Cambridge IGCSE™

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

6051202015

CO-ORDINATED SCIENCES **0654/62**

Paper 6 Alternative to Practical **May/June 2022**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 60.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

DC (CE/SG) 303343/3

1 A student investigates the movement of molecules through a cell membrane.

The student uses dialysis (Visking) tubing that can act like a cell membrane.

This tubing allows small molecules to pass through it but not large molecules.

Procedure

The student:

Step **1** uses a syringe to put 2 cm^3 of iodine solution into the dialysis tubing tied at one end

Step **2** ties the open end with a knot to enclose the iodine solution inside and make a bag

Step **3** rinses the outside of the bag with water

Step **4** places the bag containing iodine solution into a beaker of starch solution as shown in Fig. 1.1

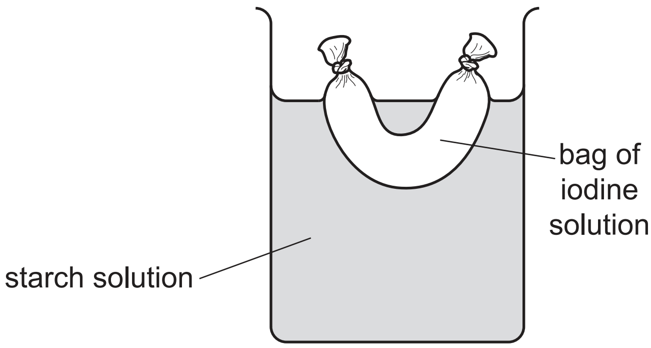

Fig. 1.1

Step **5** observes the colour in the bag and the colour in the beaker every minute for five minutes

Step **6** records all colours in Table 1.1.

Table 1.1

time t /	colour of solution	
	bag	beaker
0	brown	colourless
1	brown	colourless
2	brown	colourless
3	brown	blue-black
4	brown	blue-black
5	brown	blue-black

(a) Complete the heading in Table 1.1 by adding the unit for time. [1]

(b) Iodine solution is a test for starch.

Dialysis tubing allows small molecules to pass through it but not large molecules.

Explain the observations for the colour of the solution inside the bag and the colour of the solution in the beaker after five minutes.

Use the information provided and the results in Table 1.1.

Include ideas about the size of molecules in your answer.

....

....

....

....

.... [3]

(c) Suggest why a syringe is used to measure the 2 cm^3 of iodine solution in Step **1** of the procedure instead of a measuring cylinder.

.... [1]

(d) Suggest why the dialysis tubing is rinsed in Step **3** of the procedure.

.... [1]

(e) At lower temperatures, molecules move more slowly.

The student does the procedure at a lower temperature.

Suggest how this affects the results.

.... [1]

(f) **(i)** Starch is broken down into reducing sugar by the enzyme amylase.

Describe a test to confirm the presence of reducing sugar.

Include the colour observed for a positive result.

test ....

....

observation ....
[3]

(ii) The enzyme amylase is a protein.

Describe a test to confirm the presence of protein.

Include the colour observed for a positive result.

test ....

....

observation ....
[2]

[Total: 12]

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2 Fig. 2.1 shows a magnified section through part of a leaf.

