Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

3531782608

CO-ORDINATED SCIENCES **0654/52**

Paper 5 Practical Test **May/June 2022**

2 hours

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

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 [ ].
- Notes for use in qualitative analysis are provided in the question paper.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
Total	

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

DC (CE/FC) 303342/3

1 You are going to investigate the movement of molecules through a cell membrane.

You are provided with some dialysis (Visking) tubing that can act like a cell membrane.

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

(a) Procedure

- Take a piece of dialysis tubing. It is closed at one end with a knot.
- Rub gently at the end without the knot to open the tube.
- Using a syringe, carefully add 2 cm^3 of iodine solution into the dialysis tubing.
- Tie the open end with a knot to enclose the iodine solution and make a bag.
- Thoroughly rinse the outside of the bag with water.

(i) Record in Table 1.1 for time t = 0:
- the colour of the iodine solution in the bag
- the colour of the starch solution in the beaker.

Table 1.1

time t / minutes	colour of solution	
	bag	beaker
0		
1		
2		
3		
4		
5		

[1]

(ii) Procedure

- Place the bag containing iodine solution into the beaker of starch solution as shown in Fig. 1.1.

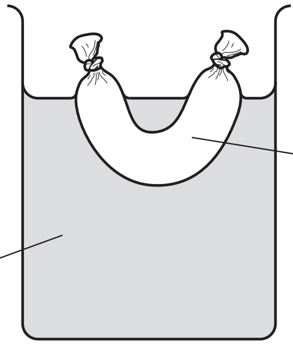

Fig. 1.1

- Start the stop-clock.
- Every minute for five minutes, carefully lift the bag above the starch solution to observe the colour in the bag and the colour in the beaker. Return the bag to the beaker of starch solution after each reading.

Record all colours in Table 1.1. [3]

(b) Iodine solution is a test for starch.

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

Explain your 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 your results from Table 1.1.

Include ideas about the size of molecules in your answer.

....

....

....

....

.... [3]

(c) Suggest why a syringe is used in the procedure instead of a measuring cylinder.

.... [1]

(d) Suggest why the dialysis tubing is rinsed in the procedure.

.... [1]

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

A student does the procedure at a lower temperature.

Suggest how this affects the results.

.... [1]

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

State the name of the reagent used to test for the presence of reducing sugar.

Include the colour observed for a positive result.

reagent ....

observation ....
[2]

[Total: 12]

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

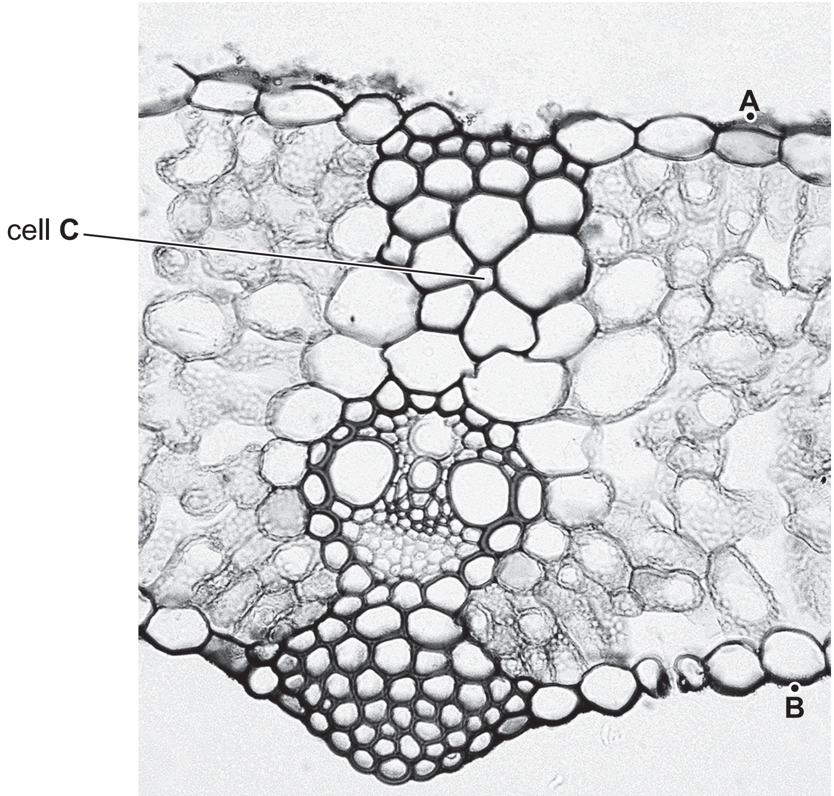

Fig. 2.1

(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]

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3 You are going to investigate the rate of reaction when calcium carbonate reacts with dilute hydrochloric acid.

