* 0000800000001 *

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

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

COMBINED SCIENCE **0653/51**

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

1 hour 15 minutes

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 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.

For Examiner's Use	
1	
2	
3	
4	
Total	

This document has **16** pages. Any blank pages are indicated.

DC (CJ/JG) 346272/2

1 You are going to investigate the nutrient content of three drinks, **A**, **B** and **C**.

(a) Procedure

step 1 Add approximately 3 cm^3 of drink **A** to a clean test-tube.

step 2 Add a few drops of **iodine solution** to the test-tube.

step 3 Record in Table 1.1 the colour of the solution in the test-tube.

step 4 Repeat **step 1** to **step 3** using drink **B** and then drink **C** instead of drink **A**.

step 5 Add approximately 3 cm^3 of drink **A** to a clean test-tube.

step 6 Add 1 cm^3 of **biuret solution** to the test-tube.

step 7 Record in Table 1.1 the colour of the solution in the test-tube.

step 8 Repeat **step 5** to **step 7** using drink **B** and then drink **C** instead of drink **A**.

Table 1.1

drink	colour with iodine solution	colour with biuret solution
A		
B		
C		

[3]

(b) Use your results in Table 1.1 to state conclusions about the nutrient content for each of the drinks.

drink **A** ....

....

drink **B** ....

....

drink **C** ....

....
[3]

(c) State the reagent used to test for fats and oils.

.... [1]

[Total: 7]

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2 Invertase is an enzyme.

Invertase breaks down the non-reducing sugar sucrose into reducing sugars.

$$\text{non-reducing sugar sucrose} \xrightarrow{\text{invertase}} \text{reducing sugars}$$

Benedict's solution is used to test for reducing sugars. The activity of invertase can be determined by measuring the time it takes for reducing sugars to form.

Plan an investigation to determine the relationship between the activity of invertase and temperature.

You are provided with:

- a solution of invertase enzyme
- a solution of sucrose
- Benedict's solution.

You may use any common laboratory apparatus.

You are not required to do this investigation.

In your plan, include:

- the apparatus you will need
- a brief description of the method
- what you will measure
- which variables you will keep constant
- how you will process your results to draw a conclusion.

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

[7]

3 You are going to investigate aqueous **H**.

(a) Investigating the rate of reaction of aqueous **H** with magnesium.

(i) Procedure

step 1 Measure 25 cm^3 of aqueous **H** using a measuring cylinder.

step 2 Pour this solution into a glass beaker.

step 3 Add one of the 30 mm lengths of magnesium ribbon to the aqueous **H** in the beaker.

step 4 Immediately start a stop-watch.

step 5 Stir the reaction mixture so that all the magnesium is under the surface of the aqueous **H** until all the magnesium ribbon has reacted.

step 6 Stop the stop-watch as soon as all of the magnesium ribbon has reacted.

step 7 Record in Table 3.1 this reaction time to the nearest second.

Table 3.1

volume of aqueous **H** / cm^3	volume of water / cm^3	reaction time / s	rate of reaction in mm/s
25	0		
20	5		
15	10		
10	15		

[1]

(ii) step 8 Empty the reaction mixture from the beaker into the waste container and then rinse the beaker and stirrer with water.

step 9 Dry the beaker with a paper towel.

step 10 Measure 20 cm^3 of aqueous **H** using a measuring cylinder and pour into the beaker.

step 11 Measure 5 cm^3 of water using a measuring cylinder and pour into the beaker of aqueous **H**.

step 12 Stir the mixture of aqueous **H** and water for 10 seconds.

step 13 Repeat **step 3** to **step 7**.

step 14 Repeat **step 8** to **step 13** using 15 cm^3 of aqueous **H** and 10 cm^3 of water as shown in Table 3.1.

step 15 Repeat **step 8** to **step 13** using 10 cm^3 of aqueous **H** and 15 cm^3 of water as shown in Table 3.1.

[3]

(iii) Calculate the rate of reaction for each experiment.

Use the equation shown.

$$\text{rate of reaction} = \frac{30}{\text{reaction time}}$$

Record in Table 3.1 your values to **two** significant figures. [2]

(iv) State the relationship between the volume of aqueous **H** and the rate of reaction.

Use information from Table 3.1.