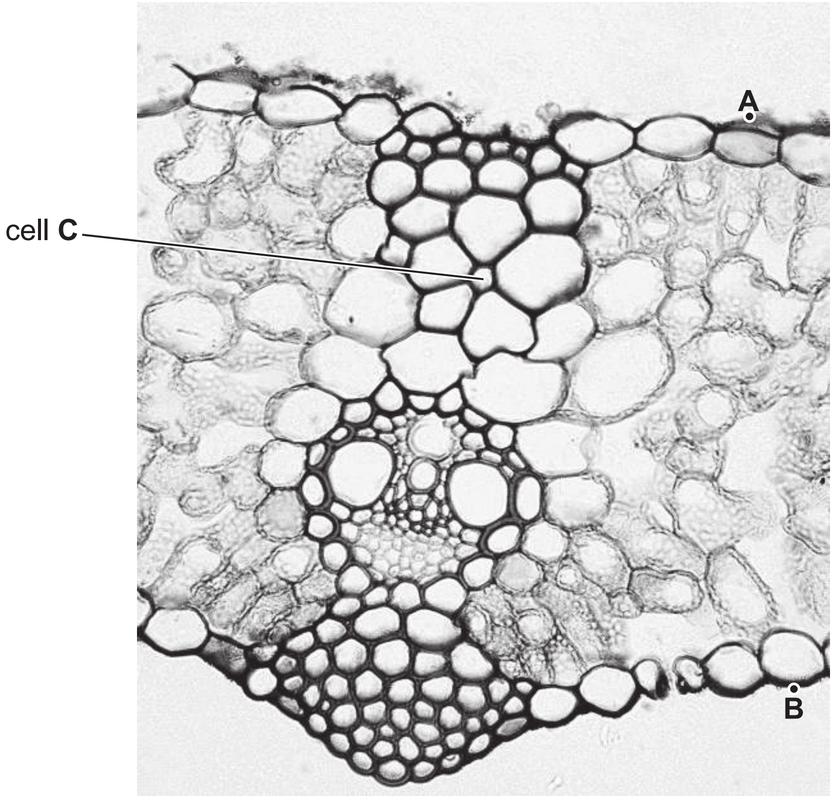


Fig. 2.1

(a) In the box, make a large pencil drawing of only the cell labelled **C** and the **5** cells touching it.

Do **not** draw any other cells.

[3]

(b) **(i)** The distance between the points **A** and **B** in Fig. 2.1 shows the thickness of the leaf.

Draw a line between points **A** and **B** in Fig. 2.1.

Measure the length of line **AB** in Fig. 2.1.

Record this length in millimetres to the nearest millimetre.

length of line **AB** in Fig. 2.1 = ... mm [1]

(ii) The thickness of the actual leaf at **AB** is 0.75 mm.

Calculate the magnification *m* of the photograph.

Use the equation shown.

$$m = \frac{\text{length of line } \mathbf{AB} \text{ in Fig. 2.1}}{\text{thickness of the actual leaf at } \mathbf{AB}}$$

m = ... [1]

(c) A teacher states that the thickness of the actual leaf measured between points **A** and **B** does **not** show the thickness of the **whole** leaf.

Suggest why the teacher is correct.

State how you can improve confidence in the measurement of the thickness of the **whole** leaf.

suggestion ....

....

improvement ....

....

....
[3]

[Total: 8]

3 A student investigates the rate of reaction when calcium carbonate reacts with dilute hydrochloric acid.

(a) Procedure

The student:

Step **1** uses a measuring cylinder to place 25 cm^3 of dilute hydrochloric acid into a conical flask

Step **2** sets up the apparatus shown in Fig. 3.1

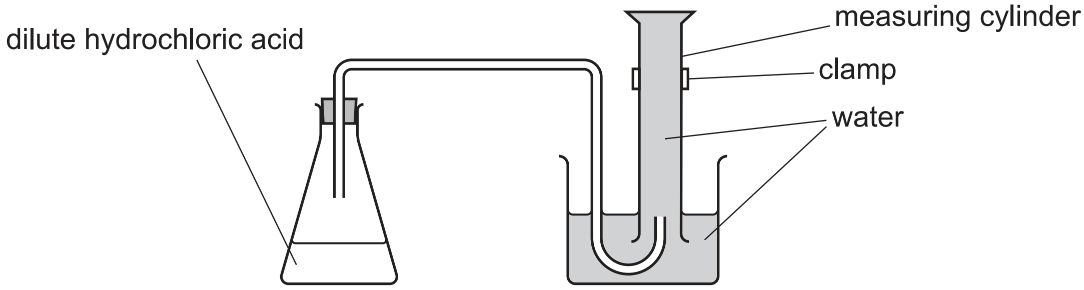


Fig. 3.1

Step **3** removes the stopper from the conical flask

Step **4** adds the calcium carbonate to the conical flask, quickly replaces the stopper and immediately starts a stop-watch

Step **5** measures the volume of gas in the measuring cylinder every 30 seconds for five minutes

Step **6** records these volumes in Table 3.1.

