Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

7007324309

CO-ORDINATED SCIENCES **0654/62**

Paper 6 Alternative to Practical **May/June 2017**

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 an HB 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.

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

DC (LK/CGW) 129153/3

[Turn over

1 Fig. 1.1 shows a flower that has been cut in half lengthways. The photograph is life-size.

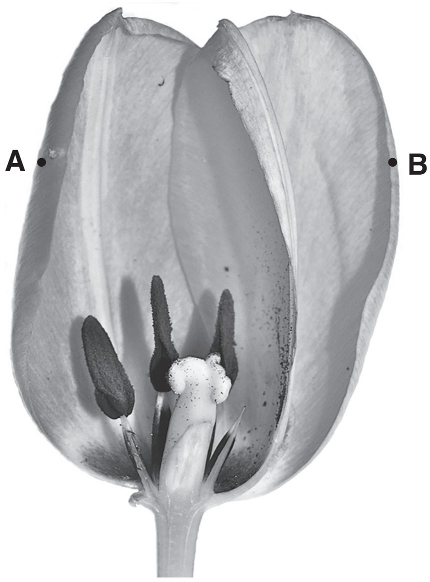


Fig. 1.1

(a) **(i)** In the box shown, make a **large** pencil drawing of the flower. This should show all the flower parts including the petals.

[4]

(ii) On your drawing, use label lines to **label only** the following structures.

- an anther
- a stigma

[2]

(b) You are going to calculate the magnification of your drawing.

(i) On Fig. 1.1 draw a straight line between points **A** and **B**.

Measure the length of this line in millimetres to the nearest millimetre.

length = ... mm

Draw a matching line **A–B** on your pencil drawing.

Measure the length of this line in millimetres to the nearest millimetre.

length = ... mm
[2]

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

Show your working in the space below.

magnification = ... [1]

(c) On Fig. 1.1, circle the structure that receives pollen during pollination. [1]

2 A student investigates how the temperature of a reactant affects the rate of reaction between calcium carbonate (marble chips) and hydrochloric acid.

He sets up the apparatus as shown in Fig. 2.1.

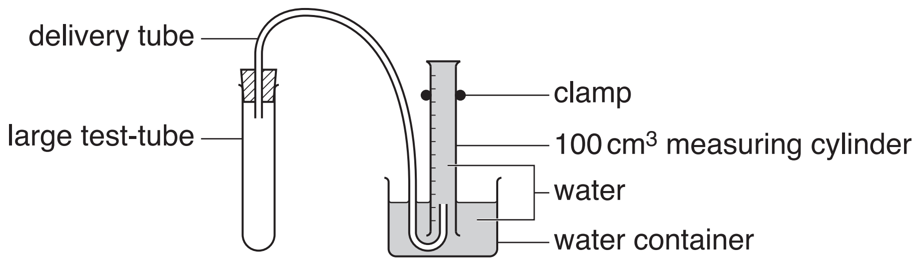


Fig. 2.1

- He places 20 cm^3 of hydrochloric acid into the large test-tube, measures the temperature of the acid and records the value in Table 2.1.
- He adds five marble chips to the acid and reconnects the delivery tube.
- He starts the stopclock.
- After **one** minute he reads the volume V_1 of gas collected in the measuring cylinder.
- After **two** minutes he reads the new total volume V_2 of gas collected in the measuring cylinder.
- Both values are shown in Table 2.1.
- This is repeated for different temperatures of acid.

Table 2.1

experiment	temperature of acid / °C	volume of gas after one minute V_1 / cm^3	volume of gas after two minutes V_2 / cm^3	volume of gas produced in second minute V / cm^3
1	21.5	6	13	
2	34.5	9	19	10
3	44.0	13	27	
4	55.0	17	38	

