Cambridge Assessment International Education

Cambridge IGCSE™ (9–1)

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

0123456789

CO-ORDINATED SCIENCES **0973/05**

Paper 5 Practical Test **For examination from 2025**

SPECIMEN PAPER **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 **20** pages. Any blank pages are indicated.

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1 You are going to investigate an enzyme-catalysed reaction using celery cells and hydrogen peroxide, H_2O_2.

Hydrogen peroxide is broken down by catalase which is an enzyme found in celery cells. Oxygen gas is released during the reaction.

$$\underset{\text{hydrogen peroxide}}{2H_2O_2} \rightarrow \underset{\text{water}}{2H_2O} + \underset{\text{oxygen}}{O_2}$$

Read all the steps in the procedure but DO NOT CARRY THEM OUT until you have drawn a table for your results in the space provided in (a)(i).

You should use the safety equipment provided while you are carrying out the practical work.

Procedure

Step 1 Use the syringe to put 4 cm^3 of hydrogen peroxide solution into the boiling tube.

Step 2 Add a drop of detergent to the boiling tube and use the stirring rod to mix.

Step 3 Cut a 2 cm length of the celery stick.

Step 4 Cut this 2 cm length into approximately 2 mm slices and then cut these slices in half as shown in Fig. 1.1.

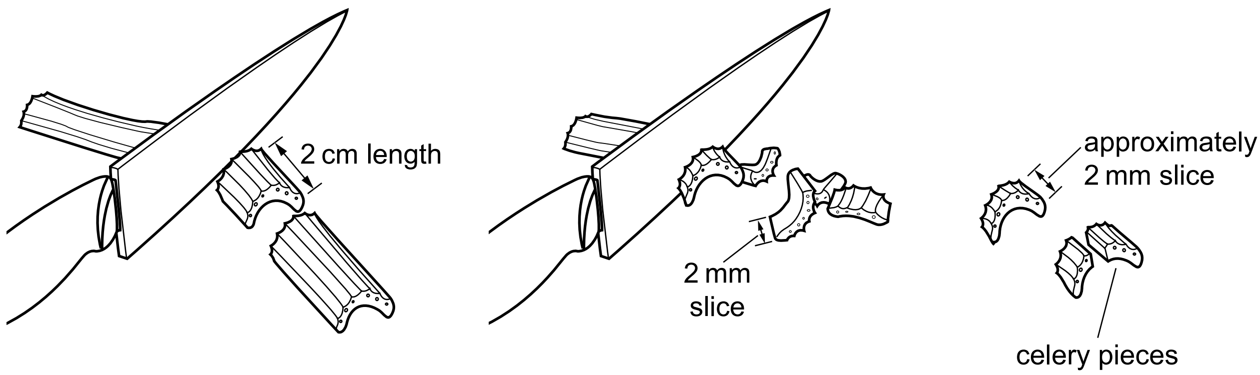


Fig. 1.1 (not to scale)

Step 5 Add these pieces of celery to the hydrogen peroxide solution in the boiling tube.

Step 6 Use the stirring rod to push the pieces of celery into the solution and immediately start the stop-watch.

Step 7 Measure the total height of the foam in the boiling tube to the nearest 0.1 cm as shown in Fig. 1.2. Continue to measure the height every 2 minutes for 10 minutes.