(i) Suggest another method of collecting and measuring the volume of gas.

....

.... [1]

(ii) State the name of a piece of apparatus the student can use to measure the 25 cm^3 of dilute hydrochloric acid in Step **1** more accurately.

.... [1]

(iii) Suggest how the student knows when the reaction has finished.

....

.... [1]

(b) Fig. 3.2 shows part of the student's notebook.

Calcium carbonate is a white solid. When calcium carbonate is added to hydrochloric acid it fizzes. When the reaction has stopped there is a solid and a colourless liquid in the conical flask.

Fig. 3.2

Suggest which reagent, calcium carbonate or dilute hydrochloric acid, is in excess.

Give a reason for your answer.

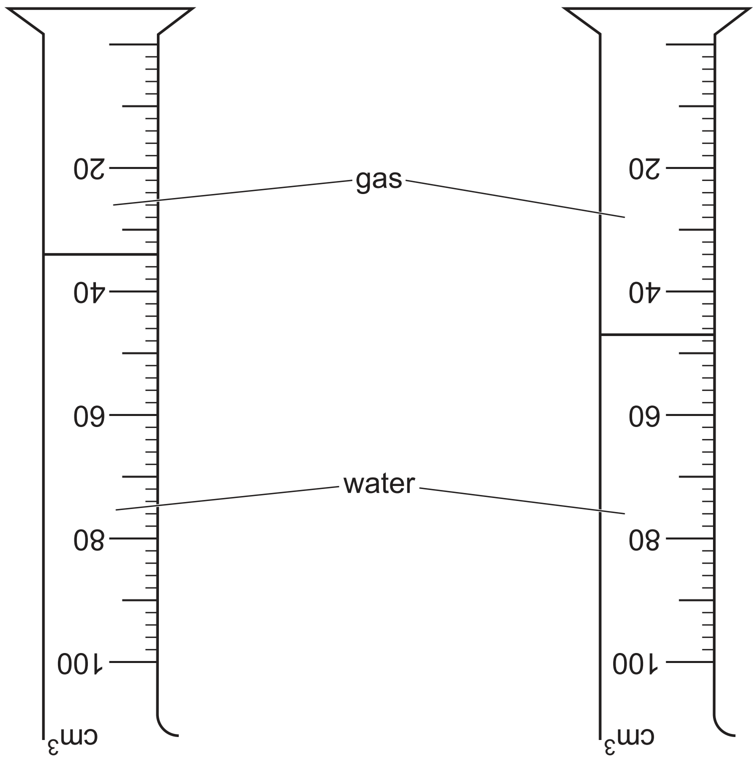
Use the notebook to help you answer the question.

....

.... [1]

(c) Fig. 3.3 shows the measuring cylinder at 60 seconds and 150 seconds.

Record these volumes in Table 3.1.



volume of gas at 60 seconds volume of gas at 150 seconds

Fig. 3.3

Table 3.1

time / s	volume of gas / cm^3
0	0
30	10
60	
90	40
120	44
150	
180	41
210	50
240	51
270	51
300	51

[2]

(d) **(i)** On the grid, plot a graph of volume of gas (vertical axis) against time.

[3]

(ii) Circle the anomalous point on the graph. [1]

(iii) Draw the line of best-fit which shows how the volume of gas changes with time. [1]

(e) **(i)** A faster reaction has a steeper line than a slower reaction.

When the reaction is finished, there is no more increase in the volume of gas given off.

Describe how the rate of the reaction changes during the course of this reaction.

Explain how your graph shows these changes.

....

....

....

.... [2]

(ii) The student repeats the experiment using the same amounts of calcium carbonate and dilute hydrochloric acid. This time, the acid is at a **higher** temperature.

The rate of reaction increases.

Draw a line on the grid in **(d)** to show the results you expect from this faster reaction.

Label the line **F**. [2]

[Total: 15]

4 Fig. 4.1 shows some of a student's notes about testing for gases and ions.

When **dilute nitric acid and aqueous silver nitrate** are added to chlorides, a white precipitate is made.

