spring.

Show on your graph how you arrived at this value.

$l_0 = \dots\dots\dots$ mm [1]

- (d) Compare your answer in (a)(i) with your answer in (c)(iii).

State whether the answers agree within the limits of experimental accuracy.

Give a reason for your statement.

.....
[1]

- (e) The gradient of your line measures the force constant of the spring. This is a measure of the elastic stiffness of the spring. The greater the force constant, the harder it is to stretch the spring.

On your graph, draw a line to show how the length of a spring with a greater force constant changes as loads are added to it. Label this line **M**. [1]

- 4 A student is studying cells.

Fig. 4.1 shows a photograph of some animal duodenum cells.

One of these cells is labelled cell A.

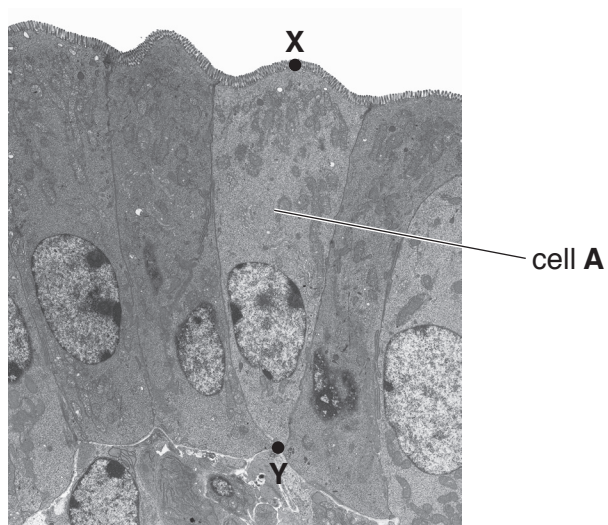
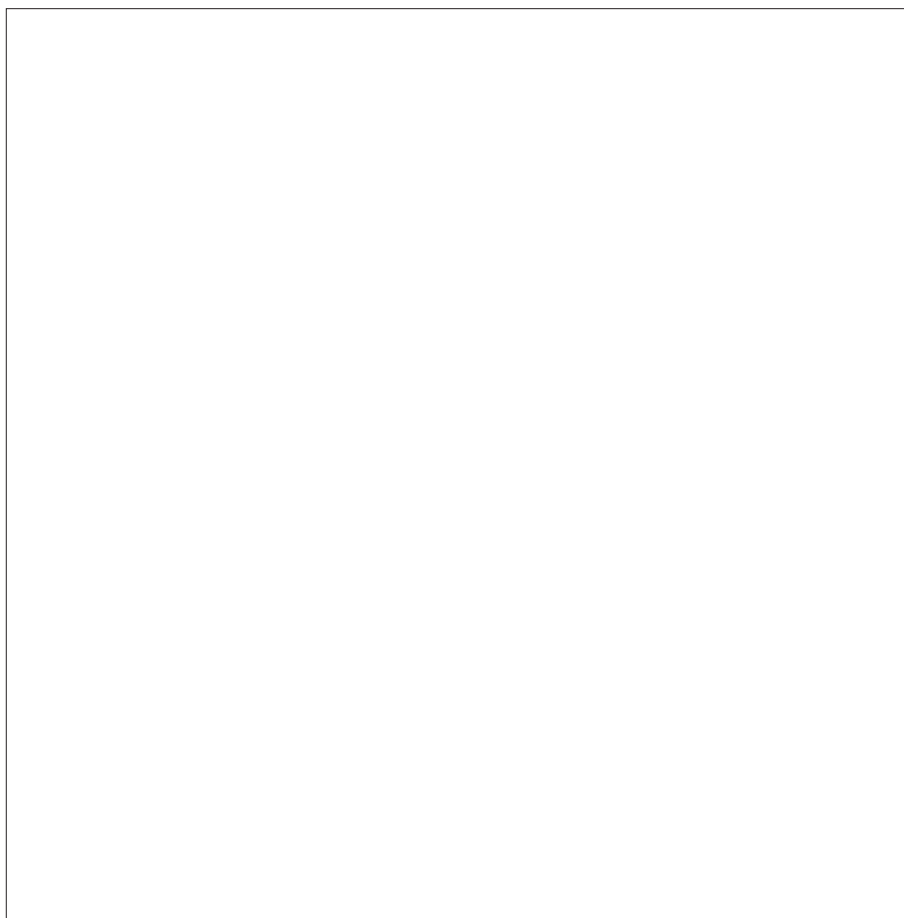


Fig. 4.1

- (a) (i) In the box below, make an enlarged and detailed pencil drawing of cell A.



[3]

(ii) Draw a label line to label the nucleus of the cell in your drawing. [1]

(b) (i) Measure in millimetres, to the nearest millimetre, the length of cell **A** between points **X** and **Y** in Fig. 4.1.

length = ... mm [1]

(ii) Draw the line **X–Y** on your drawing in the same place as **X** and **Y** are shown in Fig. 4.1.

Measure this line, in millimetres, to the nearest millimetre.

length = ... mm [1]

(iii) Use your **two** measurements to calculate the magnification of your drawing.

Show your working in the space below.

magnification = ... [1]

(c) Describe how you could test cells in a liquid sample for the presence of fat.

reagents used and method

.....

.....

observation for a positive result

[3]

- 5 A student prepares a pure sample of blue copper sulfate crystals using copper carbonate powder and dilute sulfuric acid.



He plans his experiment in a series of steps labelled **A** to **F**.

Step **A**: Add copper carbonate to the acid a little at a time until no more reacts.

Step **B**: Heat the solution until half of the water has evaporated.

Step **C**: Dry the crystals in filter paper.

Step **D**: Filter the mixture.

Step **E**: Leave the basin to cool.

Step **F**: Measure 25 cm³ of sulfuric acid into a beaker.

The teacher says that all of the steps are correct but they are in the wrong order.

- (a) Using the letters, place the steps into the correct order. Steps 1 and 6 have been completed for you.

Step 1: **F**

Step 2:

Step 3:

Step 4:

Step 5:

Step 6: **C**

[3]

- (b) Suggest how the student would know when no more copper carbonate reacts.

.....[1]

- (c) Draw a diagram of Step D. Label the apparatus and the substances.

[2]

- (d) (i) Explain why the copper carbonate needs to be added until no more reacts.

.....
[1]

- (ii) Explain why only half of the water is evaporated in Step B.

.....
[1]

- (e) The student takes a few crystals of copper sulfate and dissolves them into water in a test-tube.

He adds a few drops of ammonia solution and stirs.

He continues adding the ammonia a few drops at a time until the ammonia is in excess.

Describe what the student observes in the test-tube.

.....

[2]

- 6 A student investigates the energy efficiency of a model railway.

He sets up an oval track of circumference 10m and places a train, consisting of a locomotive and three carriages, onto it as shown in Fig. 6.1.

The d.c. power supply is connected to the train track. The electricity goes from the power supply to the train and is then used to turn the motor in the train.

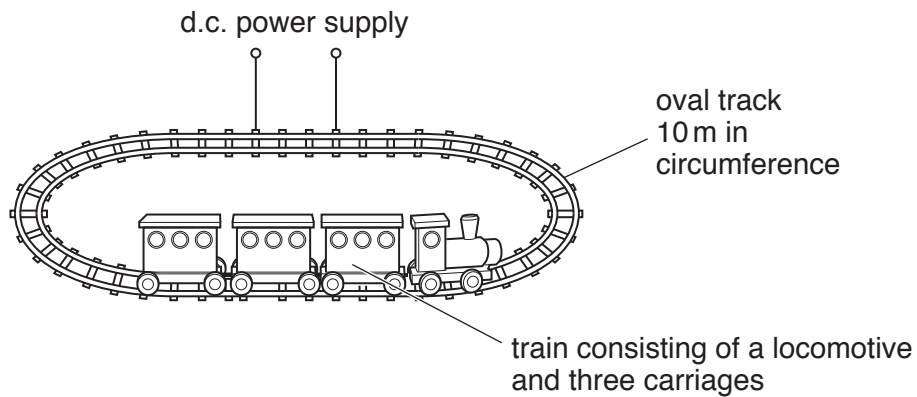


Fig. 6.1

- (a) Complete the circuit diagram shown in Fig. 6.2 using appropriate circuit symbols, which include

- an ammeter to measure the current supplied to the train,
- a voltmeter to measure the potential difference of the power supply.

