* 0000800000001 *

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

* 2 6 0 5 1 8 3 4 7 2 *

CO-ORDINATED SCIENCES **0654/52**

Paper 5 Practical Test **May/June 2025**

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.

1 **(a)** You are provided with a flower.

Remove petals from one side of the flower to leave **two** petals on the flower.

(i) In the box, make a large, detailed pencil drawing of the flower.

Include the internal parts of the flower.

[3]

(ii) On your drawing, add a line labelled **S** to identify a stigma. [1]

(b) **(i)** Draw a line on your drawing to show the width of **one** petal.

Measure the width of this petal.

Record this width in millimetres to the nearest millimetre.

width of petal on drawing = ... mm [1]

(ii) Measure the same width of the petal on the actual flower.

Record this width in millimetres to the nearest millimetre.

width of petal on actual flower = ... mm [1]

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

Use the equation shown.

$$M = \frac{\text{width of petal on drawing}}{\text{width of petal on actual flower}}$$

Give your answer to **two** significant figures.

M = ... [2]

(iv) A teacher states that the width of the petal in **(b)(ii)** does **not** represent the width of all of the petals on the flower.

Suggest how to improve confidence in the value of the width of all the petals on the flower.

....

.... [1]

(c) A student investigates the elements present in a dried plant sample, a sample where all of the water has been removed from the plant.

The student burns the dried plant sample in oxygen.

The student tests the products formed.

The gas product formed turns limewater milky.

The liquid product formed turns white anhydrous copper sulfate blue.

Name the **two** products identified by these tests.

.... and ....

State which elements these tests **confirm** are present in the dried plant sample.

....

[2]

[Total: 11]

2 You are going to investigate the nutrient content of two solutions, **A** and **B**, made from two different parts of a flower.

You are provided with:

- 3 samples of solution **A**, labelled **A1**, **A2** and **A3**
- 3 samples of solution **B**, labelled **B1**, **B2** and **B3**.

(a) Read all of the procedure in **(b)**.

Draw a results table to record the final colours observed for each solution.

[2]

(b) Procedure

- Add about 1 cm depth of Benedict's solution to test-tubes **A1** and **B1**.
- Place both of these test-tubes in the hot water-bath for at least 3 minutes.

Continue with the procedure while you are waiting.

- Add about 1 cm depth of biuret solution to test-tubes **A2** and **B2**.
- Add a few drops of iodine solution to test-tubes **A3** and **B3**.

(i) Record in your results table the final colours observed. [4]

(ii) Use your results to reach conclusions about the nutrient content of solutions **A** and **B**.

solution **A** ....

....

solution **B** ....

....

[3]

[Total: 9]

BLANK PAGE

3 You are going to investigate how the solubility of potassium sulfate changes with the volume of water in which it is dissolved.

(a) Procedure

step **1** Use a measuring cylinder to place 20 cm^3 of distilled water into a conical flask.

step **2** Add one spatula load of potassium sulfate to the water and stir.

step **3** Keep adding potassium sulfate one spatula load at a time while stirring until no more dissolves.

step **4** Record in Table 3.1 the number of spatula loads of potassium sulfate dissolved.

step **5** Add 20 cm^3 of distilled water to the conical flask. There is now a total of 40 cm^3 of water in the conical flask.

step **6** Add potassium sulfate one spatula load at a time while stirring until no more dissolves.

step **7** Record in Table 3.1 the **total** number of spatula loads of potassium sulfate dissolved in the water.
Remember this is the number recorded in step **4** added to the additional spatula loads in step **6**.

step **8** Add 20 cm^3 of distilled water to the conical flask.

step **9** Add potassium sulfate one spatula load at a time while stirring until no more dissolves.

step **10** Record in Table 3.1 the **total** number of spatula loads of potassium sulfate dissolved in the water.

step **11** Repeat step **8** to step **10** until 100 cm^3 of water is in the conical flask.

Table 3.1

total volume of water / cm^3	**total** number of spatula loads of potassium sulfate dissolved
20	
40	
60	
80	
100	

[3]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

(b) **(i)** On the grid, plot the total number of spatula loads of potassium sulfate dissolved (vertical axis) against total volume of water.

