Cambridge Assessment International Education

Cambridge IGCSE™ (9–1)

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

CO-ORDINATED SCIENCES **0973/62**

Paper 6 Alternative to Practical **May/June 2025**

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

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

DC (IP) 354643

1 **(a)** Fig. 1.1 is a photograph of a flower.

Fig. 1.1

(i) In the box, make a large, detailed pencil drawing of the flower shown in Fig. 1.1.

Include the internal parts of the flower.

[3]

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

(b) **(i)** On Fig. 1.1, draw a line to join points **A** and **B**, which shows the width of **one** petal.

Record this width, **AB**, in millimetres to the nearest millimetre.

width **AB** of petal on Fig. 1.1 = ... mm [1]

(ii) Draw a line to show the same width **AB** of the petal on your drawing.

Record this width in millimetres to the nearest millimetre.

width of petal 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.

$$M = \frac{\text{width of petal on drawing}}{\text{width } \mathbf{AB} \text{ of petal on Fig. 1.1}}$$

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

M = ... [2]

(iv) A teacher states that the width of the petal in **(b)(i)** 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 A student investigates the nutrient content of two solutions, **A** and **B**, made from two different parts of a flower.

Procedure

The student:

- adds solution **A** to three different test-tubes
- adds Benedict's solution to one test-tube of **A** and places it in a hot water-bath
- adds biuret solution to the second test-tube of **A**
- adds iodine solution to the third test-tube of **A**.

Repeats the procedure using solution **B** instead of solution **A**.

(a) Fig. 2.1 shows the notes made by the student.

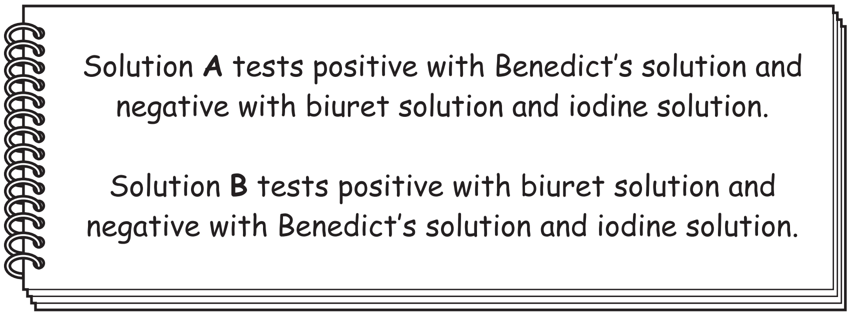


Fig. 2.1

Draw a results table to record the results the student obtains.

Record the final colours the student observes for each solution.

[6]

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

solution **A** ....

....

solution **B** ....

....

[3]

[Total: 9]

3 A student investigates how the solubility of potassium sulfate changes with the volume of water in which it is dissolved.

(a) Procedure

The student:

step **1** uses a measuring cylinder to put 20 cm^3 of water in a conical flask

step **2** measures the temperature of the water to the nearest 0.5 °C

step **3** adds spatula loads of potassium sulfate to the water while stirring until no more dissolves

step **4** records in Table 3.1 the total number of spatula loads of potassium sulfate dissolved

step **5** adds 20 cm^3 of water to the conical flask and repeats steps **3** and **4**.

The student repeats step **5** three more times.

Table 3.1

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

(i) Fig. 3.1 shows the thermometer reading of the water.

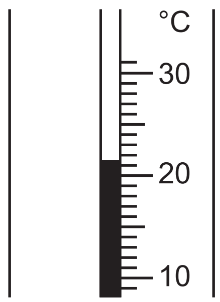


Fig. 3.1

Record this temperature to the nearest 0.5 °C.

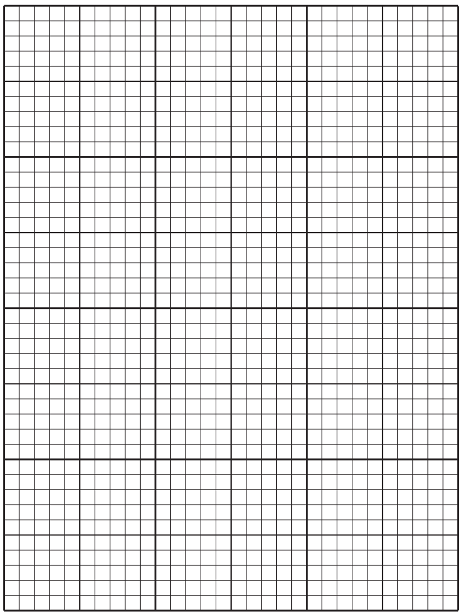
temperature = ... °C [1]

(ii) The student adds:

- 3 spatula loads of potassium sulfate in 20 cm^3 of water
- another 3 spatula loads of potassium sulfate in 40 cm^3 of water
- another 4 spatula loads of potassium sulfate in 60 cm^3 of water
- another 3 spatula loads of potassium sulfate in 80 cm^3 of water
- another 2 spatula loads of potassium sulfate in 100 cm^3 of water.

Complete Table 3.1 by entering the **total** number of spatula loads of potassium sulfate dissolved at each volume. [2]

(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]

(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 why it is **not** possible to find the solubility of potassium sulfate at –20 °C using this method.

....

.... [1]

(e) 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]

(f) The student wants to repeat the experiment at 40 °C.

Suggest how the student changes the procedure.