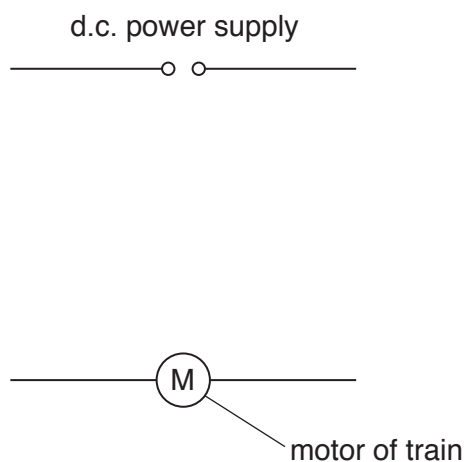


Fig. 6.2

[2]

- (b) The student switches on the power supply and waits until the train is running at a steady speed.

He measures the current I in the circuit, the potential difference V across the power supply and the time t it takes for the train to travel around the track once.

- (i) Fig. 6.3 shows the readings on the ammeter, the voltmeter and the timer.

Read and record these values, in the spaces below, to two significant figures.

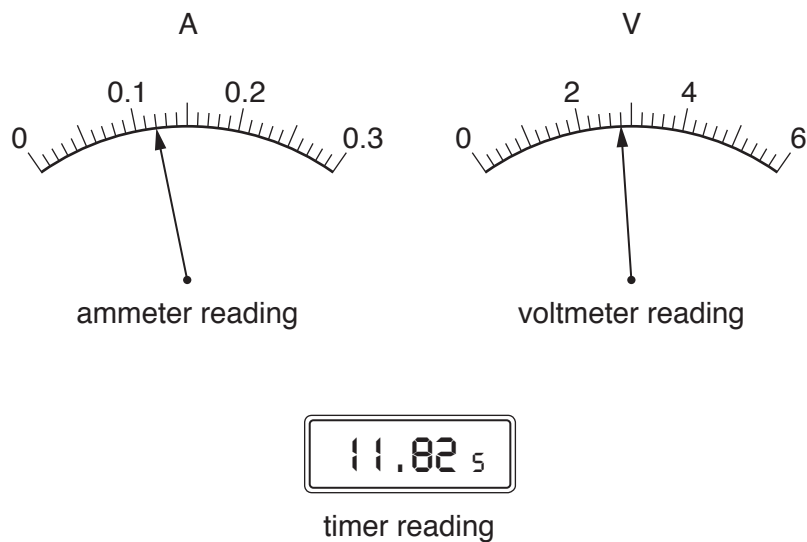


Fig. 6.3

current, I = ... A

potential difference, V = ... V

time, t = ... s
[3]

- (ii) Calculate the electrical energy supplied to the train to complete one circuit of the track using the equation shown.

$$\text{electrical energy supplied} = I \times V \times t$$

electrical energy supplied to the train = ... J [1]

- (iii) The mass m of the train is 1.6 kg.

Calculate the kinetic energy of the train using the equation shown.

$$\text{kinetic energy} = \frac{50m}{t^2}$$

kinetic energy of the train = ... J [1]

- (iv) Calculate the efficiency of the train using the equation shown.

$$\text{efficiency} = \frac{\text{kinetic energy of the train}}{\text{electrical energy supplied to the train}} \times 100$$

efficiency = ...% [1]

- (c) Explain why the energy transfer is not 100% efficient.

.....
[1]

- (d) Describe how the experiment could be modified to obtain a more accurate value for the time it takes the train to travel around the track.

.....
[1]

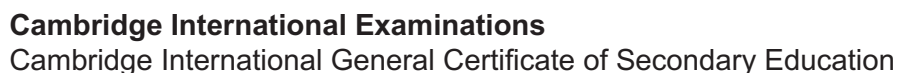
BLANK PAGE

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.



--

--	--	--	--	--

--	--	--	--

0653/62

May/June 2018

1 hour

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

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

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

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

- 1 A student investigates bananas.

He peels a banana and cuts a slice from one end. He places the slice on a white tile with the cut surface uppermost as shown in Fig. 1.1.

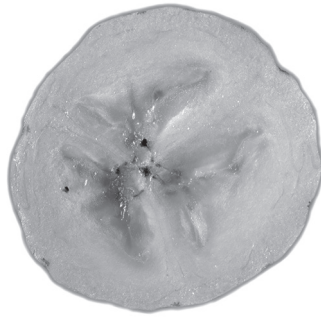
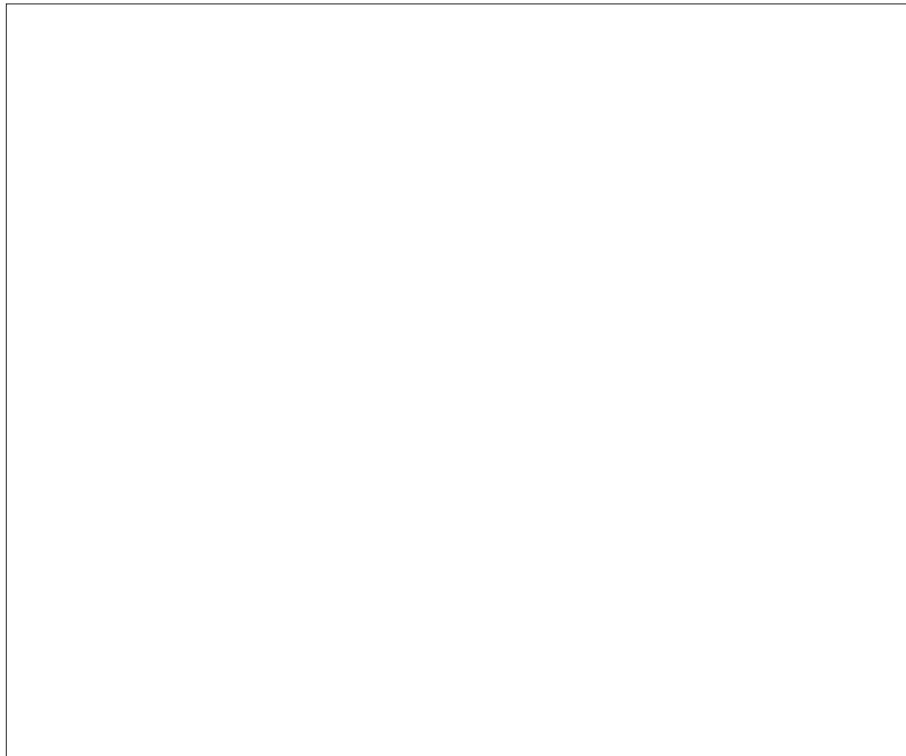


Fig. 1.1

- (a) (i) In the box shown, make a detailed and enlarged pencil drawing of the cut face of the banana slice shown in Fig. 1.1.



[2]

- (ii) Draw a horizontal line on the banana slice shown in Fig. 1.1 to represent the diameter.

Measure the diameter of the banana slice shown in Fig. 1.1, in millimetres, to the nearest millimetre.

diameter = ... mm

Draw a horizontal line on your drawing of the banana slice to represent the diameter.

Measure the diameter of your drawing of the banana slice, in millimetres, to the nearest millimetre.

diameter = ... mm
[2]

- (iii) Use these **two** measurements to calculate the magnification of your drawing.

Show your working.

magnification = ...[1]

- (b) The student adds some biuret solution to some mashed banana.

He observes a blue colour.

Explain his observation.

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

- (c) (i) Describe how you could test the banana for the presence of nutrients using Benedict's solution. Name the nutrient being tested for and the expected observation for a positive result.

method

.....

nutrient tested for

observation for a positive result[3]

- (ii) State **and** explain **one** safety precaution that is taken in this test.

.....

.....[1]

2 A student investigates the reactions of metal oxide **H**, a red solid.

(a) She places some of **H** in a hard glass test-tube and heats it strongly.

A black solid forms. She leaves this black solid to cool.

(i) She adds an acid to the black solid and warms carefully.

After heating, she allows the mixture to settle and observes a blue solution.
She suspects that the solution contains the Cu^{2+} ion.

