Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
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0123456789

COMBINED SCIENCE **0653/06**

Paper 6 Alternative to Practical **For examination from 2025**

SPECIMEN PAPER **1 hour**

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 40.
- 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 **16** pages. Any blank pages are indicated.

1 A student investigates vitamin C in apple juice.

The student is provided with half an apple and some apple juice.

Fig. 1.1 shows the cut surface of the apple provided.

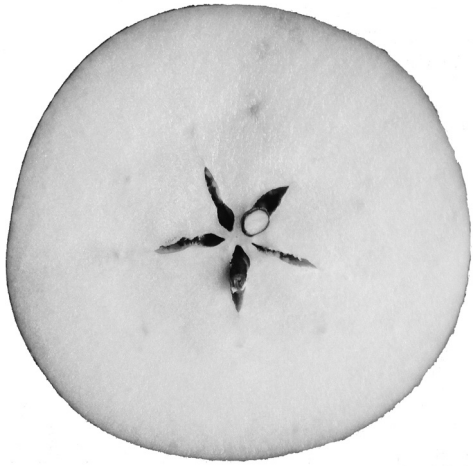

Fig. 1.1

(a) In the box, make a large drawing of the cut surface of the apple shown in Fig. 1.1.

[3]

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(b) The student tests the apple juice using DCPIP.

DCPIP is a dark blue solution that turns colourless when vitamin C is added.

The greater the amount of vitamin C in the apple juice, the fewer the drops of apple juice needed to turn the DCPIP colourless.

Procedure

The student:

- puts 2.0 cm^3 DCPIP into a test-tube
- fills a syringe with 10.0 cm^3 of apple juice
- adds apple juice to the DCPIP in the test-tube until the DCPIP turns colourless
- records in Table 1.1 the volume of apple juice **remaining** in the syringe for experiment **1**.

The student repeats the procedure and records the volume of apple juice remaining in the syringe for experiment **2** in Table 1.1.

The student repeats the procedure again for experiment **3**.

Fig. 1.2 shows the volume of apple juice remaining in the syringe in experiment **3**.

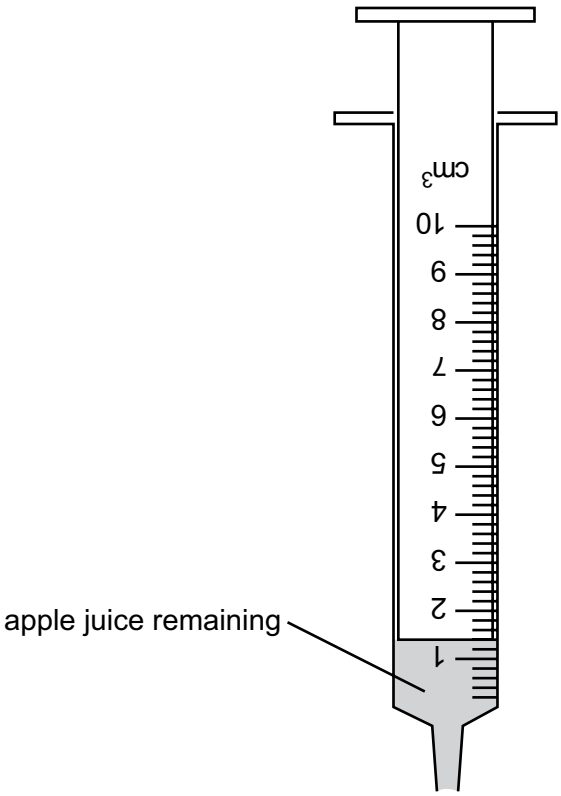

Fig. 1.2

(i) Record in Table 1.1 the volume of apple juice remaining in the syringe in experiment **3**.

Table 1.1

experiment	volume of apple juice remaining in syringe / cm^3	volume of apple juice added to the DCPIP / cm^3
1	1.3	8.7
2	1.5	8.5
3		

[1]

(ii) Calculate the volume of apple juice added to the DCPIP in experiment **3**.

Record your answer in Table 1.1. [1]

(iii) Calculate the average volume of apple juice added.

average volume = ... cm^3 [1]

(iv) Suggest why the student repeats the experiment.

.....

..... [1]

[Total: 7]

2 When an aquatic plant is exposed to light, it produces bubbles of oxygen gas.

Plan an investigation to determine the relationship between light intensity and the volume of oxygen gas produced by the aquatic plant.

