CAMBRIDGE International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

CO-ORDINATED SCIENCES 0654/52

Paper 5 Practical Test

February/March 2026

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. Do **not** use correction fluid or tape.
- 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	
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Total	

This document has **20** pages.

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[Turn over

1 You are provided with a slice of okra.

(a) In the box, make a large, detailed, pencil drawing of the cut surface of the slice of okra.

[3]

(b) **(i)** Record the width of the slice of okra in millimetres to the nearest millimetre.

width of the slice of okra = ... mm [1]

(ii) Draw a line to show the width of the slice of okra on your drawing in **1(a)**.

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

width of the slice of okra on your drawing = ... mm [1]

(iii) Calculate the magnification *m* of your drawing.

Use your measurements in **1(b)(i)** and **1(b)(ii)** and the equation shown.

$$m = \frac{\text{width of the slice of okra on your drawing}}{\text{width of the slice of okra}}$$

Record your value to **two** significant figures.

magnification *m* = ... [2]

(c) Figure 1.1 is a photograph of a slice of star fruit shown actual size.

Figure 1.1

Describe **two** visible differences and **one** visible similarity between the slice of okra provided and the slice of star fruit in Figure 1.1.

difference 1 ....

....

difference 2 ....

....

similarity ....

....

[3]

[Total: 10]

2 You are going to investigate the nutrient content of yogurt.

You are provided with two test-tubes containing equal amounts of yogurt.

(a) **(i)** Read through the procedure in **2(a)(ii)**.

Draw a results table to record your results.

[2]

(ii) **Procedure**

step 1 Add approximately 1 cm depth of Benedict's solution to one of the test-tubes of yogurt.

step 2 Stir with a glass rod to mix the contents of the test-tube.

step 3 Place the test-tube carefully into the hot water-bath for approximately three minutes.
Continue with **step 4** and **step 5** while you are waiting.

step 4 Add approximately 1 cm depth of biuret solution to the other test-tube of yogurt.

step 5 Stir with a clean glass rod to mix the contents of the test-tube.

Record in your table in **2(a)(i)**, the final colours observed in each test-tube. [2]

(iii) Use your results to state a conclusion for the nutrient content of yogurt.

....

.... [2]

(b) (i) Explain why it is important in **step 2** and **step 5** to stir to mix the contents of the test-tubes.

....

.... [1]

(ii) Explain why it is important in **step 5** to use a clean stirring rod.

....

.... [1]

(c) A student tests a food sample for the presence of fat.

State the reagents needed and the observation for a positive result.

reagents needed .... and ....

observation for a positive result ....
[2]

[Total: 10]

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

Calcium carbonate reacts with dilute hydrochloric acid forming carbon dioxide gas.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$$

Procedure

- The apparatus shown in Figure 3.1 is assembled for you.

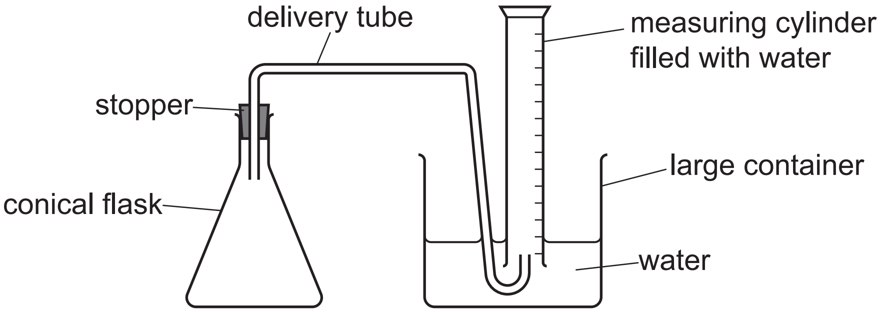

Figure 3.1

- Remove the conical flask from the apparatus.
- Using a 50 cm^3 measuring cylinder put 25 cm^3 of dilute hydrochloric acid into the conical flask.
- Add all of the calcium carbonate to the conical flask.
- Quickly replace the conical flask into the apparatus and start a stop-watch.
- Measure the total volume of carbon dioxide gas in the measuring cylinder every 30 seconds for 5 minutes.

(a) **(i)** Record in Table 3.1 these values to the nearest 0.5 cm^3.

If the total volume of carbon dioxide gas is more than 100 cm^3 write **more than 100**.

Table 3.1

time / s	total volume of carbon dioxide gas / cm^3
0	0.0
30	
60	
90	
120	
150	
180	
210	
240	
270	
300	

[4]

(ii) On the grid, plot total volume of carbon dioxide gas (on the vertical axis) against time.

[3]

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

(iv) Describe how the rate of the reaction changes during the 300 seconds.

Explain how your graph shows these changes.

....

....

....

.... [2]

(v) Use the graph to estimate the volume of carbon dioxide gas evolved at 75 seconds.

volume of carbon dioxide gas = ... cm^3 [1]

(b) Calculate the average rate of reaction.