Describe a test that the student could carry out on the solution to identify the cation present.

Include in your answer the observations that will identify the cation as Cu^{2+} .

test

.....

observations

.....

[2]

(ii) The acid the student used in (a)(i) is either hydrochloric acid or sulfuric acid.

Complete Table 2.1 to describe two tests which she uses to identify the acid.

Include in Table 2.1 the observations which would be expected for both tests on each acid.

Table 2.1

test	observation with hydrochloric acid	observation with sulfuric acid

[3]

- (b) Next the student takes another sample of red solid **H** and adds acid to it.
She heats the mixture and allows it to cool.
She then filters the mixture.
The residue is red-brown and the filtrate is blue.

Draw a labelled diagram of the apparatus that the student uses for the filtering of the mixture.

Identify the positions of the filtrate and the residue on your diagram.

[2]

- (c) The student places the blue filtrate from (b) into a beaker. She adds one spatula load of magnesium powder and stirs.

The beaker becomes quite hot.

When the mixture settles the solution is now colourless and the powder is pink.

- (i) Name the type of reaction that takes place between magnesium and the filtrate from (b).

.....[1]

- (ii) Identify the pink powder.

.....[1]

- (d) Suggest why the test-tube used in (a) is a hard glass test-tube.

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

- 3 A student measures the approximate mass of a metre rule using a balancing method. She sets up the apparatus as shown in Fig. 3.1.

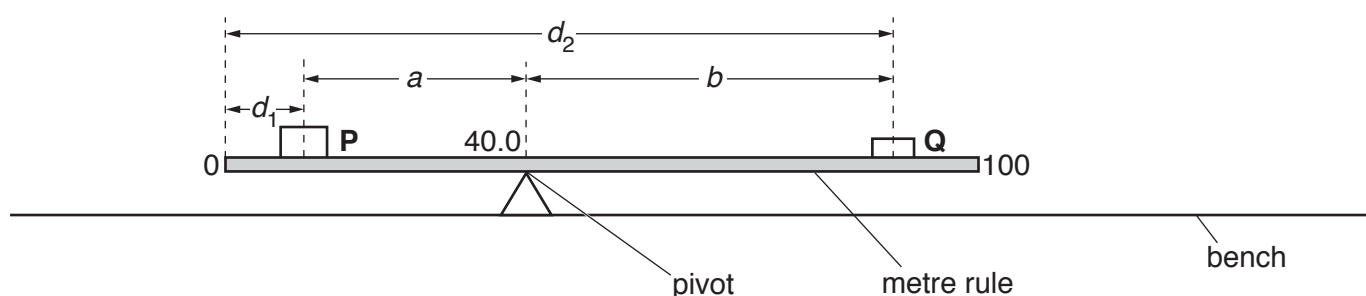


Fig. 3.1

(a) Procedure

- The pivot is under the 40.0 cm mark. **The position of the pivot does not change during this experiment.**
- She places a load **P** of mass 200g on the rule so that its centre is at a distance $d_1 = 10.0$ cm from the zero end of the rule, as shown in Fig. 3.1.
- She adjusts the position of the load **Q**, of mass 100g, so that the rule is as close as possible to being balanced.

Part of the balanced rule is shown in Fig. 3.2.

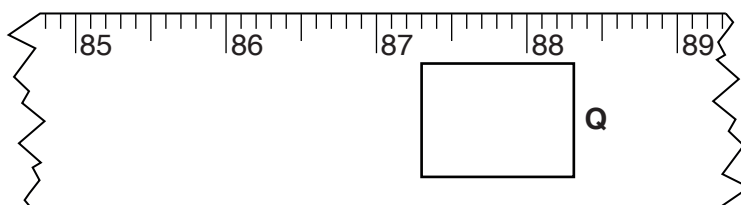


Fig. 3.2

- (i) Record, to the nearest 0.1 cm, in Table 3.1, the position of the centre of load **Q** shown in Fig. 3.2. This is the distance d_2 from the zero end of the rule to the **centre** of load **Q**. [1]

Table 3.1

d_1 /cm	d_2 /cm	$a = (40 - d_1)$ /cm	$b = (d_2 - 40)$ /cm
10.0			
15.0	78.0	25.0	38.0
20.0	68.1	20.0	28.1
25.0	57.2	15.0	17.2
30.0	47.9	10.0	7.9

- (ii) Suggest **and** describe a method by which the student ensures that the centre of load **P** is directly above the 10.0 cm mark on the rule.

.....
[1]

- (b) The student repeats the procedure in (a) for values of $d_1 = 15.0\text{ cm}$, 20.0 cm , 25.0 cm and 30.0 cm . Her results are shown in Table 3.1.

For $d_1 = 10.0\text{ cm}$, calculate the distances a and b . Use the equations shown.

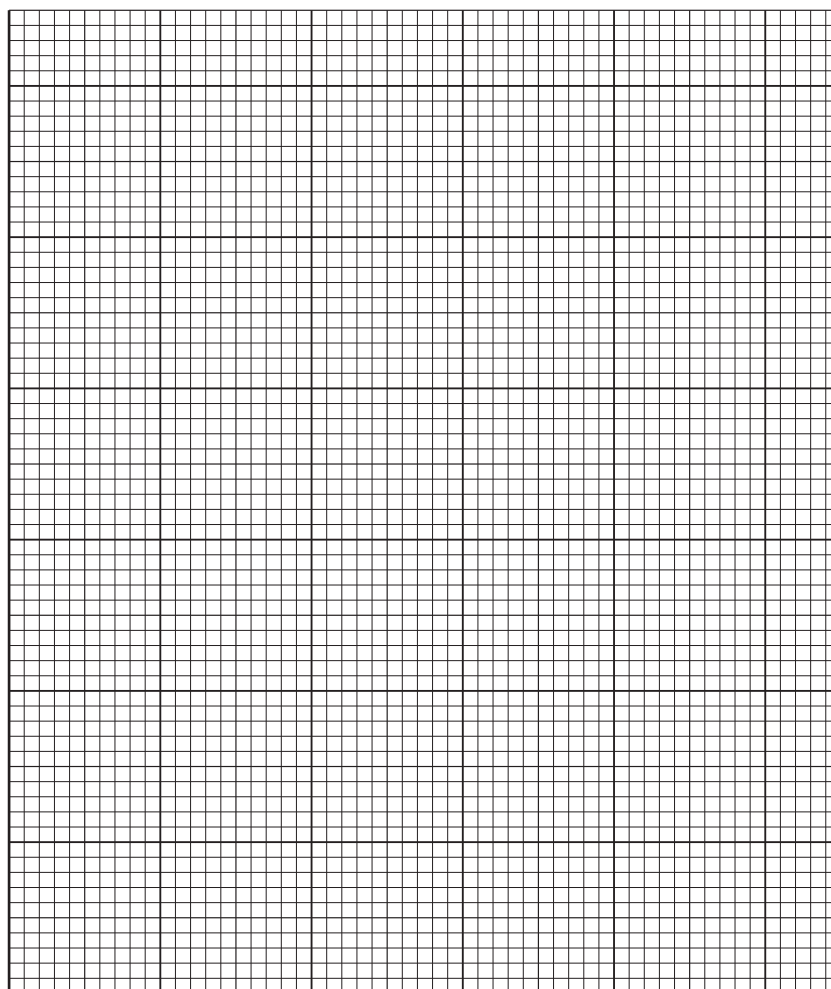
$$a = (40 - d_1)$$

$$b = (d_2 - 40)$$

Record, in Table 3.1, your values of a and b .

[1]

- (c) (i) On the grid provided, plot a graph of a (vertical axis) against b . Start your axes from the origin (0, 0).



[3]

- (ii) Draw the best-fit straight line.

[1]

- (iii) Write down the value of the intercept I on the vertical axis.

$I = \dots\dots\dots$ [1]

- (d) The mass m in grams of the metre rule is given by the equation shown.

$$m = 20 \times I$$

Use this equation to calculate a value for m . Give your answer to an appropriate number of significant figures.

$$m = \dots\dots\dots \text{ g [1]}$$

- (e) Suggest **one practical** reason why, despite carrying out the experiment with care, the student's value for the mass of the rule is only approximate.