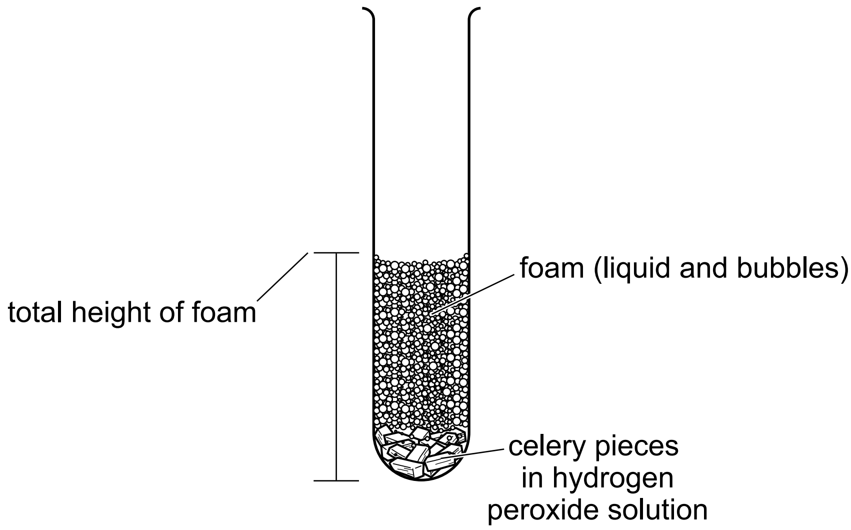


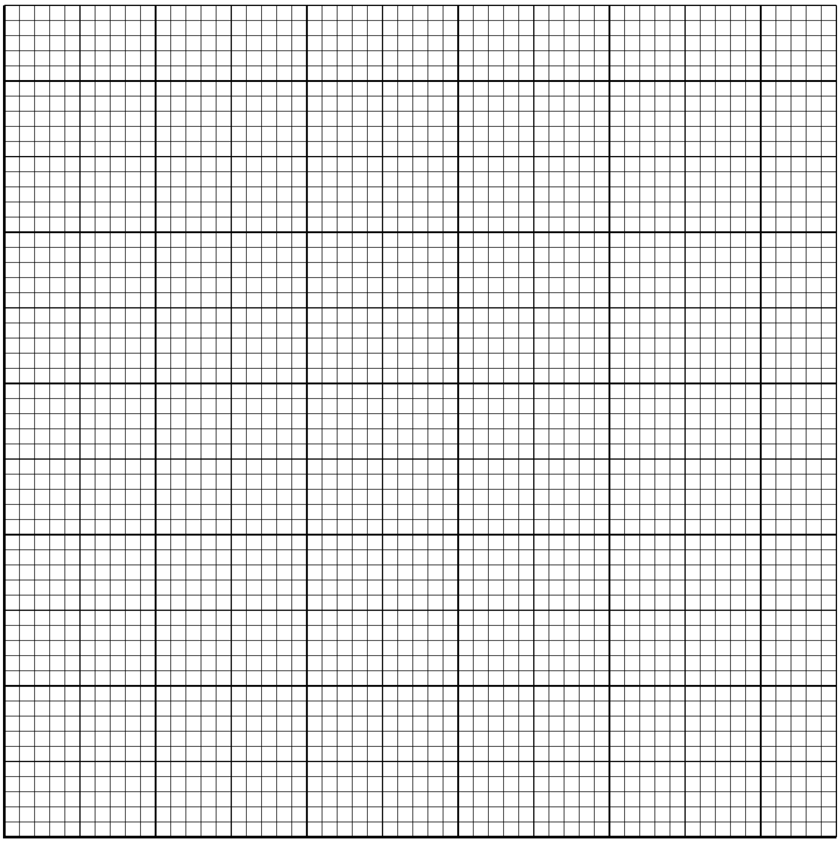
Fig. 1.2

(a) **(i)** Draw a table to record your results in the space provided.

[2]

(ii) Record your results in the table in **(a)(i)**. [3]

(b) **(i)** On the grid, plot a graph of total height of foam (vertical axis) against time.



[3]

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

(iii) Use your graph to determine the total height of the foam at 3 minutes.

height = ... cm [1]

(iv) Describe the relationship between the total height of the foam and the time taken.

....

.... [1]

(c) Explain why repeating the procedure several times allows you to be more confident in your results.

....

.... [1]

(d) Suggest why it was difficult to measure the height of the foam.

....

.... [1]

[Total: 13]

2 You are going to test celery for its nutrient content.

You should use the safety equipment provided while you are carrying out the practical work.

Procedure

Step 1 Label three boiling tubes **A**, **B** and **C**.

Step 2 Cut a 1 cm length of the celery stick.

Step 3 Cut this 1 cm length into approximately 2 mm slices and then cut these slices in half as shown in Fig. 2.1.

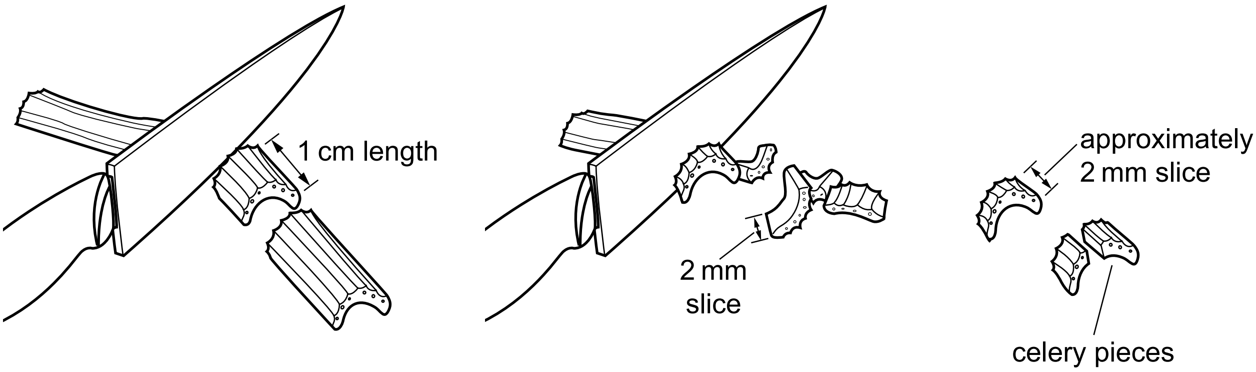


Fig. 2.1 (not to scale)

Step 4 Place the celery pieces in boiling tube **A**.