You are provided with the apparatus shown in Fig. 2.1.

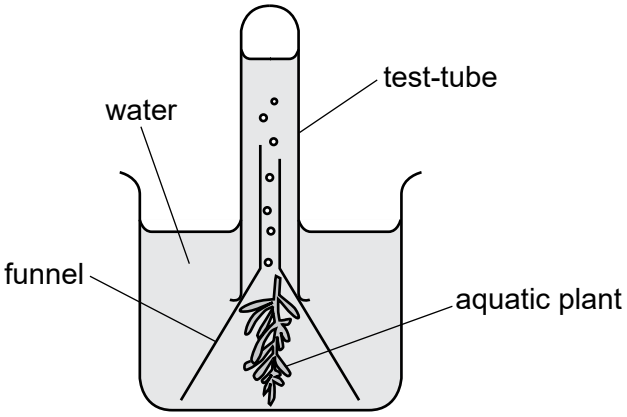

Fig. 2.1

You may use any other common laboratory apparatus in your plan.

In your plan, include:

- any **additional** apparatus and chemicals that you will use
- a brief description of the method, explaining any safety precautions you will take
- what you will measure
- which variables you will control
- how you will process your results to form a conclusion.

You may include a labelled diagram.

You may include a results table (you are not required to enter any readings in the table).

.....

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..... [7]

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3 A student investigates the reaction between metal **F** and dilute sulfuric acid.

(a) (i) Procedure

The student:

- adds 3 cm depth of dilute sulfuric acid to a test-tube
- adds a spatula of metal **F** to the test-tube
- observes the mixture fizzing slowly
- tests the gas produced with a lighted splint
- hears a squeaky pop.

Identify the gas produced.

..... [1]

(ii) The student repeats the procedure in **(a)(i)** but also adds aqueous copper(II) sulfate to the dilute sulfuric acid and metal **F**.

The student observes that this reaction is faster than the reaction in **(a)(i)**.

Suggest **one** observation the student makes which shows that this reaction is faster.

.....

..... [1]

(iii) Procedure

The student:

- pours a small volume of the aqueous product from the procedure in **(a)(i)** into a test-tube
- adds aqueous sodium hydroxide
- observes a white precipitate.

Use this observation to suggest **two** possible identities for the cation produced from metal **F**.

..... and ..... [1]

(b) Procedure

The student:

- uses a measuring cylinder to measure 10 cm^3 of dilute sulfuric acid
- adds the dilute sulfuric acid to a boiling tube
- sets up apparatus as shown in Fig. 3.1

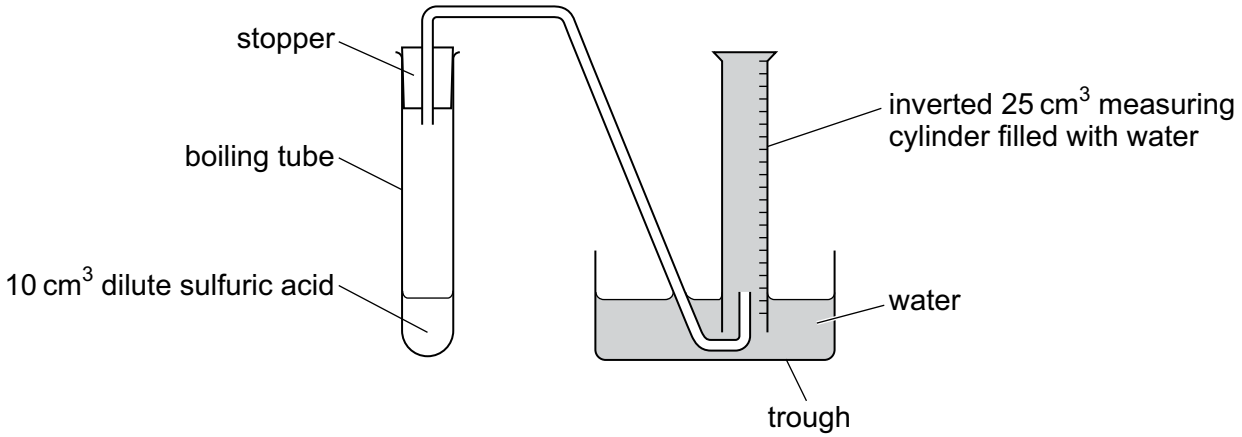
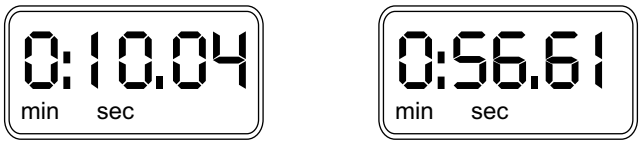


Fig. 3.1

- removes the stopper from the boiling tube
- adds one spatula of metal **F** to the boiling tube
- puts the stopper back into the boiling tube and starts the stop-watch
- records in Table 3.1 the time taken to collect 5 cm^3, 10 cm^3, 15 cm^3, 20 cm^3 and 25 cm^3 of gas.