When **dilute nitric acid and aqueous barium nitrate** are added to sulfates, a white precipitate is made.

When **aqueous ammonia** is added to metal ions, a precipitate is often made. Iron(II) ions give a green precipitate, iron(III) ions a brown precipitate, copper ions a blue precipitate which dissolves in excess ammonia to give a dark blue solution, calcium a white precipitate and zinc a white precipitate that dissolves in excess ammonia.

When **aqueous sodium hydroxide** is added to metal ions, a precipitate is often made. Iron(II) ions give a green precipitate, iron(III) ions a brown precipitate, copper ions a blue precipitate, calcium a white precipitate and zinc a white precipitate that dissolves in excess ammonia.

Fig. 4.1

The student has aqueous calcium chloride and aqueous copper sulfate.

Complete Table 4.1 with the results the student gets with these two solutions.

Table 4.1

test	observations	
	aqueous calcium chloride	aqueous copper sulfate
add a few drops of aqueous ammonia add excess aqueous ammonia		
add a few drops of aqueous sodium hydroxide		
add dilute nitric acid and aqueous barium nitrate		
add dilute nitric acid and aqueous silver nitrate		

[5]

5 A student investigates the resistance of different combinations of identical lamps.

The student sets up the circuit shown in Fig. 5.1. This is circuit **1**.

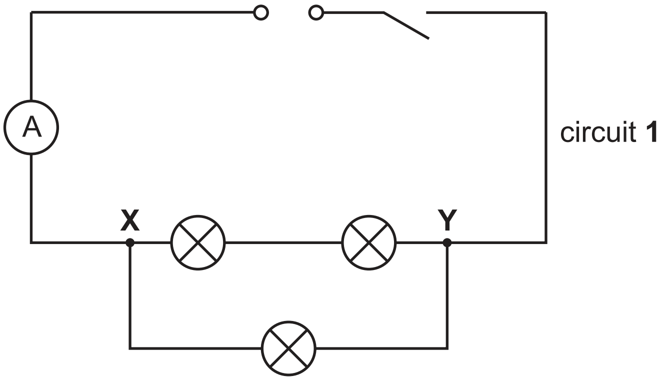


Fig. 5.1

(a) On Fig. 5.1, draw the symbol for a voltmeter connected to measure the potential difference between point **X** and point **Y**. [2]

(b) Procedure

The student:

- connects the voltmeter into circuit **1** to measure the potential difference between **X** and **Y**
- closes the switch
- records in Table 5.1 the potential difference V and the current I
- opens the switch.

Table 5.1

circuit	V/V	I/A	R/...........
1			
2	3.0	0.25	12
3	2.8	0.20	14

(i) Fig. 5.2 shows the readings on the voltmeter and the ammeter.

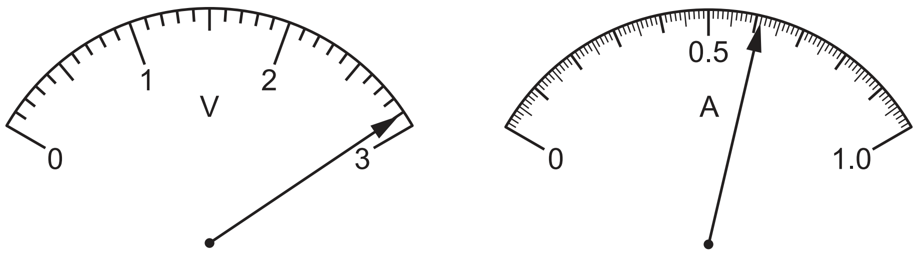


Fig. 5.2

Record in Table 5.1 the values of the potential difference V and the current I. [2]

(ii) Suggest why the student opens the switch after completing the procedure.