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

Please turn over for Question 4.

- 4** A student investigates if light and chlorophyll are needed for photosynthesis.

She has two plants. Before she can start her investigation she needs to de-starch (remove the starch from) both plants.

- (a)** Describe how she de-starches the plants.

.....

.....

.....[2]

- (b)** She places one of these plants in the dark and the other plant in the light for a few days. A leaf from each plant is tested for the presence of starch using iodine solution.

Describe how she carries out this test. Include in your answer:

- method
- safety precautions
- observation for a positive result.

.....

.....

.....

.....

.....

.....[4]

- (c)** Explain why the student needs to de-starch the plants.

.....

.....[1]

- (d) The plant in the light tests positive for starch. The plant in the dark does not.

The green pigment chlorophyll is also needed for photosynthesis.

Fig. 4.1 shows two leaves from another de-starched plant. Leaf **A** is kept in the light and leaf **B** is kept in the dark.

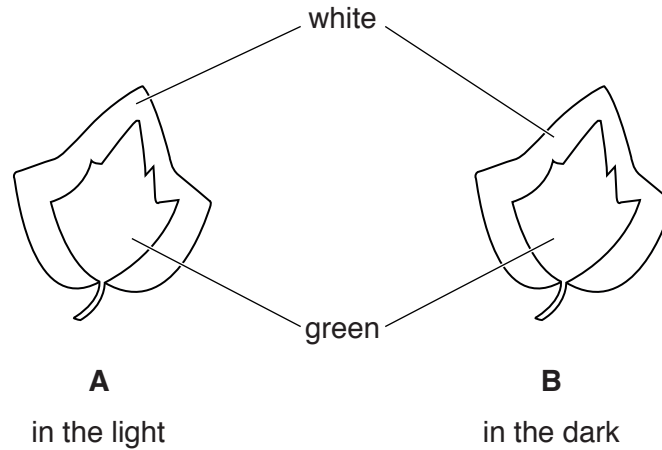


Fig. 4.1

The student tests these leaves for the presence of starch.

On Fig. 4.2, complete the label lines to show her observations after she tests the leaves with iodine solution.

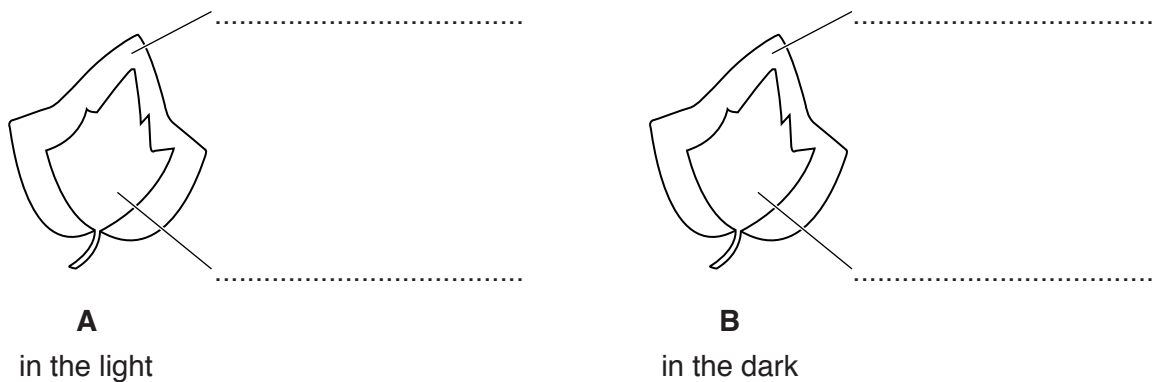


Fig. 4.2

[3]

- 5 A student investigates the rate of reaction of calcium carbonate with hydrochloric acid.

Calcium carbonate reacts with hydrochloric acid to form calcium chloride, water and carbon dioxide gas. As the carbon dioxide gas is given off during the reaction the mass of the reactants decreases.

(a) Procedure

- She places 5 g of finely powdered calcium carbonate (which is an excess) into a conical flask.
- She adds 50 cm³ of dilute hydrochloric acid into the conical flask.
- The acid is at a temperature of 25 °C.
- She quickly places cotton wool into the neck of the flask and puts the flask onto the balance, as shown in Fig. 5.1.

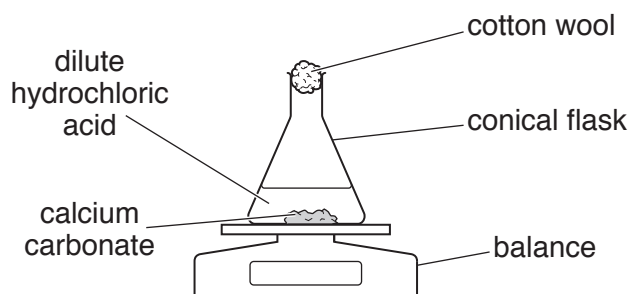
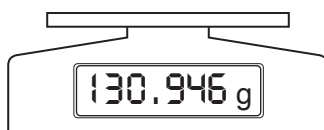


Fig. 5.1

- She immediately measures the mass of the flask and contents and records it in Table 5.1 at time $t = 0$ minutes.
- She measures and records, in Table 5.1, the mass of the flask and contents every minute until there is no further change in mass.

Fig. 5.2 shows the reading for the mass of the flask and contents at $t = 5$ minutes. **Record this mass in Table 5.1.**



mass at 5 minutes

Fig. 5.2

Table 5.1

t / minutes	mass of flask and contents / g
0	132.62
1	131.74
2	131.40
3	131.21
4	131.06
5	
6	130.88
7	130.82
8	130.81
9	130.80
10	130.80

[1]

- (b) (i)** Use the values in Table 5.1 to calculate the total mass of carbon dioxide gas given off.

mass = ... g [1]

- (ii)** The total amount of carbon dioxide gas expected is 1.90 g.

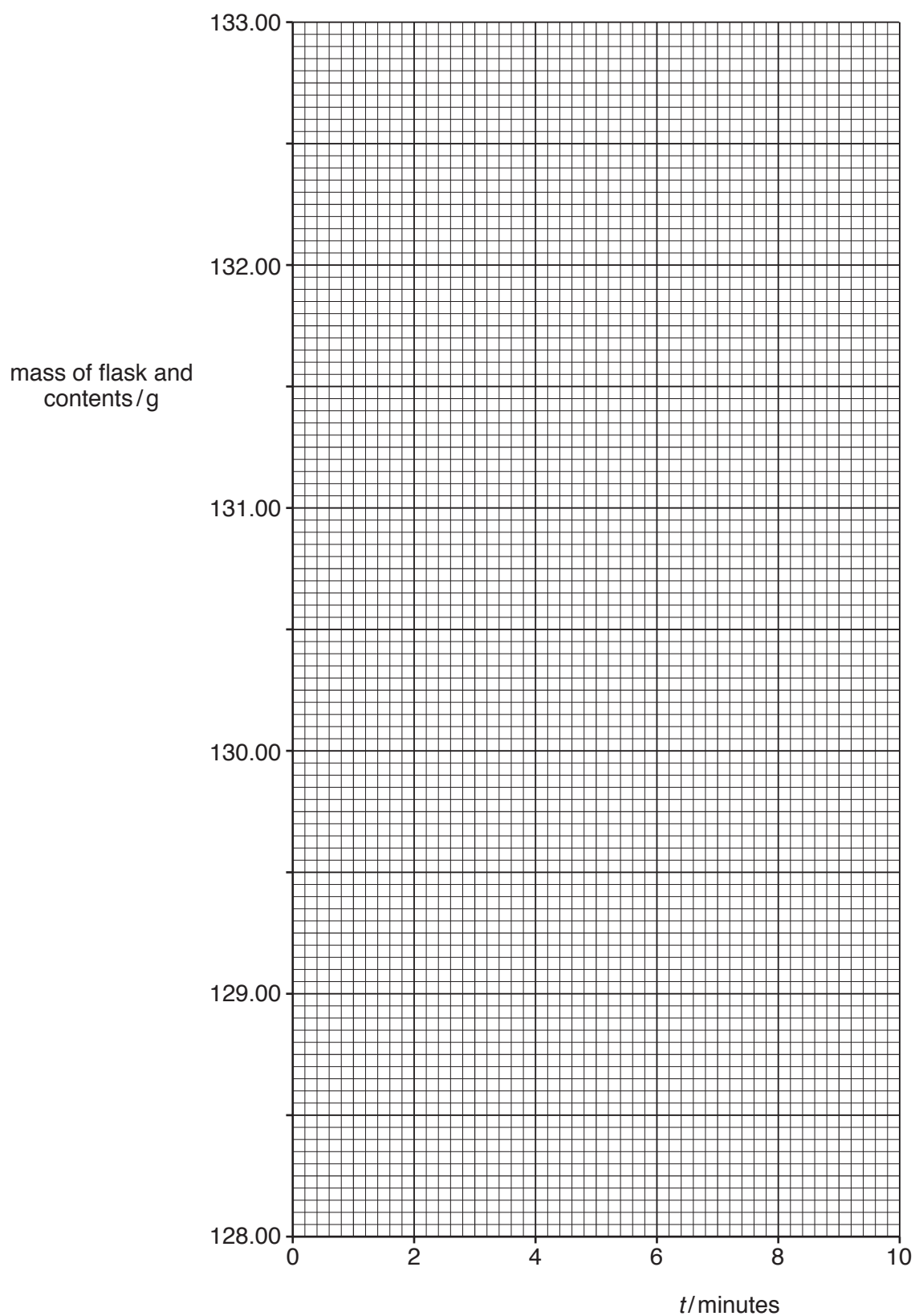
Suggest **one** reason why your value in **(b)(i)** is different from this.