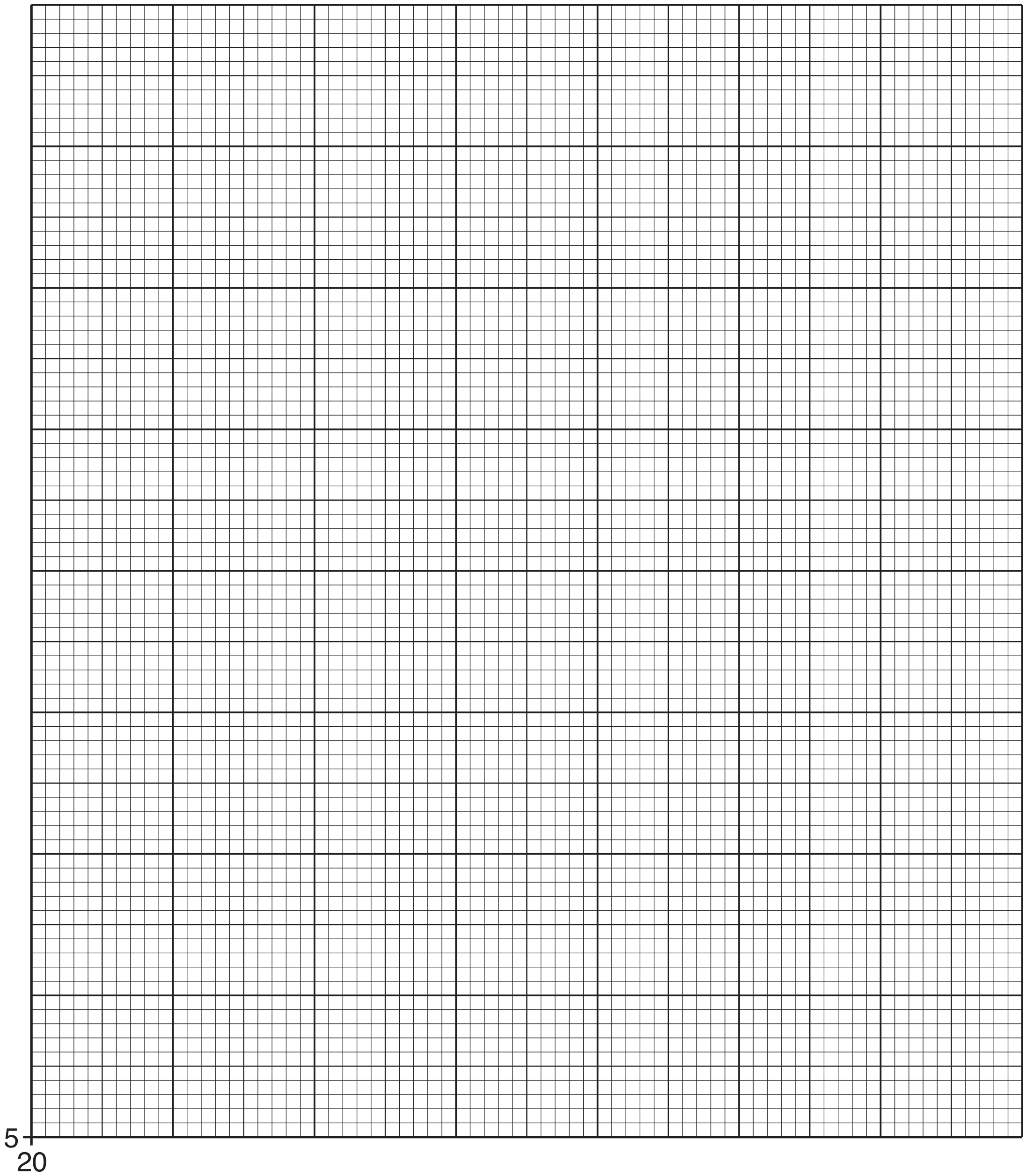
(a) **(i)** For each experiment use the equation shown to calculate the volume of gas V produced in the second minute. One has been done for you. Record these values in Table 2.1.

$$V = V_2 - V_1$$

[1]

(ii) On the grid provided, plot a graph of the volume of gas *V* produced in the second minute (vertical axis) against the temperature of the hydrochloric acid.

Draw the best-fit straight line or smooth curve as appropriate.



[4]

(iii) Use your graph to describe the relationship between the temperature of the acid and the rate of the reaction.

....

....[1]

(b) (i) Suggest **one** reason why it is more accurate to compare the volumes of gas produced in the second minute rather than in the first minute.

....

....[1]

(ii) Another student does **not change** the marble chips for each new temperature of acid.

His results are significantly different from those of the first student.

Suggest why this happens.

....

....[1]

(iii) Suggest an alternative method for measuring the rate of reaction between marble chips and acid.

You may draw a labelled diagram but you must state what is being measured.

....

....

....

....[2]

Please turn over for Question 3.

3 A student measures the density of water by two different methods.

(a) Method 1

She uses a balance to measure the mass m_1 of an empty measuring cylinder.

The scale of the balance is shown in Fig. 3.1.