Step 5 Repeat Step 2 and Step 3 and place the celery pieces in boiling tube **B**.

Step 6 Repeat Step 2 and Step 3 and place the celery pieces in boiling tube **C**.

Step 7 Add approximately 2 cm depth of Benedict's solution to boiling tube **A** and place it in a hot water-bath for about 5 minutes.

Step 8 Add approximately 2 cm depth of biuret solution to boiling tube **B**.

Step 9 Add a few drops of iodine solution to boiling tube **C**.

Table 2.1

boiling tube	testing solution	nutrient being tested	final colour observed
A	Benedict's		
B	biuret		
C	iodine		

(a) **(i)** In Table 2.1, state the nutrient being tested in each boiling tube. [3]

(ii) In Table 2.1, state the final colour observed in each boiling tube. [3]

(b) State which of the nutrients are present in celery. Use the information in Table 2.1.

....

.... [1]

[Total: 7]

3 You are going to investigate the reaction of three metals with dilute hydrochloric acid.

(a) Procedure

- Use a measuring cylinder to add 10 cm^3 of dilute hydrochloric acid to a clean boiling tube.
- Record in Table 3.1 the initial temperature of the dilute hydrochloric acid in the boiling tube to the nearest 0.5 °C.
- Add two spatulas of magnesium powder to the dilute hydrochloric acid in the boiling tube and start a stop-watch.
- Stir and measure the temperature of the mixture after one minute.
- Record this temperature in Table 3.1 to the nearest 0.5 °C.

Repeat the procedure using copper powder and then zinc powder instead of magnesium powder.

Table 3.1

metal powder	initial temperature of dilute hydrochloric acid / °C	temperature of mixture at one minute / °C	change in temperature / °C	thermal energy released / J
magnesium				
copper				
zinc				

[4]

(b) Calculate the change in temperature for each metal.

Record these values in Table 3.1. [1]

(c) Calculate the thermal energy released for each metal.

Use the equation shown.

$$\text{thermal energy released} = 42.2 \times \text{change in temperature}$$

Record these values to **three** significant figures in Table 3.1.

[2]

(d) Table 3.2 shows the order of reactivity of some metals.

Table 3.2

sodium magnesium aluminium zinc iron lead copper	most reactive ↓ least reactive

The procedure is repeated using aluminium powder instead of magnesium powder.

Suggest a value for the thermal energy released.

Explain your answer.

thermal energy released = ... J

explanation ....

....
[2]

(e) Suggest **two** changes to the procedure that would give more confidence in the values for the thermal energy released by the metal powders.

change 1 ....

....

change 2 ....

....
[2]

(f) Draw a labelled diagram of the assembled apparatus used to separate the copper solid from the mixture at the end of the procedure in **(a)**.

Label the residue and the filtrate.

[2]
[Total: 13]

4 You are going to identify the blue solution **H**.

(a) Procedure

- Add about 2 cm depth of solution **H** into each of five test-tubes.
- Add a splint to one test-tube and leave it to soak. Leave this solution and splint until **after** all the other tests are complete.
- Do the tests described in Table 4.1 to the other four separate samples of solution **H**. Record your observations in Table 4.1.
- Do the flame test using the splint that has been soaked in solution **H**. Record your observations in Table 4.1.

Table 4.1

test	observations
add a few drops of aqueous ammonia add excess aqueous ammonia	
add a few drops of aqueous sodium hydroxide add excess aqueous sodium hydroxide	
add 1 cm depth of dilute nitric acid followed by 10 drops of aqueous silver nitrate	
add 1 cm depth of dilute nitric acid followed by 1 cm depth of aqueous barium nitrate	
place the splint soaked in **H** into the top of a blue Bunsen burner flame and record the initial colour seen	

[6]

(b) Identify the **two** ions present in solution **H**.

cation ....

anion ....
[1]

[Total: 7]

5 You are going to use a pendulum to measure the acceleration of free fall *g*.

A pendulum has been set up in a clamp for you, as shown in Fig. 5.1.