.....
 [1]

- (c)** Explain why cotton wool was placed into the neck of the flask.

.....
 [1]

(d) (i) On the grid provided, plot a graph of mass of flask and contents against time.



[1]

(ii) Draw the best-fit curve.

[1]

- (e) (i) The student repeats the procedure in (a) using 100 cm^3 of the same dilute hydrochloric acid at the same temperature. The 5g of powdered calcium carbonate is still an excess.

Sketch on the grid in (d)(i) the line she should expect to get from her experiment. Assume that the starting mass of the flask and contents at time $t = 0$ is 132.62g. Label this line **F**. [2]

- (ii) The student repeats the procedure in (a) using 50 cm^3 of the same dilute hydrochloric acid but which is at a temperature of 40°C .

Sketch on the grid in (d)(i) the line she should expect to get from her experiment. Start the line in the same place as the line drawn in (d)(ii). Label this line **M**. [2]

Please turn over for Question 6.

- 6 A student investigates the speed gained by a ball as it rolls down a ramp.

He sets up the apparatus shown in Fig. 6.1.

He marks **P** and **Q** on the surface of the bench so that they are 1 m apart.

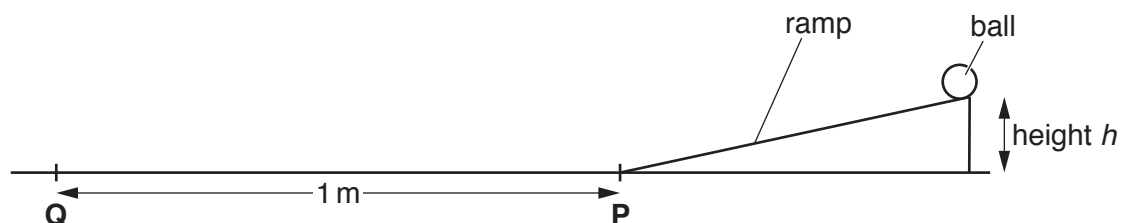


Fig. 6.1

The shorter the time it takes for the ball to roll between **P** and **Q**, the higher the average speed of the ball.

Procedure

- He adjusts the height h of the ramp to 5 cm.
- He releases the ball from rest at the top of the ramp.
- When the ball reaches **P** he starts the timer and he stops the timer when the ball reaches **Q**.
- He records the time t in Table 6.1.
- He repeats this procedure twice more and calculates the average time for the ball to roll between **P** and **Q**.
- He then repeats the experiment with the ramp at heights $h = 10$ cm, 15 cm, 20 cm and 25 cm.

Table 6.1

height h of ramp/cm	time t for ball to roll between P and Q /s			
	t_1	t_2	t_3	average time
5	4.5	5.1	4.8	4.8
10			3.6	
15	2.5	3.1	2.7	2.8
20	2.5	1.9	2.4	2.3
25	1.7	2.1	5.4	

- (a) (i) The timer displays for t_1 and t_2 at 10 cm are shown in Fig. 6.2.

Record, in Table 6.1, the times t_1 and t_2 to the nearest 0.1 seconds.

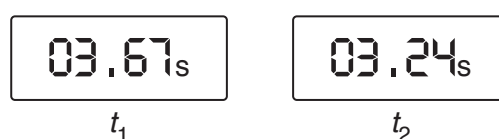


Fig. 6.2

- (ii) Calculate the average time for $h = 10\text{ cm}$.

Record this average time in Table 6.1. [1]

- (iii) Suggest why all of the times recorded are likely to be inaccurate.

.....
[1]

- (iv) Explain why the experiment was performed three times at each height.

.....
[1]

- (v) State the relationship between height h of the ramp and the average speed of the ball between **P** and **Q**.

.....
[1]

- (b) (i) The value of t_3 at $h = 25\text{ cm}$ is incorrect. It is possible that the student has misread the timer. Suggest another reason for this incorrect timing.

.....
[1]

- (ii) Calculate the average time for $h = 25\text{ cm}$.

Record this average time in Table 6.1. [1]

- (c) The student decides to use the same apparatus to investigate the relationship between the mass of the ball and its average speed between **P** and **Q**.

State **two** variables which must be kept constant during this experiment.

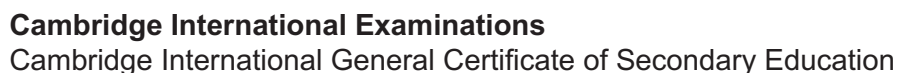
1
 2
 [2]

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.



--

--	--	--	--	--

--	--	--	--

0653/63

May/June 2018

1 hour

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

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

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

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

- 1 A student investigates the effect of temperature on the rate of photosynthesis using the apparatus shown in Fig. 1.1.

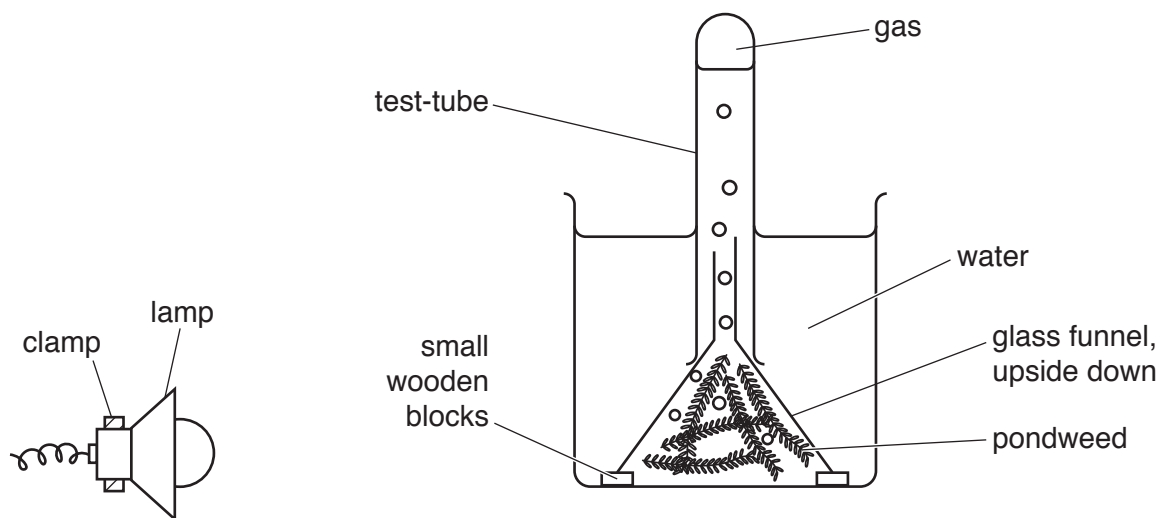


Fig. 1.1

- (a) The student measures the temperature, T_1 , of the water in the beaker.