(i) Fig. 3.2 shows the stop-watch readings for 5 cm^3 and 25 cm^3 of gas collected.



5 cm^3 of gas 25 cm^3 of gas

Fig. 3.2

Record in Table 3.1 the time taken to the nearest second to collect 5 cm^3 and 25 cm^3 of gas.

Table 3.1

volume of gas collected / cm^3	time taken / s
5	
10	22
15	34
20	46
25	

[2]

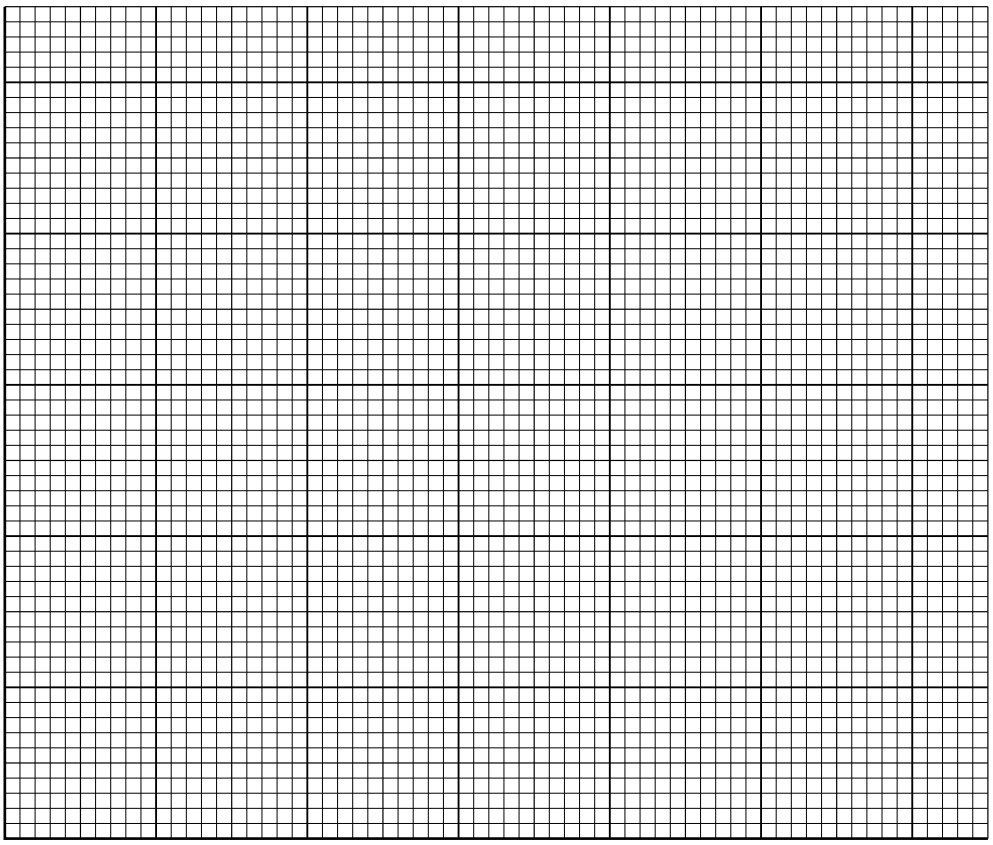
(ii) State the independent variable and the dependent variable in this investigation.

independent variable .....

dependent variable .....

[1]

(iii) On the grid, plot a graph of volume of gas collected (vertical axis) against time taken.



[3]

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

(v) Describe the relationship between the volume of gas collected and the time taken.

.....

.....

..... [1]

(vi) Suggest **one** possible source of error in the measurement of the time taken.

.....

..... [1]

(vii) Suggest **one** way to obtain a more accurate measurement of the volume of gas collected.

.....

