Cambridge Assessment International Education

Cambridge IGCSE™ (9–1)

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

2252943626

CO-ORDINATED SCIENCES 0973/51

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 **16** pages. Any blank pages are indicated.

DC (EF) 309156

1 You are going to investigate two leaves from the same plant.

(a) You are provided with a leaf labelled **A**.

In the box, make an enlarged detailed pencil drawing of leaf **A**.

[3]

(b) **(i)** Measure the longest length of leaf **A**, excluding any stalk.

Record this length in millimetres to the nearest millimetre.

length of leaf **A** = ... mm [1]

(ii) Draw a line to show this length on your drawing in **(a)**.

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

length on drawing = ... mm [1]

(iii) Use your measurements in **(b)(i)** and **(b)(ii)** to calculate the magnification *m* of your drawing.

Use the equation shown.

$$m = \frac{\text{length on drawing}}{\text{length of leaf } \mathbf{A}}$$

m = ... [1]

(c) You are provided with leaf **B** on a white tile.

This leaf has had the green chlorophyll removed.

Procedure

- Cut leaf **B** into three pieces.
- Place one piece into one test-tube and a second piece into a separate test-tube.
- Add approximately 2 cm depth of Benedict's solution to one of the test-tubes and place it in a hot water-bath for approximately two minutes.
- Add approximately 2 cm depth of biuret solution to the other test-tube and swirl it to mix.
- Add a few drops of iodine solution onto the third piece of leaf on the white tile.

(i) State the name of the nutrient tested by each reagent.

Record your answers in Table 1.1.

Table 1.1

reagent	nutrient to be tested	final colour observed with leaf **B**
Benedict's solution		
biuret solution		
iodine solution		

[3]

(ii) Record in Table 1.1 the **final colour** observed with each piece of leaf **B**. [3]

(iii) State the nutrient or nutrients present in leaf **B**.

.... [1]

[Total: 13]

2 Water from the soil enters a plant through its roots, travels up the plant in xylem vessels and exits through holes in the leaves.

Plan an investigation to show that the mass of water lost from the leaves of a plant is greater when it is windy compared to when it is not windy.

You are provided with several plants in pots.

You may use any common laboratory apparatus.

You are not required to do this investigation.

Include in your plan:

- the apparatus needed
- a brief description of the method
- the measurements you will make including how to make them as accurate as possible
- the variables you will control
- how you will process your results to draw a conclusion.

You may include a labelled diagram if you wish.

You may include a results table if you wish. You are **not** required to include any results.

[7]

3 You are going to find the value of **x** in the formula of copper sulfate crystals, $CuSO_4{\cdot}\mathbf{x}H_2O$.

(a) (i) **Procedure**

- Use a balance to find the mass of the empty evaporating basin and record this mass in Table 3.1.
- Add three spatula loads of blue copper sulfate **crystals** into the evaporating basin.
- Use a balance to find the total mass of the evaporating basin and copper sulfate crystals. Record this mass in Table 3.1.
- Place the evaporating basin on top of the tripod and gauze.
- Heat the crystals until they form a dry white **powder**. Do **not** let the solid turn black.
- Let the evaporating basin cool.
  Continue with **(a)(ii)** and **Question 4** while you wait for the evaporating basin to cool.
- Use a balance to find the total mass of the cool evaporating basin and dry copper sulfate **powder**. Record this mass in Table 3.1.

Table 3.1

mass of empty evaporating basin / g	
total mass of evaporating basin and copper sulfate crystals, $CuSO_4{\cdot}\mathbf{x}H_2O$, before heating / g	
total mass of evaporating basin and dry copper sulfate powder, $CuSO_4$, after heating / g	

[4]

(ii) Draw a labelled diagram of the assembled apparatus showing the heating of the copper sulfate crystals.

[2]

(b) **(i)** Calculate the mass of water lost by the crystals.

Use the equation shown.

mass of water	=	total mass of evaporating basin and copper sulfate crystals before heating	–	total mass of evaporating basin and dry copper sulfate powder after heating

mass of water = ... g [1]

(ii) Calculate the amount of water in the copper sulfate crystals.

Use the equation shown.

$$\text{amount of water} = \frac{\text{mass of water}}{18}$$

amount of water = ... [1]

(iii) Calculate the mass of dry copper sulfate powder.

Use the equation shown.

mass of dry copper sulfate powder	=	total mass of evaporating basin and dry copper sulfate powder	–	mass of empty evaporating basin

mass of dry copper sulfate powder = ... g [1]

(iv) Calculate the amount of dry copper sulfate powder.

Use the equation shown.

$$\text{amount of dry copper sulfate powder} = \frac{\text{mass of dry copper sulfate powder}}{160}$$

amount of dry copper sulfate powder = ... [1]

(v) Use the answers to **(b)(ii)** and **(b)(iv)** to calculate the value of **x** in $CuSO_4 \cdot xH_2O$.

Use the equation shown.

$$\mathbf{x} = \frac{\text{amount of water}}{\text{amount of dry copper sulfate powder}}$$

Give your answer to **one** significant figure.

x = ... [2]

(c) Describe how you can change the **white** copper sulfate **powder** back into **blue** copper sulfate.

....

.... [1]

(d) Suggest what you can do to have more confidence in your value of **x**.

....

.... [1]

(e) The value for the mass of the dry copper sulfate powder after heating is **larger** than expected.

Suggest a reason why the mass of the dry copper sulfate powder after heating is **larger** than expected.

....