He counts the number of bubbles of gas produced by the pondweed for 5 minutes and records this number in Table 1.1.

He replaces the water with warm water at temperature T_2 . He then repeats this experiment.

- (i) Use the thermometer diagrams in Fig. 1.2 to read and record, in Table 1.1, the temperatures T_1 and T_2 to the nearest 0.5°C .

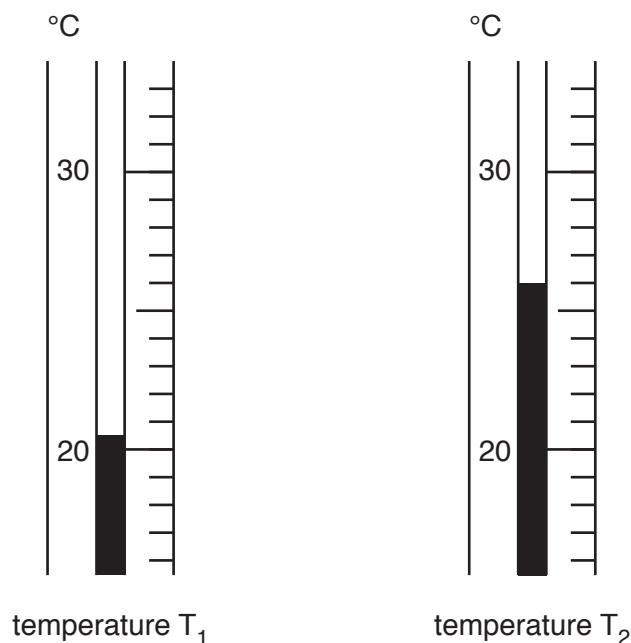


Fig. 1.2

Table 1.1

	temperature $T_1 =$ / °C	temperature $T_2 =$ / °C
number of bubbles in 5 minutes	16	24

[2]

- (ii) Use the results to state **and** explain the effect of temperature on the number of bubbles produced.

effect on number of bubbles

.....

explanation

.....

[2]

- (iii) State **one** variable, **not** including the lamp, that needs to be kept constant in both of these experiments. Explain why it is important this variable is kept constant.

variable

explanation

.....

[2]

- (b) The student repeats the experiment at temperature T_2 but switches off the lamp.

Predict **and** explain the effect on the number of bubbles produced in 5 minutes.

.....

.....[1]

- (c) (i) The student tests the gas collected and obtains a positive result for oxygen.

State the test and observation that allows the student to confirm that the gas produced is oxygen.

test

observation

[1]

- (ii) Another student suggests that measuring the volume of the gas produced would be a more accurate way of carrying out this experiment.

Explain why this student is correct.

.....

.....[1]

- (iii) Complete the apparatus diagram in Fig. 1.3 to show how the volume of gas could be measured.

Include water levels in your diagram.

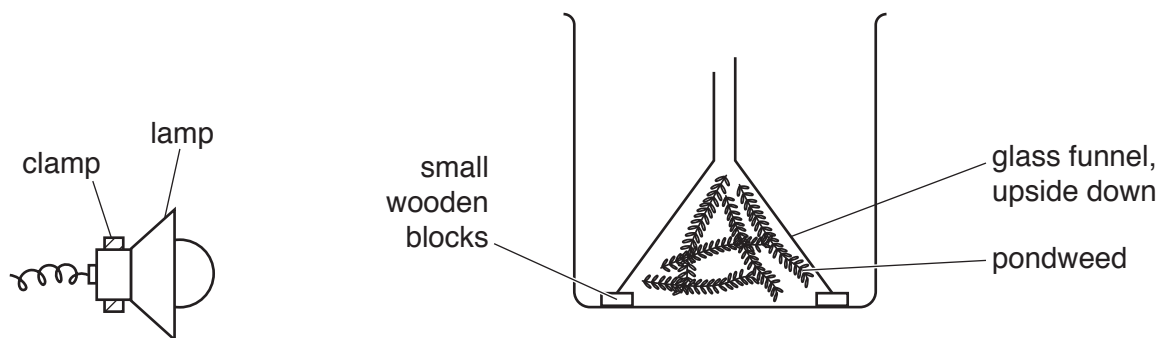


Fig. 1.3

[1]

- 2 A student investigates the rate of reaction between zinc and hydrochloric acid.

She sets up apparatus to measure the volume of gas produced during the reaction of zinc with hydrochloric acid.

- She places 0.30 g of zinc powder into a conical flask.
- She adds a known concentration of 25 cm^3 hydrochloric acid, which is in excess, to the conical flask.
- Quickly, she connects the conical flask to more apparatus to collect and measure the volume of gas produced.
- She records the volume of gas produced every 2 minutes until the reaction stops.

- (a) (i) Draw a **labelled** diagram to show the apparatus when it is connected up.

Include a suitable means of collecting and measuring the volume of gas.

[3]

- (ii) State how the student knows when the reaction has stopped.

.....

.....[1]

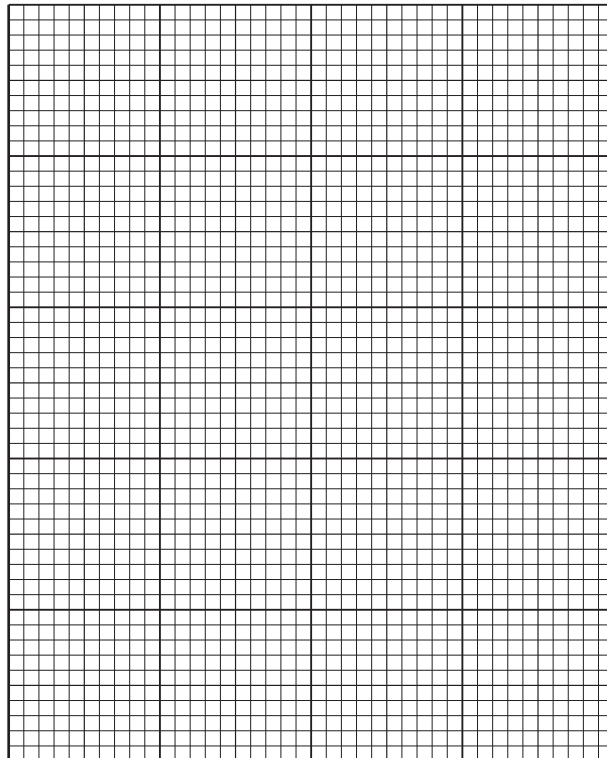
(b) Table 2.1 shows the student's results.

Table 2.1

time t / min	total volume V of gas / cm ³
0	0
2	30
4	54
6	72
8	83
10	91
12	96
14	96

- (i) On the grid provided, plot a graph of volume V of gas (vertical axis) against time t using the data in Table 2.1.

V/cm^3



t/min

[2]

- (ii) Draw the best-fit curve **and** label it *experiment 1*. [1]
- (iii) Use your graph to predict the total volume of gas produced at time $t = 5$ minutes.

Draw lines on your graph to show how you obtained this volume.

volume cm^3 [1]

- (c) The student carries out a second experiment.

She repeats *experiment 1*, keeping everything the same except that she uses hydrochloric acid which is twice as concentrated.

Draw on the grid in **(b)(i)** a second line labelled *experiment 2* to show the expected results. [2]

- 3 A student investigates the power output of lamps connected in series and in parallel.

She sets up the series circuit shown in Fig. 3.1.

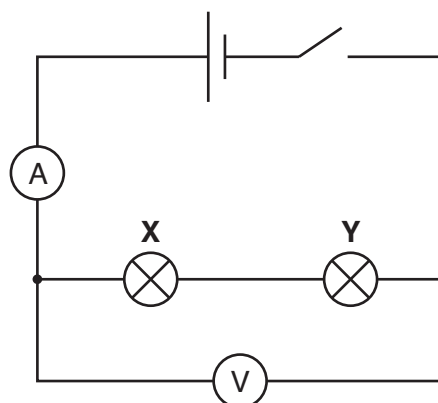


Fig. 3.1

(a) Procedure

- The student closes the switch.
- She measures the current I flowing through the lamps.
- She measures the potential difference V across both lamps.
- She opens the switch.

Fig. 3.2 shows the scales of the ammeter and voltmeter.