[3]

(ii) Draw the straight line of best fit. [1]

(iii) Describe the relationship between the total volume of water and the total number of spatula loads of potassium sulfate dissolved.

....

.... [1]

(iv) Estimate how many spatula loads of potassium sulfate dissolve in 45 cm^3 of water.

Show on your graph how you determine your value.

number of spatula loads of potassium sulfate = ... [2]

[Turn over

(c) Solubility of a solid is sometimes measured by how much solid dissolves in 1000 cm^3 of water at a particular temperature.

Calculate the solubility of potassium sulfate in **this** investigation.

solubility = ... spatula loads / 1000 cm^3 of water [1]

(d) Suggest **two** improvements to the method that increase the accuracy of the measurements.

Do **not** include any form of temperature measurement.

improvement 1 ....

....

improvement 2 ....

....
[2]

[Total: 13]

4 You are going to investigate copper sulfate.

(a) (i) Procedure

- Use a measuring cylinder to add 10 cm^3 of water to a boiling tube.
- Record in Table 4.1 the temperature of the water to the nearest 0.5 °C.
- Add 2 spatula loads of anhydrous copper sulfate to the water.
- Stir until all of the copper sulfate dissolves.
- Record in Table 4.1 the highest temperature reached by the solution to the nearest 0.5 °C.
- Keep this solution to use in **(b)(i)**.

Table 4.1

temperature of water / °C	
highest temperature of solution / °C	
increase in temperature ΔT / °C	

[3]

(ii) Calculate the increase in temperature.

Record your answer in Table 4.1.

Calculate the thermal energy given out by the anhydrous copper sulfate as it dissolves.

Use the equation shown.

$$\Delta E = 42 \times \Delta T$$

ΔE = ... J [1]

(b) (i) Pour 2 cm depth of aqueous copper sulfate from **(a)(i)** into a boiling tube.

Add aqueous **L** dropwise to the aqueous copper sulfate, until in excess.

Describe your observations.

....

....

.... [2]

(ii) State the identity of aqueous **L**.

.... [1]

[Total: 7]

5 When a metal ball drops into sand, it will form a small crater (hole).

You are going to investigate how the diameter of the crater depends on the height from which the metal ball is dropped.

(a) The equipment in Fig. 5.1 has been set up for you.

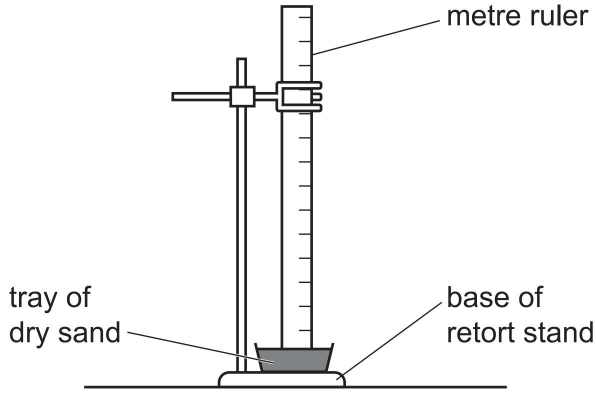

Fig. 5.1

Procedure

- Make the surface of the sand level using the small piece of wood.
- Make sure the 0.0 cm mark on the metre ruler is level with the surface of the sand.
- Hold the ball at a height of 20.0 cm above the surface of the sand as shown in Fig. 5.2.

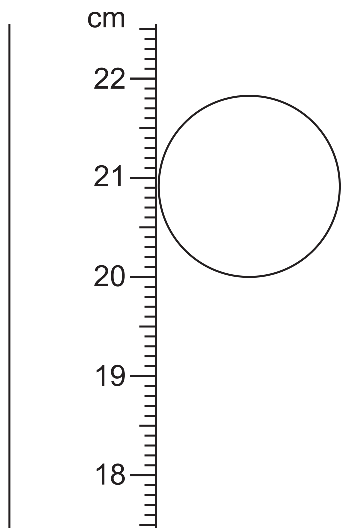

Fig. 5.2

- Drop the ball so that it falls into the sand. Do **not** throw the ball downwards.
- Carefully remove the ball from the sand.
- Use a ruler to measure the diameter of the crater you make as shown in Fig. 5.3.
- Record in Table 5.1 the diameter in mm to the nearest mm.