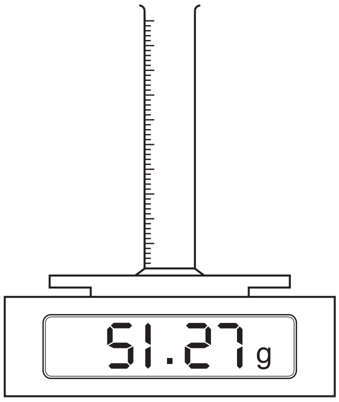


Fig. 3.1

(i) Read the scale and record the mass of the empty measuring cylinder to the nearest 0.1 g.

m_1 = ... g [1]

(ii) She removes the measuring cylinder from the balance and pours water into it. Part of the scale of the measuring cylinder is shown in Fig. 3.2.

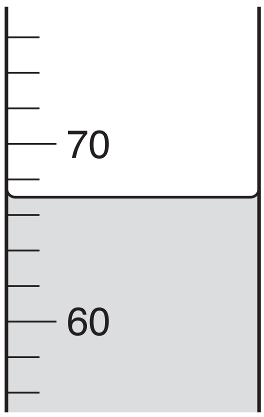


Fig. 3.2

Read the scale and record the volume V_1 of water in the measuring cylinder.

V_1 = ... cm^3 [1]

(iii) State how the student should ensure that the reading of the volume of water in the measuring cylinder that she records in **(a)(ii)** is as accurate as possible.

....

....[1]

(iv) She uses the balance to measure and record the mass m_2 of the measuring cylinder and water.

$$m_2 = 120.4\,g$$

Calculate the density d_1 of the water using your values from **(a)(i)** and **(a)(ii)** and the value of m_2. Use the equation shown. State the unit of your answer.

$$d_1 = \frac{(m_2 - m_1)}{V_1}$$

d_1 = ... unit = ... [2]

(b) Method 2

The student uses the balance provided to measure and record the mass m_3 of a test-tube.

$$m_3 = 18.1\,g$$

She takes the measuring cylinder and water used in **Method 1** and slowly lowers the test-tube into the measuring cylinder until it floats, approximately vertically, as shown in Fig. 3.3.

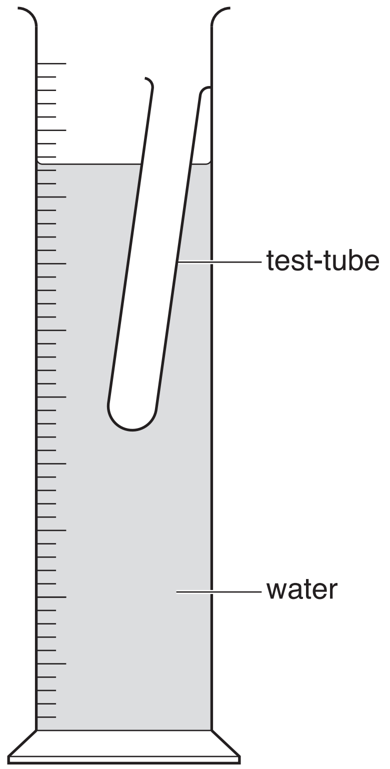


Fig. 3.3

She measures the volume V_2 of water recorded by the measuring cylinder.

$$V_2 = 85\,cm^3$$

(i) Use the volume value from **(a)(ii)** and V_2 to calculate the volume of water V_3 displaced by the test-tube.

V_3 = ... cm^3 [1]

(ii) Calculate the density d_2 of the water using your value from **(b)(i)** and the value of m_3. Use the equation shown.

$$d_2 = \frac{m_3}{V_3}$$

d_2 = ... [2]

(c) **(i)** Apart from the reading of the volumes, suggest **one** other possible source of inaccuracy in **Method 2**.

....

....[1]

(ii) Suggest **one** reason why it is good experimental practice for the student to carry out the two measurements of density in the order that she does.

....

....[1]

Please turn over for Question 4.

4 A student investigates the starch and sugar content of plants using four similar shoots.

She sets up the shoots as shown in Fig. 4.1.