.... [1]

[Total: 15]

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

(a) Procedure

- Place 2 cm depth of solution **Q** into five separate test-tubes.
- To one test-tube add a wooden splint and leave this to soak.
- Do tests 1 to 4, as shown in Table 4.1, on separate samples of solution **Q**.
- Record your observations in Table 4.1.
- For test 5, take the splint which has been soaking in solution **Q** and place it into the top of a blue Bunsen burner flame. Record the colour seen immediately the splint is put into the flame. If you do not see a colour, dip the splint back in the solution and back into the flame.

Table 4.1

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

[3]

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

.... [2]

[Total: 5]

Go back and complete Question 3, beginning with the last part of the procedure, finding the mass of the cooled evaporating basin and copper sulfate powder.

5 You are going to determine the volume of glass used to make a 100 cm^3 beaker.

Fig. 5.1 shows the external diameter *d* and the height *h* of the beaker.

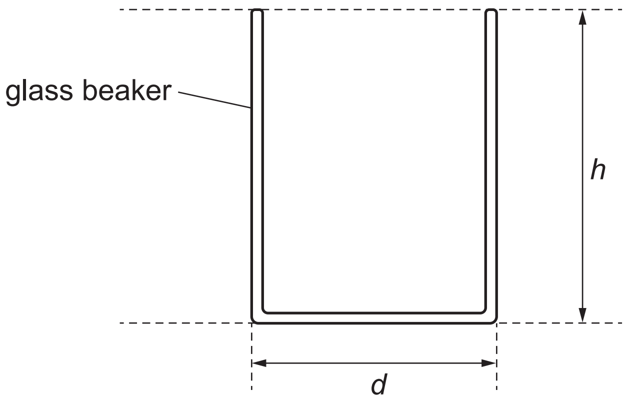

Fig. 5.1

(a) (i) Use the ruler to measure the external diameter *d* of the empty 100 cm^3 beaker in centimetres to the nearest 0.1 cm.

Use the two wooden blocks to help you obtain an accurate answer.

external diameter *d* = ... cm [1]

(ii) Draw a diagram to show how you use the blocks to help you obtain an accurate answer.

[1]

(iii) Measure the height *h* of the beaker in centimetres to the nearest 0.1 cm.

height *h* = ... cm [1]

(b) Calculate the external volume V_{EXT} of the beaker.

Use the equation shown.

$$V_{EXT} = 0.79d^2h$$

V_{EXT} = ... cm^3 [2]

(c) Fill the empty 100 cm^3 beaker to the top with water.

Use the measuring cylinder to measure the volume of water that the beaker contains.

This is the internal volume V_{INT} of the beaker.

Use the space below to record any readings taken.

V_{INT} = ... cm^3 [2]

(d) Calculate the volume V_G of glass used to make the beaker.

Use the equation shown.

$$V_G = V_{EXT} - V_{INT}$$

V_G = ... cm^3 [1]

(e) Your answer for V_G is approximate. State one source of error in measuring:

(i) the external volume V_{EXT} of the beaker.

....

.... [1]

(ii) the internal volume V_{INT} of the beaker.

....

.... [1]

[Total: 10]

6 You are going to investigate how the resistance R of a lamp changes as the potential difference V across it changes.

The circuit shown in Fig. 6.1 has been set up for you.

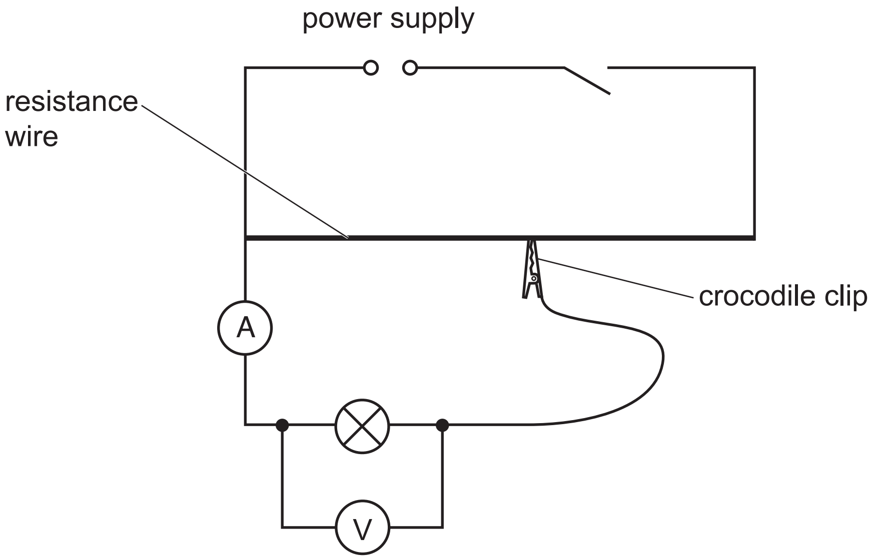

Fig. 6.1

(a) Procedure

- Close the switch.
- Adjust the position of the crocodile clip on the resistance wire until the potential difference V across the lamp is 0.3 V.

Record in Table 6.1 the current reading I on the ammeter.

- Open the switch.

Table 6.1

potential difference V/V	current I/A	resistance R/Ω
0.3		
0.8		
1.3		
1.8		
2.1		
2.5		

[1]

(b) Repeat the procedure in **(a)** for values of potential difference V = 0.8 V, 1.3 V, 1.8 V, 2.1 V and 2.5 V. [2]

(c) Calculate the resistance R of the lamp for each value of V.

Use the equation shown.

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

Record these values in Table 6.1. [1]

(d) **(i)** On the grid, plot a graph of R (vertical axis) against V.

[3]

(ii) Draw the best-fit curve. [1]

(e) Use your graph to describe in detail how the resistance of the lamp changes as the potential difference across it increases.

....

....

.... [2]

[Total: 10]

BLANK PAGE

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