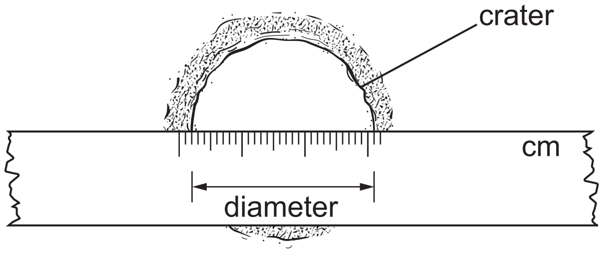

Fig. 5.3

Table 5.1

height of ball / cm	diameter of crater / mm
20.0	
40.0	
60.0	
80.0	
100.0	

Repeat the procedure for heights of 40.0 cm, 60.0 cm, 80.0 cm, and 100.0 cm. [4]

(b) State the relationship between the height of the ball and the diameter of the crater.

....

.... [1]

(c) (i) One possible error in this investigation is that the metre ruler is **not** placed perpendicular to the surface of the sand.

Name **one** suitable piece of equipment which shows if the metre ruler is perpendicular to the surface of the sand.

.... [1]

(ii) State **one** other source of error in your investigation.

Suggest how this error is reduced.

error ....

....

suggestion ....

....
[2]

(d) (i) A student repeats the investigation but uses a larger metal ball and flour instead of sand.

Table 5.2 shows the results the student obtains.

Table 5.2

height of ball / cm	diameter of crater / mm			
	trial 1	trial 2	trial 3	average
20.0	18	18	18	18
40.0	22	24	24	
60.0	27	30	28	28
80.0	32	27	37	32
100.0	40	42	41	41

Calculate the average diameter of the crater for the 40.0 cm height.

Record your answer in Table 5.2. [1]

(ii) One of the calculated average diameters is incorrect because an anomalous value is used in the calculation.

Circle the incorrect average diameter in Table 5.2.

Explain the error the student makes.

....

....

....

.... [2]

(e) A student investigates the effect of the volume *V* of a ball on the diameter of the crater formed.

The student drops two balls, **X** and **Y**, from the same height and measures the diameters of the craters.

Table 5.3 shows the results the student obtains.

Table 5.3

	volume of ball / cm^3	diameter of crater / mm
ball **X**	16.8	37
ball **Y**		62

(i) The radius *r* of ball **Y** is 2.0 cm.

Calculate the volume *V* of ball **Y**.

Use the equation shown.

$$V = 4.2 \times r^3$$

Record this value in Table 5.3. [1]

(ii) The student concludes that the volume of the ball is proportional to the diameter of the crater.

State if the student is correct.

Explain your answer.

statement ....

explanation ....

....

[1]

[Total: 13]

6 The rate of cooling of hot water in a beaker depends upon the number of layers of insulating newspaper wrapped around the beaker.

Plan an investigation to find the relationship between the rate of cooling of hot water and the number of layers of newspaper wrapped around the beaker.

You are provided with:

- a stop-watch
- a beaker
- a supply of hot water
- several pages from a newspaper.

You are **not** required to do this investigation.

In your plan, include:

- any other apparatus you will need
- a brief description of the method
- the measurements you will make and how you make them as valid as possible
- the variables you will control
- how you will process your results to reach a conclusion.

You may include a table that can be used to record results. You are **not** required to include any results.

DO NOT WRITE IN THIS MARGIN DO NOT WRITE IN THIS MARGIN DO NOT WRITE IN THIS MARGIN DO NOT WRITE IN THIS MARGIN DO NOT WRITE IN THIS MARGIN

[7]

NOTES FOR USE IN QUALITATIVE ANALYSIS

Tests for anions

anion	*test*	*test result*
carbonate, CO_3^{2-}	add dilute acid, then test for carbon dioxide gas	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.
iodide, I^- [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	yellow ppt.
nitrate, NO_3^- [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate, SO_4^{2-} [in solution]	acidify with dilute nitric acid, 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, ppt. turns brown near surface on standing	green ppt., insoluble in excess, ppt. turns brown near surface on standing
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