(a) (i) Procedure

- The apparatus is set up as shown in Fig. 3.1.

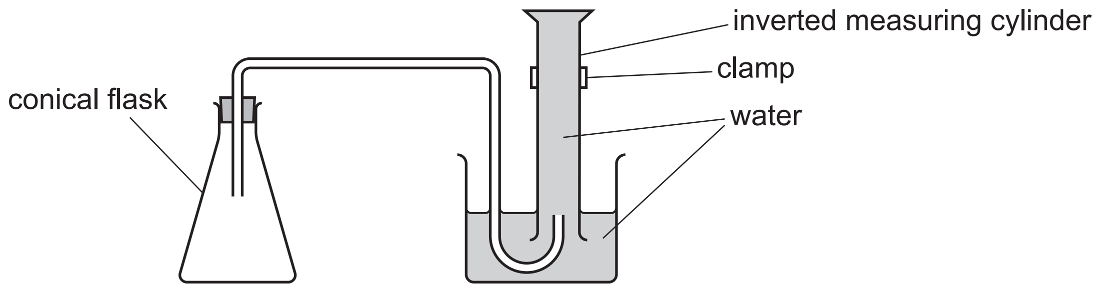

Fig. 3.1

- Remove the stopper from the conical flask.
- Use a 50 cm^3 measuring cylinder to place 25 cm^3 of dilute hydrochloric acid into the conical flask.
- Add all of the calcium carbonate to the conical flask and quickly replace the stopper. Immediately start the stop-watch.
- Record in Table 3.1 the volume of gas in the inverted measuring cylinder every 60 seconds for 300 seconds.

Table 3.1

time / s	volume of gas / cm^3
0	
60	
120	
180	
240	
300	

[4]

(ii) State the name of a piece of apparatus suitable for measuring the volume of dilute hydrochloric acid more accurately.

.... [1]

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

....

.... [1]

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

Give a reason for your answer.

....

.... [1]

(v) Suggest why the volume of gas you collected in this experiment is **less** than the volume of gas expected.

....

.... [1]

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

[3]

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

(iii) 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]

[Total: 14]

4 You are going to identify the ions present in solution **R**.

(a) Procedure

- Place 2 cm depth of solution **R** into each of four test-tubes.
- Do tests 1 to 4 as shown in Table 4.1 on the separate samples of solution **R**.
- Record your observations in Table 4.1.

Table 4.1

test	observations
1 add a few drops of aqueous ammonia add excess aqueous ammonia	
2 add a few drops of aqueous sodium hydroxide add excess aqueous sodium hydroxide	
3 add 1 cm depth of dilute nitric acid and 1 cm depth of aqueous barium nitrate	
4 add 1 cm depth of dilute nitric acid and 1 cm depth of aqueous silver nitrate	

[4]

(b) State the **two** ions present in solution **R**.

.... [2]

[Total: 6]

5 You are going to investigate the resistance of different combinations of identical lamps.

The circuit shown in Fig. 5.1 has been set up for you. This is circuit **1**.

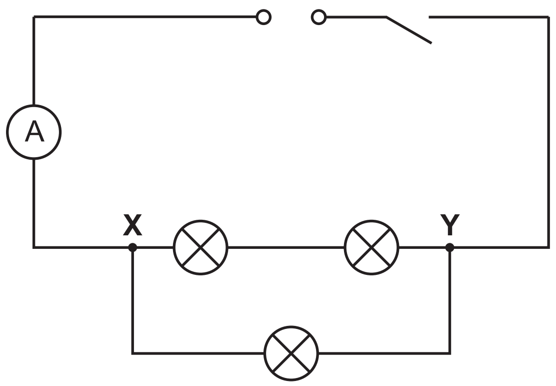

Fig. 5.1

(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

- Connect the voltmeter into circuit **1** to measure the potential difference between **X** and **Y**.
- Close the switch.
- Record in Table 5.1 the potential difference V and the current I.
- Open the switch.