....

.... [1]

[Total: 15]

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4 A student investigates copper sulfate.

(a) Procedure

The student:

- adds 10 cm^3 of water to a boiling tube
- records in Table 4.1 the temperature of the water
- dissolves 2 spatula loads of anhydrous copper sulfate in the water
- records in Table 4.1 the highest temperature reached by the solution.

Table 4.1

temperature of water / °C	22.5
highest temperature of solution / °C	
increase in temperature ΔT / °C	

(i) Fig. 4.1 shows the thermometer reading for the highest temperature of the solution.

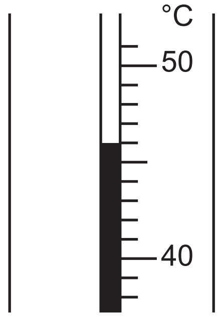

Fig. 4.1

Record in Table 4.1 this temperature to the nearest 0.5 °C. [1]

(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) Procedure

The student:

- pours 2 cm depth of aqueous copper sulfate from **(a)** into a test-tube
- adds aqueous **L** dropwise to the aqueous copper sulfate.

The student observes a light blue precipitate which dissolves in excess aqueous **L** to form a dark blue solution.

State the identity of aqueous **L**.

.... [1]

(c) The student does a flame test on a sample of the aqueous copper sulfate.

A blue Bunsen burner flame is used in the flame test because it is hotter than a yellow flame.

State **one** other reason why a blue Bunsen burner flame is used rather than a yellow flame.

....

.... [1]

(d) The student adds aqueous barium nitrate to a sample of aqueous copper sulfate in a test-tube.

The student observes a blue precipitate, however the test-tube contains a white precipitate in a blue solution.

Suggest what the student does to see the white precipitate.

....

.... [1]

[Total: 5]

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

A student investigates how the diameter of the crater depends on the height from which the metal ball is dropped.

(a) Fig. 5.1 shows the assembled apparatus.

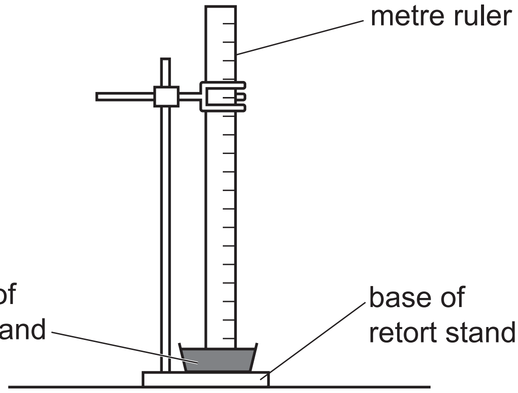

Fig. 5.1

Procedure

The student:

- makes the surface of the sand level
- places the 0.0 cm mark of the metre ruler level with the surface of the sand
- holds the ball above the surface of the sand and records in Table 5.1 the height of the ball in cm
- drops the ball into the sand
- carefully removes the ball from the sand
- records in Table 5.1 the diameter of the crater in mm. The diameter is shown in Fig. 5.2.

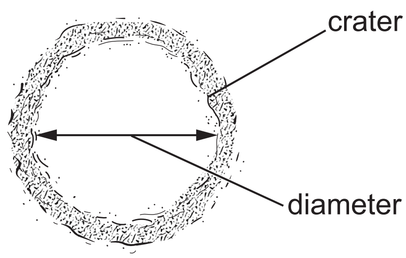

Fig. 5.2

The student repeats the procedure for 4 other heights above the sand.

(i) The student measures the height of the ball above the sand.

Fig. 5.3 shows the ball just before it is dropped.

Record in Table 5.1 the height of the **bottom** of the ball in cm to the nearest 0.1 cm.

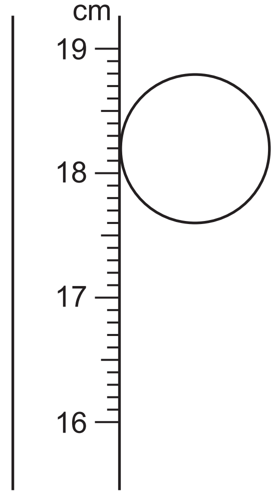

Fig. 5.3

Table 5.1

height of ball / cm	diameter of crater / mm
	29
41.6	
59.8	46
82.6	48
99.6	50

[1]

(ii) The student then drops the ball from a height of 41.6 cm.

Fig. 5.4 shows the crater formed in the sand.

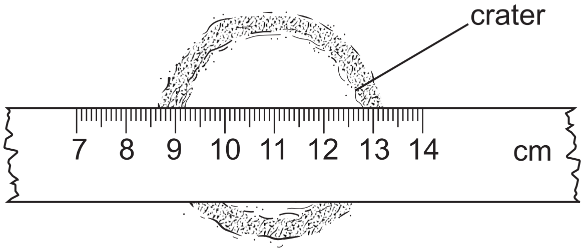

Fig. 5.4

State the reading on the ruler at both ends of the diameter of the crater.

readings .... and ....

Calculate the diameter of the crater.

Record this diameter in Table 5.1. [2]

(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 this investigation.

Suggest how this error is reduced.

error ....

....

suggestion ....

....

[2]

(iii) Suggest **one** reason why the tray containing the sand is **not** made of glass.

....

.... [1]

(d) (i) Another student repeats the investigation.

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]

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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.

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.

[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