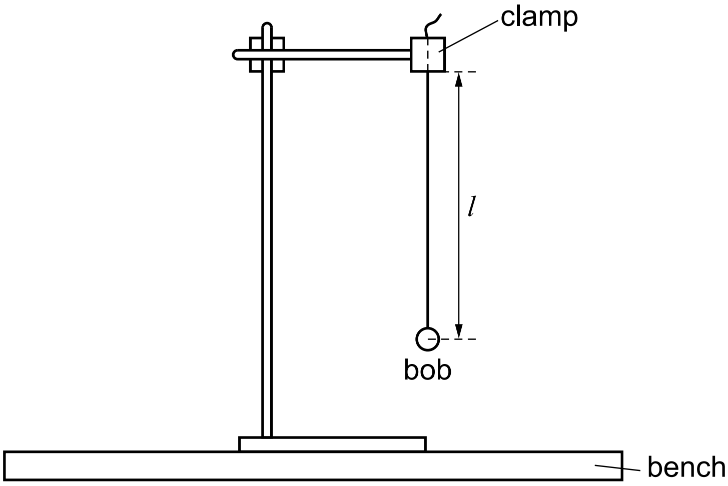


Fig. 5.1

The length l of the pendulum is the distance from the bottom of the clamp to the centre of the pendulum bob.

(a) Measure the length l of the pendulum.

Record your answer in centimetres to the nearest 0.1 cm.

l = ... cm [1]

(b) Fig. 5.2 shows one complete oscillation of the pendulum.

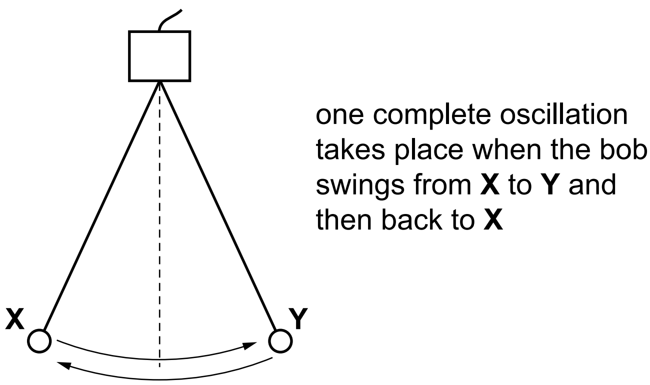


Fig. 5.2

(i) Pull the bob back a small suitable distance to position **X**. Release it so that it swings backwards and forwards.

Measure the time *t* for 20 complete oscillations.

t = ... s [1]

(ii) Calculate the time T for **one** complete oscillation of the pendulum.

T = ... s [1]

(iii) Calculate T^2.

T^2 = ... s^2 [1]

(c) The acceleration of free fall g is given by the equation shown.

$$g = \frac{0.395l}{T^2}$$

Use your value of l in centimetres from **(a)** and your value of T^2 in s^2 from **(b)(iii)** to calculate a value g_1 for the acceleration of free fall.

g_1 = ... m / s^2 [1]

(d) Adjust the string until the length l of the pendulum is 80.0 cm.

Repeat the procedure in **(b)(i)**, **(ii)** and **(iii)**.

t = ... s

T = ... s

T^2 = ... s^2

[2]

(e) Use the equation shown in **(c)** with l = 80.0 cm to calculate a second value g_2 for the acceleration of free fall.

g_2 = ... m / s^2 [1]

(f) Calculate an average value for the acceleration of free fall g_{AV} using your answers to **(c)** and **(e)**.

g_{AV} = ... m / s^2 [1]

(g) Two quantities can be considered to be the same within the limits of experimental accuracy if their values are within 10% of each other.

Compare your value for g_{AV} in **(f)** with the expected value, g = 9.8 m / s^2.

State whether your value agrees with the expected value of g within the limits of experimental error. Justify your answer with a calculation.

statement ....

justification ....

....

....
[2]

(h) **(i)** State **one** precaution that you took while performing your experiment to get accurate readings.

....

.... [1]

(ii) Suggest why it is good experimental practice to use long lengths of pendulum when performing this experiment.

....

.... [1]

[Total: 13]

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6 Plan an investigation to find out whether the rate of cooling of hot water depends on the initial temperature of the water.

You are provided with:

- a beaker
- a measuring cylinder
- a supply of hot water.

You may suggest the use of any other common laboratory apparatus.

The student doing the experiment takes all the necessary safety precautions. You are **not** required to write about safety precautions.

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

In your plan, include:

- any other apparatus needed
- a brief description of the method, including what you will measure and how you will make sure your measurements are accurate
- the variables you will control
- a results table to record your measurements (you are **not** required to enter any readings in the table)
- how you will process your results to reach a conclusion.

You may include a labelled diagram in your answer.

[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

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