Use the equation shown.

$$\text{average rate} = \frac{\text{total volume of carbon dioxide gas given off}}{300}$$

average rate = ... cm^3/s [1]

(c) A systematic error in an experiment causes all readings to differ from the true reading by a similar amount or similar proportion. Repeating does **not** correct for a systematic error.

(i) One systematic error is the loss of gas when replacing the conical flask into the apparatus.

Explain why this is a systematic error.

....

.... [1]

(ii) Suggest one method of reducing this systematic error.

....

.... [1]

(d) A random error in an experiment is due to changes in the environment or the misreading of a measurement. Repeating and calculating an average may reduce the effect of the random error.

One random error in this experiment is the reading of volume on the measuring cylinder.

Describe how this random error is reduced. Do **not** include repeating the procedure, repeating the readings or changes in the environment.

....

.... [1]

(e) To determine the rate of a reaction at a particular time, a tangent is drawn on the curve at that time.

For example, the rate of reaction at 30 seconds is found by drawing a tangent at 30 seconds as shown on Figure 3.2.

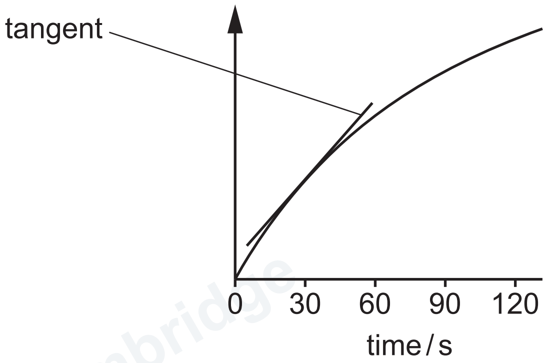

Figure 3.2

The rate of the reaction at 30 seconds is the gradient of the tangent in Figure 3.2.

A student does an experiment measuring the mass of gas given off in a reaction.

Figure 3.3 shows the graph of the student's results.

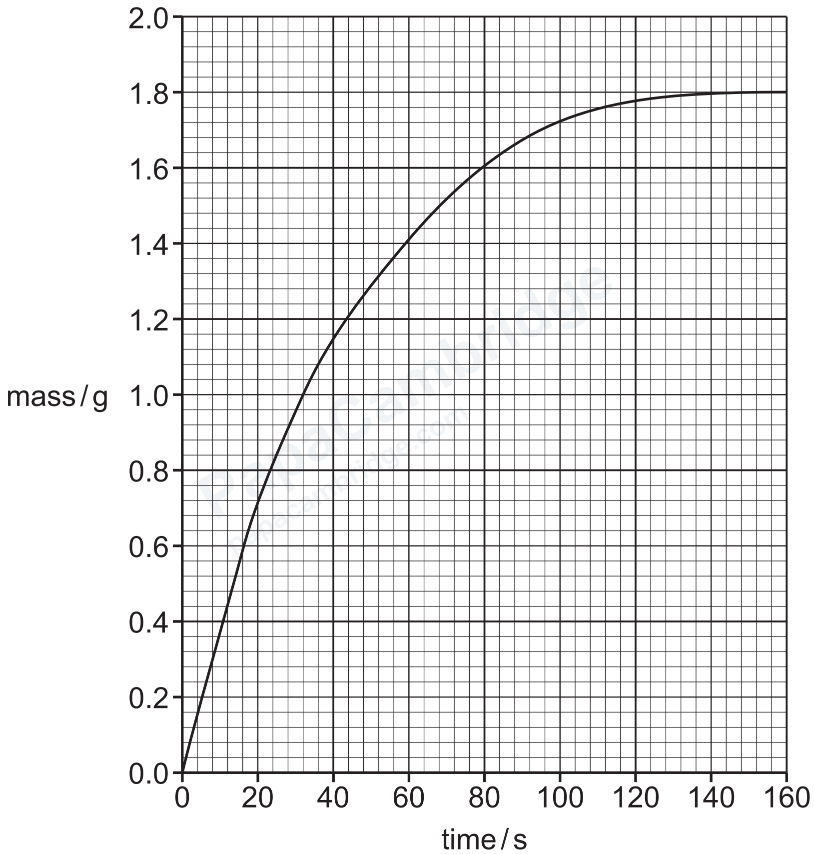

Figure 3.3

(i) Draw a tangent at 40 seconds on the graph in Figure 3.3. [1]

(ii) Calculate the gradient of your tangent.

This is the rate of reaction at 40 seconds.

gradient = ... [1]

[Total: 17]

4 You are going to identify aqueous **H**.

(a) Procedure

- Add approximately 1 cm depth of aqueous **H** into each of three test-tubes.
- Do the tests in Table 4.1 on the separate test-tubes of aqueous **H**.
- Record your observations in Table 4.1.

Table 4.1

test	observations
add a few drops of universal indicator	
add 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate	
add 1 cm depth of dilute nitric acid followed by 1 cm depth of aqueous barium nitrate	

[2]

(b) State the identity of aqueous **H**.