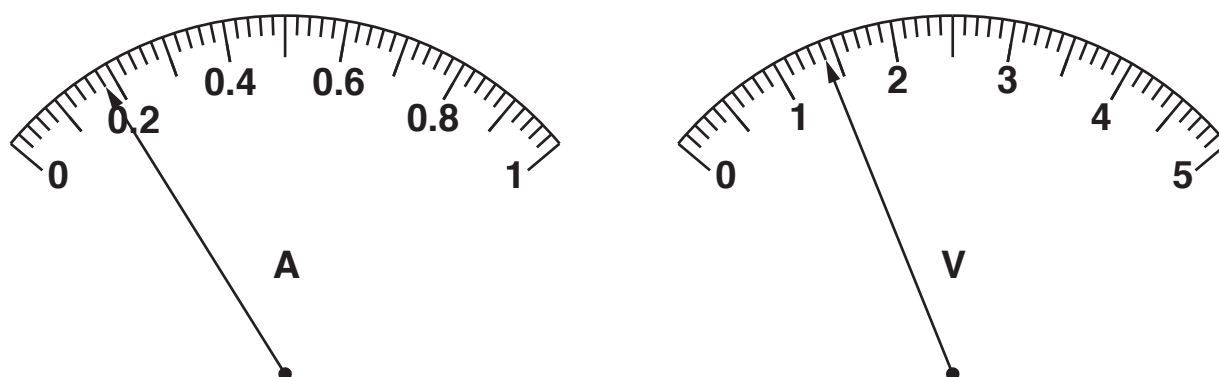


Fig. 3.2

- (i) Read the scales and record the current I and the potential difference V .

current $I = \dots\dots\dots$ A

potential difference $V = \dots\dots\dots$ V
[2]

- (ii) Calculate the combined power output P_S of lamps X and Y when connected in series using the equation shown.

$$P_S = V \times I$$

$P_S = \dots\dots\dots$ W [1]

- (iii) Explain why it is good experimental practice to open the switch between taking readings.

.....[1]

- (b) The student rearranges the circuit and connects the lamps in parallel as shown in Fig. 3.3.

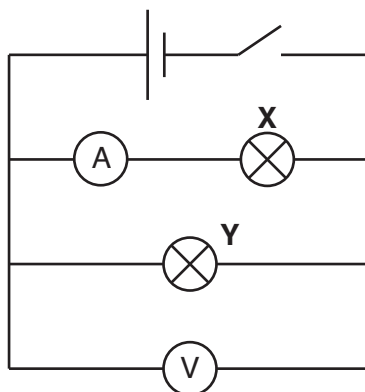


Fig. 3.3

Procedure

- The student closes the switch.
- She measures the current I flowing through lamp X.
- She measures the potential difference V across lamp X.
- She records her results in Table 3.1 and opens the switch.

She disconnects the ammeter and reconnects it so that it is now in series with lamp Y as shown in Fig. 3.4.

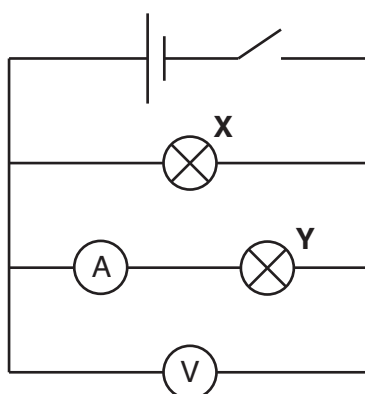


Fig. 3.4

Procedure

- The student closes the switch.
- She measures the current I flowing through lamp Y.
- She also measures the potential difference V across lamp Y.
- She records her results in Table 3.1 and opens the switch.

Table 3.1

	potential difference V/V	current I/A	power P/W
lamp X	1.4	0.23	
lamp Y	1.4	0.21	

- (i) Calculate the power output of each lamp using the equation shown.

$$P = V \times I$$

Record your results in Table 3.1 to an appropriate number of significant figures. [2]

- (ii) Calculate the total power output P_p of lamps **X** and **Y** when connected in parallel.

$$P_p = \dots\dots\dots W [1]$$

- (c) The power output P_s of the lamps connected in series is less than the power output P_p in parallel.

State what the student would have seen to confirm this fact.

.....
[1]

- (d) The student uses the readings recorded in Table 3.1 to deduce which lamp, **X** or **Y**, has the greater resistance.

Explain how the student is able to do this.

.....
[2]

- 4 A student investigates the effects of physical activity on breathing.

He sets up the apparatus shown in Fig. 4.1.

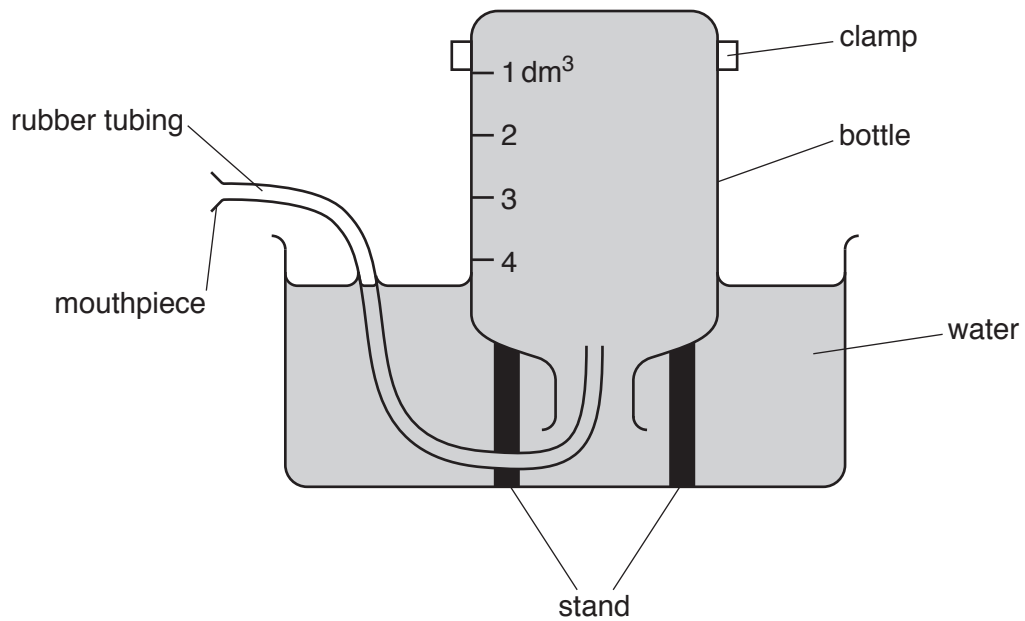


Fig. 4.1

- (a) Describe how the student can use the apparatus in Fig. 4.1 to measure the maximum volume of air he can expire (breathe out) from his lungs.

.....

.....

.....

.....[2]

(b) Table 4.1 shows the composition of samples of inspired (breathed in) air and expired air.

Table 4.1

gas	sample A /percentage	sample B /percentage
nitrogen	78.00	78.00
oxygen	21.00	16.00
carbon dioxide	0.04	5.04
other gases	0.96	0.96

- (i) State which sample, **A** or **B**, is expired air. Use the data in Table 4.1 and your knowledge to explain your answer.

sample

explanation

.....

.....

.....

[2]

- (ii) Describe how you could confirm the presence of carbon dioxide in the air samples.

test

observation

[1]

- (c) Table 4.2 shows the number of breaths taken per minute and the volume of air in each breath before exercise.

Suggest values for the breathing rate and the volume of air in each breath immediately after exercise.

Record these values in Table 4.2.

Table 4.2

	before exercise	after exercise
breathing rate / breaths per minute	12.0	
volume of air in each breath / dm ³	0.5	

[2]

- (d) Plan an investigation to show the effect of physical activity on pulse rate.

Include the following in your answer.

- How you would measure pulse rate.
- When you would measure pulse rate.
- How you would make sure you have confidence in your results.

.....

.....

.....

.....

.....

.....

.....[3]

- 5 A group of students investigate the electrolysis of aqueous copper chloride using inert electrodes. The apparatus and circuit diagram are shown in Fig. 5.1.