.... [1]

(c) Procedure

The student:

- connects circuit **2** as shown in Fig. 5.3

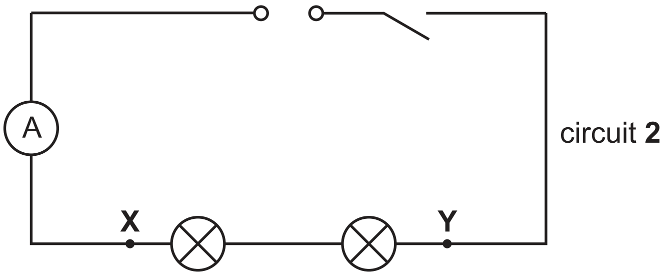


Fig. 5.3

- connects the voltmeter to measure the potential difference between **X** and **Y**
- closes the switch
- records in Table 5.1 the potential difference V and the current I
- opens the switch.

The student repeats the procedure in **(c)** for circuit **3**, shown in Fig. 5.4.

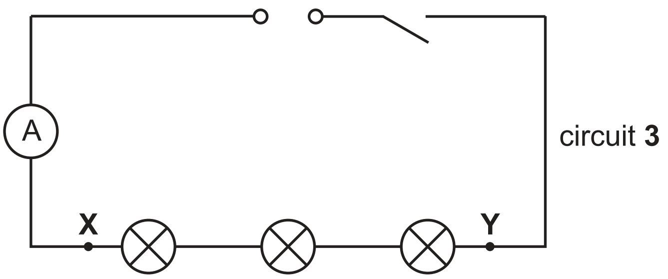


Fig. 5.4

(i) Calculate and record in Table 5.1 the total resistance *R* in circuit **1**.

Use the equation shown.

$$R = \frac{V}{I}$$

[1]

(ii) Complete the headings in Table 5.1 with the unit for resistance. [1]

(d) Another student suggests that if each lamp has the same resistance, the resistance *R* in circuit **3** should be equal to 1.5 times the resistance *R* in circuit **2**.

Two quantities can be considered equal, within the limits of experimental error, if their values are within 10% of each other.

State if the results support the student's suggestion.

Justify your statement by doing a calculation using appropriate values of *R* from Table 5.1.

statement ....

justification ....

....

....
[2]

(e) Another student finds that in their circuit **3**, the lamps do **not** light up.

Suggest **one** observation that the student makes to check if one of the lamps is broken.

....

.... [1]

(f) The student extends the investigation and connects the 3 lamps together in parallel to make circuit **4**.

(i) In the space provided, draw the circuit diagram for circuit **4**.

[2]

(ii) State the name of a component that can be connected in series with the power supply in circuit **4** that will allow the brightness of the lamps to be changed.

.... [1]

[Total: 13]

6 Plan an experiment to investigate how the area of the water surface in a beaker affects the rate of cooling of hot water in the beaker.

Fig. 6.1 shows the area of the water surface.

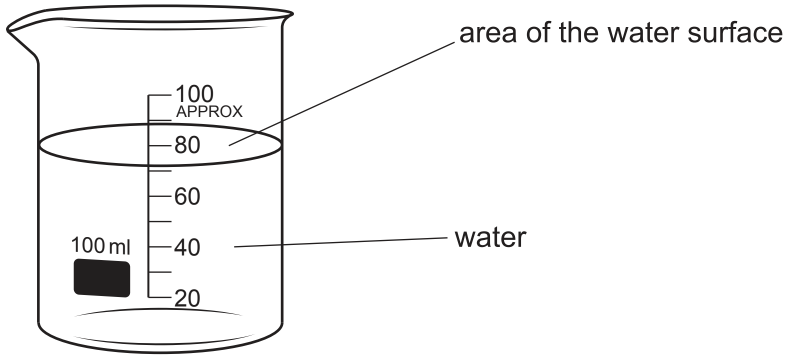


Fig. 6.1

You are provided with:

- a supply of hot water
- a set of different sized beakers made from the same material, but with different areas of water surface. The beakers are lagged with insulation on their sides and bases.

You may use any other common laboratory apparatus.

Include in your plan:

- any other apparatus needed
- a brief description of the method, including what you will measure and how you will make sure your measurements are accurate
- the variables you will control
- a results table to record your measurements (you are **not** required to enter any readings in the table)
- how you will process your results to draw a conclusion.

You may include a labelled diagram if you wish.

.... [7]

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