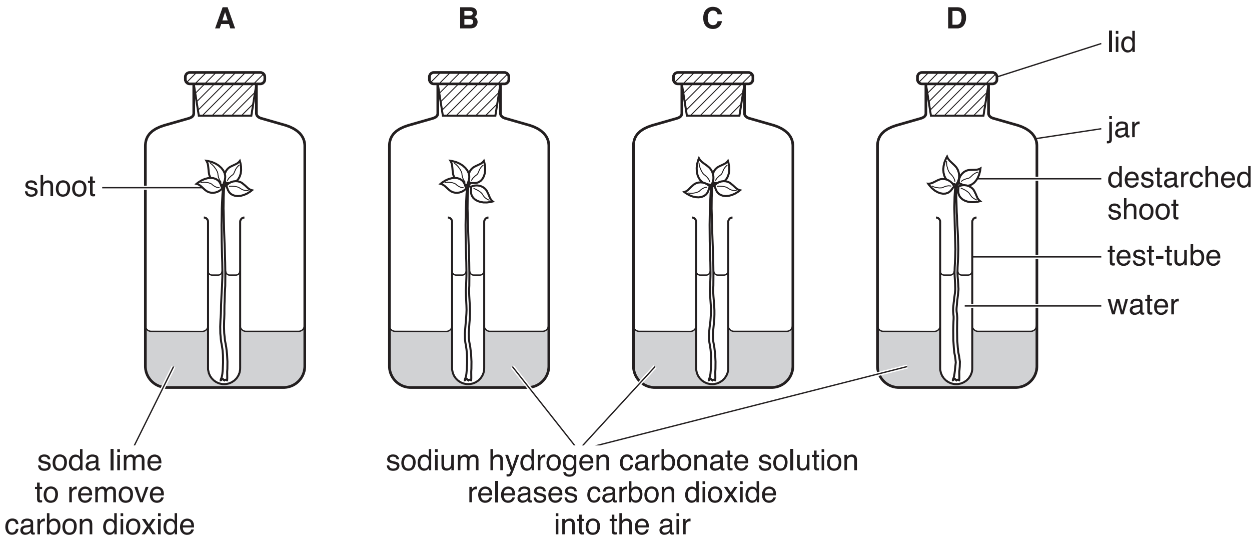


Fig. 4.1

The shoot in jar **D** is destarched. The other three shoots are **not** destarched.

(a) Describe how a shoot can be destarched.

....

.... [2]

(b) The jars are left for five days. Jars **A** and **B** are placed in light. Jars **C** and **D** are placed in the dark.

Each test-tube is tested for starch and reducing sugar at the start of day **1** and at the end of day **5**. The results of these tests are shown in Table 4.1.

Table 4.1

	A	**B**	**C**	**D**
presence of carbon dioxide	none	present	present	present
light conditions	light	light	dark	dark
starch content on day **1**	high	high	high	none
starch content on day **5**	none	high	none	none
reducing sugar content on day **1**	high	high	high	little
reducing sugar content on day **5**	little	high	little	none

(i) Describe how the student can test a leaf for starch. Include the observation for a positive result.

....

....

....

....[3]

(ii) Describe how the student can test for reducing sugar. Include the observation for a positive result.

....

....

....

.... [3]

(iii) State and explain **one** important safety precaution that the student should take in either of the above tests.

....[1]

(c) Use the results in Table 4.1 to state what the student can conclude from her investigation.

....

....[1]

5 A student prepares some pure blue crystals of copper sulfate.

He heats some dilute sulfuric acid in a beaker and then adds a small amount of black copper oxide, CuO.

He stirs the mixture and keeps adding copper oxide until it is in excess. See Fig. 5.1.

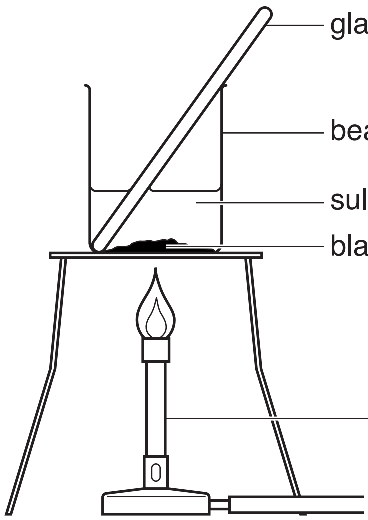


Fig. 5.1

(a) **(i)** Explain how he knows when the copper oxide is in excess. Include observations in your answer.

....

....[1]

(ii) Explain why he adds excess copper oxide.

....

....[1]

(iii) Describe how the student removes the excess copper oxide.

....

....[1]

(b) **(i)** The student wants to make pure dry crystals of blue copper sulfate.

He heats the solution from **(a)(iii)** strongly with a Bunsen burner, but he does **not** obtain blue crystals of copper sulfate. Instead he sees a white powder which gradually turns black.

Suggest what might have happened to the copper sulfate during this heating to dryness.

....

....[1]

(ii) Describe a three-step method which the student should have used to obtain pure dry crystals of blue copper sulfate.

step **1** ....

....

step **2** ....

....

step **3** ....

....
[3]

(c) The student wants to show that the blue crystals contain the sulfate ion.

Describe the test for the sulfate ion. Include the result for a positive test in your answer.

....