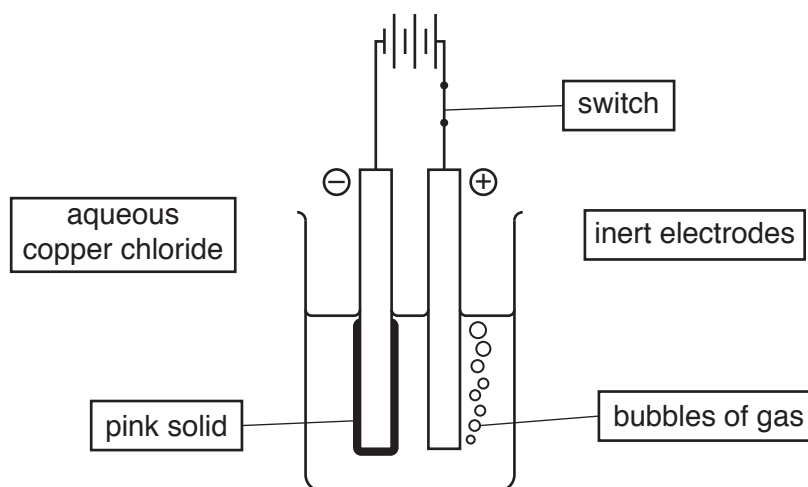


Fig. 5.1

- (a) Add label lines to connect the two boxes labelled *inert electrodes* and *aqueous copper chloride* to the appropriate parts in Fig. 5.1. [2]
- (b) When the switch is closed, the students observe gas bubbles at the anode and a pink solid forming on the cathode as shown in Fig. 5.1.

- (i) One of the students tests the gas forming at the anode and concludes that the gas is chlorine.

State the test and observation that allows the student to make this conclusion.

test

observation

[2]

- (ii) Another student is sure that the solid forming on the cathode is copper metal.

The teacher reacts a small amount of the pink solid to form a blue solution.

The student adds ammonia solution to this blue solution.

State the observations that the student makes which identifies the presence of Cu^{2+} ions.

.....

.....

..... [2]

(c) A student repeats the electrolysis in Fig. 5.1 quantitatively.

- He weighs the cathode before the circuit is connected and switched on.
- He records this mass in Table 5.1.
- He switches on the circuit and starts a stopclock.
- After 300 seconds he switches off the circuit.
- The cathode is dried and reweighed.
- He records the new mass in Table 5.1.
- The circuit is reconnected and switched on for another 300 seconds.
- He dries and reweighs the cathode and records the mass in Table 5.1.
- This process is repeated until the electrolysis has taken place for a total of 1200 seconds.
- He calculates the total increase in mass at each time and records the values in Table 5.1.

Table 5.1

total time of electrolysis/s	mass of cathode/g	total increase in mass of cathode/g
0	11.63	0.00
300	11.80	0.17
600	11.97	0.34
900		0.51
1200	12.31	0.68

- (i) Complete Fig. 5.2 to show the reading on the stopclock in **minutes and seconds** for the time 900 seconds.

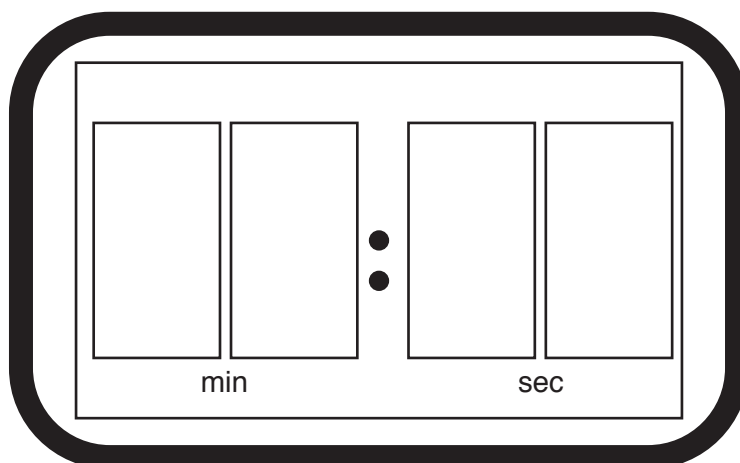


Fig. 5.2

[1]

- (ii) Use the data in Table 5.1 to calculate the mass of the cathode after 900 seconds.

Record this mass in Table 5.1.

[1]

- (iii) Use the data in Table 5.1 to describe the relationship between the total time of electrolysis and the total mass of copper deposited at the cathode.

Show how you have used the data to find this relationship.

.....

.....

.....

.....[2]

- 6 A student performs an experiment to measure an approximate value for the specific heat capacity of water.

The specific heat capacity c of water is the amount of thermal energy needed to raise the temperature of 1 g of water by 1 °C.

Procedure

- The student places a heating coil (heater) into a beaker containing 150 g of water.
- He connects the heater in series with an ammeter to a 12 V power supply as shown in Fig. 6.1.
- He measures the initial temperature θ_1 of the water.

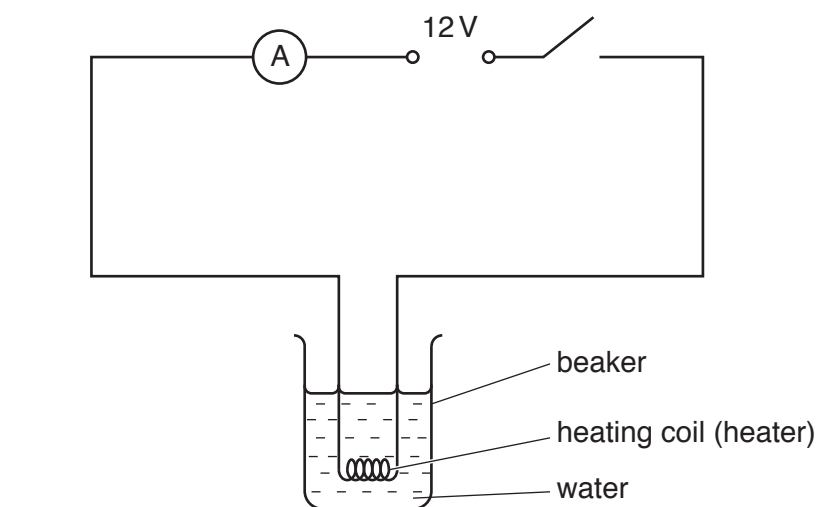


Fig. 6.1

- (a) On Fig. 6.1, draw a voltmeter to measure the potential difference V across the heating coil.

Use the correct voltmeter symbol.

[1]

(b) Procedure

- The student switches on the circuit and starts a stopwatch.
- He switches off the circuit after 500 s.
- He stirs the water and immediately measures the temperature θ_F of the water.

(i) State why it is important that he stirs the water before measuring temperature θ_F .

.....
[1]

(ii) The temperature of the water continues to rise after the student has measured θ_F .

Suggest a reason for this.

.....
[1]

(c) The student's results for (a) and (b) are shown in Table 6.1.

Table 6.1

mass of water m/g	150
initial temperature of water $\theta_1/^\circ\text{C}$	20
temperature of water after heating $\theta_F/^\circ\text{C}$	42
rise in temperature of water $\theta/^\circ\text{C}$	22
current I/A	3
potential difference V/V	12
time t/s	500

Calculate the thermal energy E supplied by the heater. Use the equation shown.

$$E = V \times I \times t$$

$$E = \dots\dots\dots \text{ J [1]}$$

(d) Use your answer to (c) and the results in Table 6.1 to calculate a value for the specific heat capacity c of water. Use the equation shown.

$$E = m \times c \times \theta$$

$$c = \dots\dots\dots \text{ J/g}^\circ\text{C [2]}$$

- (e) (i) The specific heat capacity c of water is $4.2 \text{ J/g } ^\circ\text{C}$.

Use Fig. 6.1 to suggest **two** practical reasons why your calculated value for c is inaccurate.

reason 1

.....

reason 2

.....

[2]

- (ii) State **one** improvement that could be made to the design of the apparatus to produce a more accurate result.

.....[1]

- (f) The student forgets to switch the heater off at the end of his experiment.

The temperature of the water continues to rise until it reaches 72°C and then remains constant at this value.

Suggest a reason why the water does **not** reach its boiling point.

.....

.....[1]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.