.... [1]

[Total: 3]

Turn over

5 You are going to calculate the power *P* of a burning candle by heating two different liquids.

(a) (i) **Procedure**

step 1 Place a clean beaker on a balance and zero the balance.

step 2 Pour approximately 50 g of water into the beaker.

step 3 Record the mass reading on the balance in g to the nearest 0.1 g in Table 5.1.

step 4 Remove the beaker from the balance and stir the water with a stirring thermometer.

step 5 Record in Table 5.1 the initial temperature of the water to the nearest 0.5 °C.

step 6 Light the candle.

step 7 Clamp the beaker so that the bottom of the beaker is **just** above the top of the flame as shown in Figure 5.1.

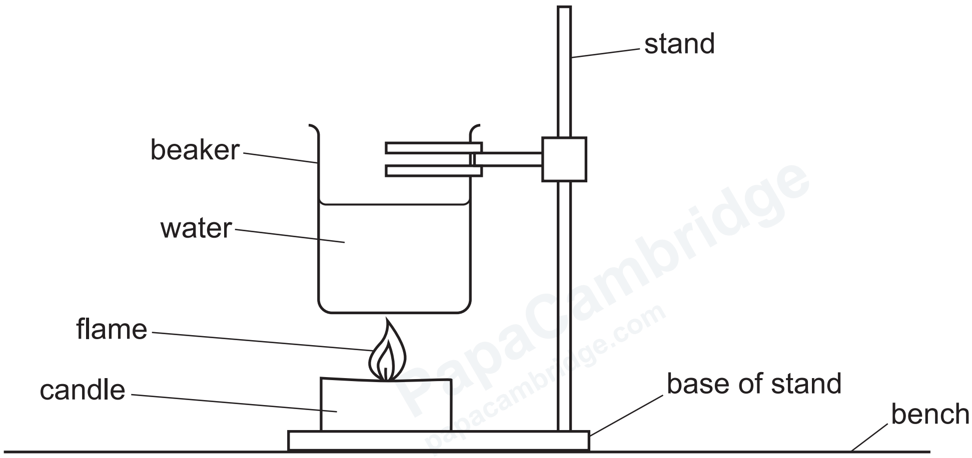

Figure 5.1

step 8 Immediately start a stop-watch and wait for 120 s.

step 9 Blow out the candle.

step 10 Stir the water and record in Table 5.1 the final temperature of the water to the nearest 0.5 °C.

Repeat **step 1** to **step 10** using oil instead of water.

Table 5.1

liquid	mass / g	initial temperature / °C	final temperature / °C	change in temperature / °C
water				
oil				

[4]

(ii) Calculate the changes in temperature for the water and the oil.

Use the equation shown.

change in temperature = final temperature – initial temperature

Record these values in Table 5.1.

[1]

(iii) Calculate the power P of the burning candle for each liquid.

Use the equations shown.

water

$$P = \frac{4.2 \times \text{mass of water} \times \text{change in temperature}}{120}$$

P = ... W

oil

$$P = \frac{3.2 \times \text{mass of oil} \times \text{change in temperature}}{120}$$

P = ... W
[2]

(iv) Two values are considered to be equal within the limits of experimental error if the difference between them is less than 10%.

Explain if your values of P from **5(a)(iii)** are considered equal within the limits of experimental error.

Justify your answer with a calculation.

(If you do not have values of P from **5(a)(iii)**,
use P = 15.5 W for water and P = 21.6 W for oil.)

....

.... [2]

(v) To obtain accurate readings of temperature, it is important to stir the water in **step 4** and **step 10** of the procedure.

Explain how stirring improves accuracy.

....

.... [1]

(b) (i) Another student repeats the procedure three times using 50.0 g of sand and then repeats it three times using 50.0 g of solid wax.

The student's changes in temperature are shown in Table 5.2.

Table 5.2

solid	**change in temperature / °C**		
	trial 1	**trial 2**	**trial 3**
sand	61.1	59.6	60.8
wax	22.2	13.9	14.6

The student concludes the average change in temperature for sand is 60.5 °C and for wax is 16.9 °C.

Explain why the student's conclusion is **not** correct.

....

....

.... [2]

(ii) The student moves the beaker upwards so that it is further away from the flame.

Suggest what effect this has on the calculated values of *P*.

Explain your answer.

effect ....

explanation ....

....

[1]

[Total: 13]

Turn over

6 A student investigates how the current in a series circuit changes with the number of lamps connected in the circuit.

Plan an investigation to determine the relationship between the current in a series circuit and the number of lamps connected in the circuit.

You are provided with:

- a number of identical lamps
- connecting wires.

You may use any common laboratory apparatus in your plan.

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

In your plan, include:

- the apparatus you will use
- a brief description of the method
- the variables you will control and how you will ensure your results are valid
- a results table for your measurements (you are **not** required to enter any readings into the table)
- how you will process your results to form a conclusion.

[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