....[1]

(d) Another student is asked to make a sample of zinc chloride crystals using the same method as in **(a)** and **(b)(ii)**.

Name the **two** chemicals he should use.

1 ....

2 ....
[2]

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6 Five students, **P**, **Q**, **R**, **S** and **T**, investigate how temperature changes during the process of evaporation. They use the apparatus shown in Fig. 6.1.

They each perform the same experiment.

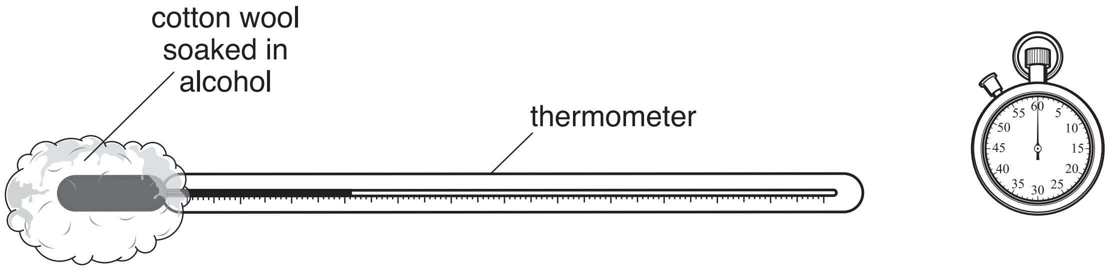


Fig. 6.1

They each put 1 cm^3 of alcohol onto the cotton wool surrounding the thermometer bulb.

They measure the starting temperature and then the temperature every 30 seconds for five minutes.

(a) **(i)** Name a suitable piece of equipment for putting 1 cm^3 of alcohol onto the cotton wool surrounding the bulb of the thermometer.

....[1]

(ii) Explain why it is important for the students to use the same sized pieces of cotton wool to make it a fair comparison.

....

....[1]

(b) (i) Read the thermometers shown in Fig. 6.2, which show the temperatures measured by student **Q** at 0 s and 150 s.

Fig. 6.2

Record the temperatures to the nearest 0.5 °C in Table 6.1. [2]

Table 6.1

time / s	**P**	**Q**	**R**	**S**	**T**	average temperature / °C
0	25.0		26.5	25.0	25.0	25.8
30	22.0	20.5	22.0	19.0	20.5	20.8
60	18.0	17.0	18.0	17.0	19.0	
90	14.0	16.5	17.0	15.5	14.5	15.5
120	12.0	14.5	15.5	13.0	12.0	13.4
150	11.0		11.5	12.0	10.5	11.8
180	14.0	11.0	10.0	11.0	10.0	11.2
210	10.0	10.0	9.0	10.0	9.5	9.7
240	9.0	9.0	8.5	9.5	9.0	
270	8.0	8.0	8.0	9.0	8.0	8.2
300	8.0	7.0	8.0	7.5	8.0	7.7

(ii) Calculate the average (mean) temperatures at 60 s and 240 s. Record these values in Table 6.1.

[2]

(c) One of student **P**'s results is anomalous.

(i) State the time at which this anomalous result occurred.

time = ... s [1]

(ii) Suggest what could have happened to cause this anomaly.

....

....[1]

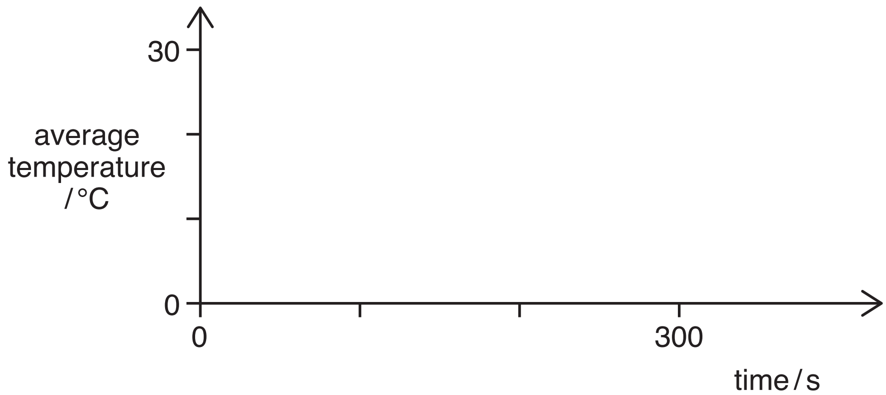
(d) Explain why the changes in temperature between 240 s and 300 s are very small.

....

....[1]

(e) On the axes provided, sketch a line to show how the average temperature changes with time.

You do **not** have to plot the points.



[1]

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