..... [1]

[Total: 13]

4 A student determines the density of the material used to make a metre rule.

(a) Fig. 4.1 shows the metre rule (**not** drawn to scale).

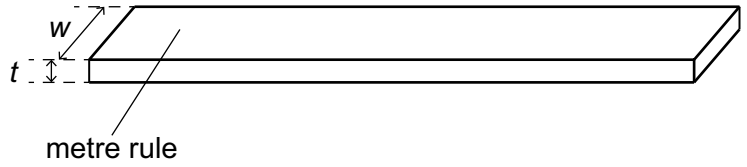


Fig. 4.1 (not to scale)

(i) On Fig. 4.1, draw a double-headed arrow (↔) to show the length *L* of the metre rule. [1]

(ii) Fig. 4.2 shows the **actual** size of the end of the metre rule.

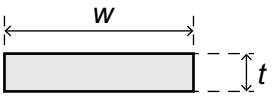


Fig. 4.2 (actual size)

Use a ruler to measure width *w* and thickness *t* of the metre rule in Fig. 4.2.

Record each measurement to the nearest 0.1 cm.

w = ... cm

t = ... cm
[2]

(iii) The measurements in **(a)(ii)** are recorded to the nearest 0.1 cm.

State why it is **not** appropriate to record the measurements to the nearest 0.01 cm.

.....

..... [1]

(iv) The length *L* of the metre rule is 100.0 cm.

Calculate the volume *V* of the metre rule.

Use your answers to **(a)(ii)** and the equation shown.

$$V = L \times w \times t$$

V = ... cm^3 [1]

(b) The student determines the mass M of the metre rule using a balancing method.

Procedure

The student:

step 1 places a pivot directly under the 60.0 cm mark on the metre rule.

Fig. 4.3 shows the distance d = 60.0 cm.

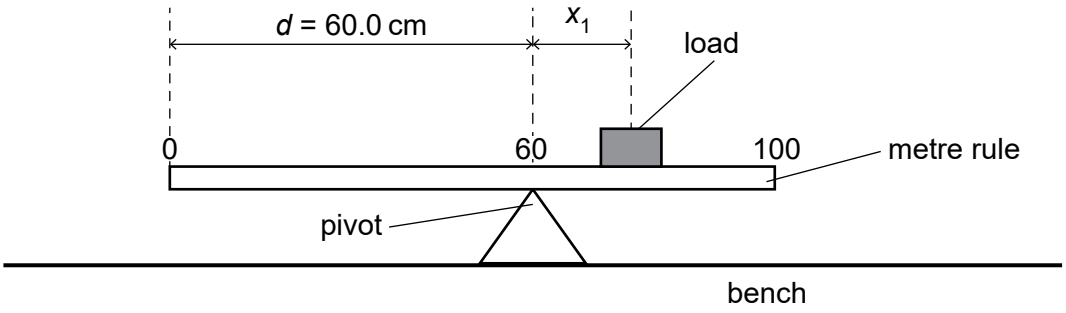


Fig. 4.3 (not to scale)

step 2 places a load on the metre rule and adjusts the position of the load so that the rule balances

step 3 records that the **centre** of the load is directly above the 67.1 cm mark on the metre rule.

(i) Calculate the distance x_1 from the **centre** of the load to the pivot.

x_1 = ... cm [1]

step 4 moves the pivot so that distance d = 70.0 cm

step 5 adjusts the position of the load so that the metre rule balances

step 6 records that the centre of the load is directly above the 84.2 cm mark on the metre rule.

(ii) Calculate the distance x_2 from the **centre** of the load to the pivot.

x_2 = ... cm [1]

(iii) Use the results for **(b)(i)** and **(b)(ii)** to calculate the mass M of the metre rule.

Use the equation shown.

$$M = 5\ (x_1 + x_2)$$

M = ... g [1]

(c) Fig. 4.4 shows apparatus used for measuring mass.

Fig. 4.4

(i) State the name of the apparatus shown in Fig. 4.4.

..... [1]

(ii) The apparatus in Fig. 4.4 is showing an error.

State the type of error shown in Fig. 4.4.

..... [1]

(d) Use your answers to **(a)(iv)** and **(b)(iii)** to calculate the density ρ of the material used to make the metre rule.

Use the equation shown.

$$\rho = \frac{M}{V}$$

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

Give the unit for your answer.

ρ = ...

unit = ...
[3]

[Total: 13]

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.
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