Table 5.1

circuit	V/V	I/A	R/Ω
1			
2			
3			

[2]

(c) Procedure

- Disconnect the voltmeter.
- Connect the circuit as shown in Fig. 5.2. This is circuit **2**.

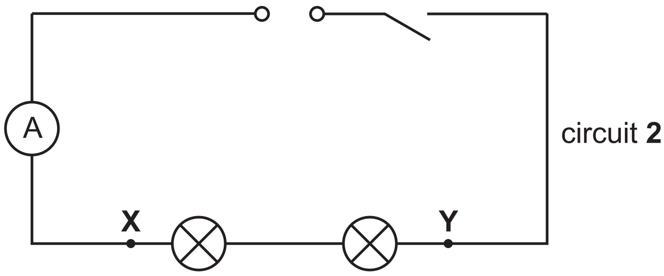

Fig. 5.2

- Reconnect the voltmeter to measure the potential difference between **X** and **Y**.
- Close the switch.
- Record in Table 5.1 the potential difference *V* and the current *I*.
- Open the switch.

[2]

(d) Procedure

- Disconnect the voltmeter.
- Connect the circuit as shown in Fig. 5.3. This is circuit **3**.

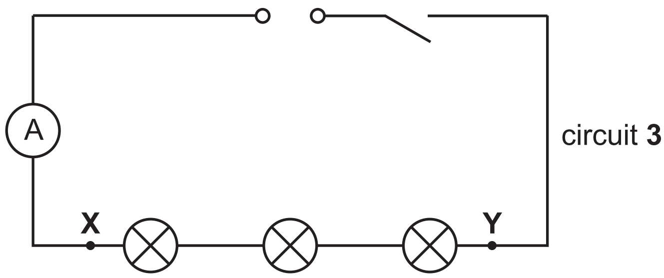

Fig. 5.3

- Reconnect the voltmeter to measure the potential difference between **X** and **Y**.
- Close the switch.
- Record in Table 5.1 the potential difference *V* and the current *I*.
- Open the switch.

[2]

(e) Calculate and record in Table 5.1 the total resistance *R* in each circuit.

Use the equation shown.

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

[2]

(f) A 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 your 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]

(g) 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]

[Total: 13]

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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.

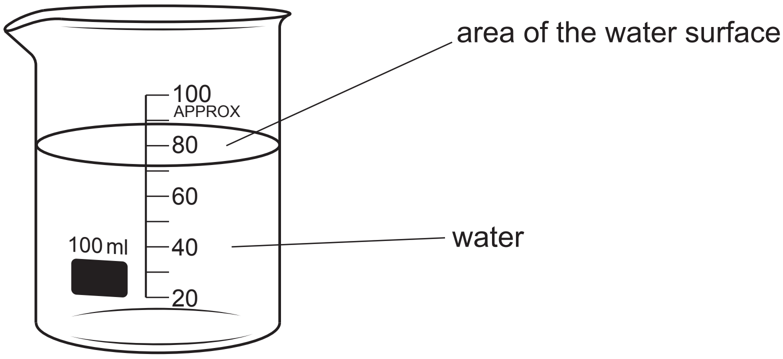

Fig. 6.1

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.

You are not required to do this investigation.

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]

NOTES FOR USE IN QUALITATIVE ANALYSIS

Tests for anions

anion	*test*	*test result*
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
bromide (Br^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	cream ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify, then add aqueous barium nitrate	white ppt.

Tests for aqueous cations

cation	*effect of aqueous sodium hydroxide*	*effect of aqueous ammonia*
ammonium (NH_4^+)	ammonia produced on warming	–
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt., or very slight white ppt.
copper(II) (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess, giving a dark blue solution
iron(II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) (Fe^{3+})	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess, giving a colourless solution	white ppt., soluble in excess, giving a colourless solution

Tests for gases

gas	*test and test result*
ammonia (NH_3)	turns damp red litmus paper blue
carbon dioxide (CO_2)	turns limewater milky
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	'pops' with a lighted splint
oxygen (O_2)	relights a glowing splint

Flame tests for metal ions

metal ion	*flame colour*
lithium (Li^+)	red
sodium (Na^+)	yellow
potassium (K^+)	lilac
copper(II) (Cu^{2+})	blue-green