....

.... [1]

(v) Explain why in **step 5** it is important that all the magnesium is under the surface of aqueous **H**.

....

.... [1]

(vi) Explain why in **step 8** it is important the beaker and stirrer are rinsed.

....

.... [1]

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

(i) Pour 2 cm depth of aqueous **H** into each of three test-tubes.

Do each one of the tests shown in Table 3.2 to a different test-tube of aqueous **H**.

Record your observations in Table 3.2.

Table 3.2

test	observation
add 1 cm depth of dilute nitric acid followed by 1 cm depth of aqueous barium nitrate	
add 1 cm depth of dilute nitric acid followed by 1 cm depth of aqueous silver nitrate	
add 5 drops of universal indicator	

[3]

(ii) Suggest the name of aqueous **H**.

Explain your answer.

name ....

explanation ....

....
[1]

[Total: 13]

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4 You are going to determine the period T of a pendulum.

(a) The apparatus shown in Fig. 4.1 has been set up for you.

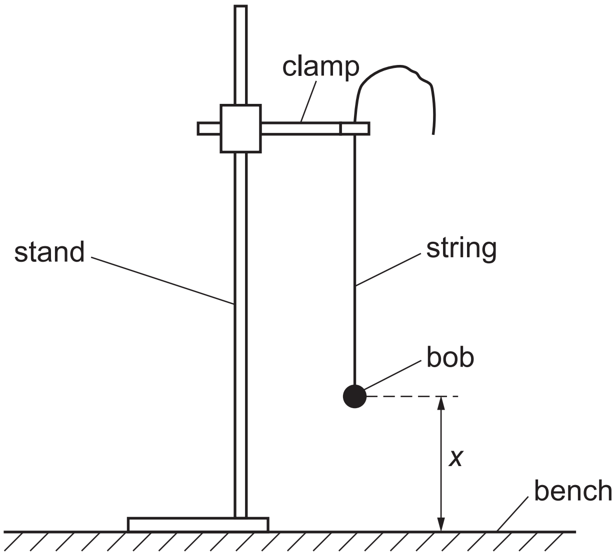


Fig. 4.1

The distance x is the height of the centre of the bob above the bench.

Measure the distance x.

Record in Table 4.1, this distance x to the nearest 0.1 cm.

Table 4.1

distance x / cm	time for 10 oscillations / s		average time for 10 oscillations for trial 1 and trial 2 / s	period T / s	T^2 / s^2
	trial 1	trial 2			
10.0	13.6	13.2	13.4	1.34	1.80
20.0	11.6	12.0	11.8	1.18	1.39
25.0	11.1	10.9	11.0	1.10	1.21
30.0	9.9	10.3	10.1	1.01	1.02

[1]

(b) The period T is the time it takes for the pendulum to complete one oscillation.
In one oscillation the bob moves from **A** to **B** and back to **A** as shown in Fig. 4.2.

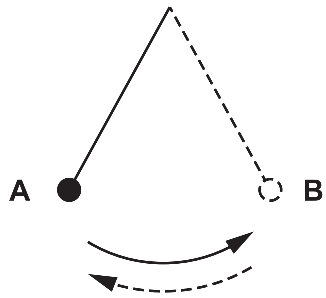


Fig. 4.2

(i) **Procedure**

- Pull the bob a short distance to one side and release it.
- Immediately start the stop-watch.
- Measure the time taken for 10 oscillations of your pendulum.

Record in Table 4.1 this time for trial 1. [1]

(ii) Repeat the procedure in **(b)(i)**.

Record in Table 4.1 this time for trial 2. [1]

(iii) Calculate the average time for 10 oscillations for trial 1 and trial 2.

Record your value in Table 4.1. [1]

(iv) Calculate the period T.

Use the equation shown.

$$T = \frac{\text{average time for 10 oscillations}}{10}$$

Record in Table 4.1 this value of T.

Calculate T^2.

Record in Table 4.1 this value of T^2. [1]

(v) One reason why the student does two trials is to calculate an average time.

State one **other** reason.

....

.... [1]

(vi) For $x = 30.0\,\text{cm}$, the times for the trials are 9.9 s and 10.3 s.

Two values are considered equal within the limits of experimental accuracy if they are within 10% of each other.

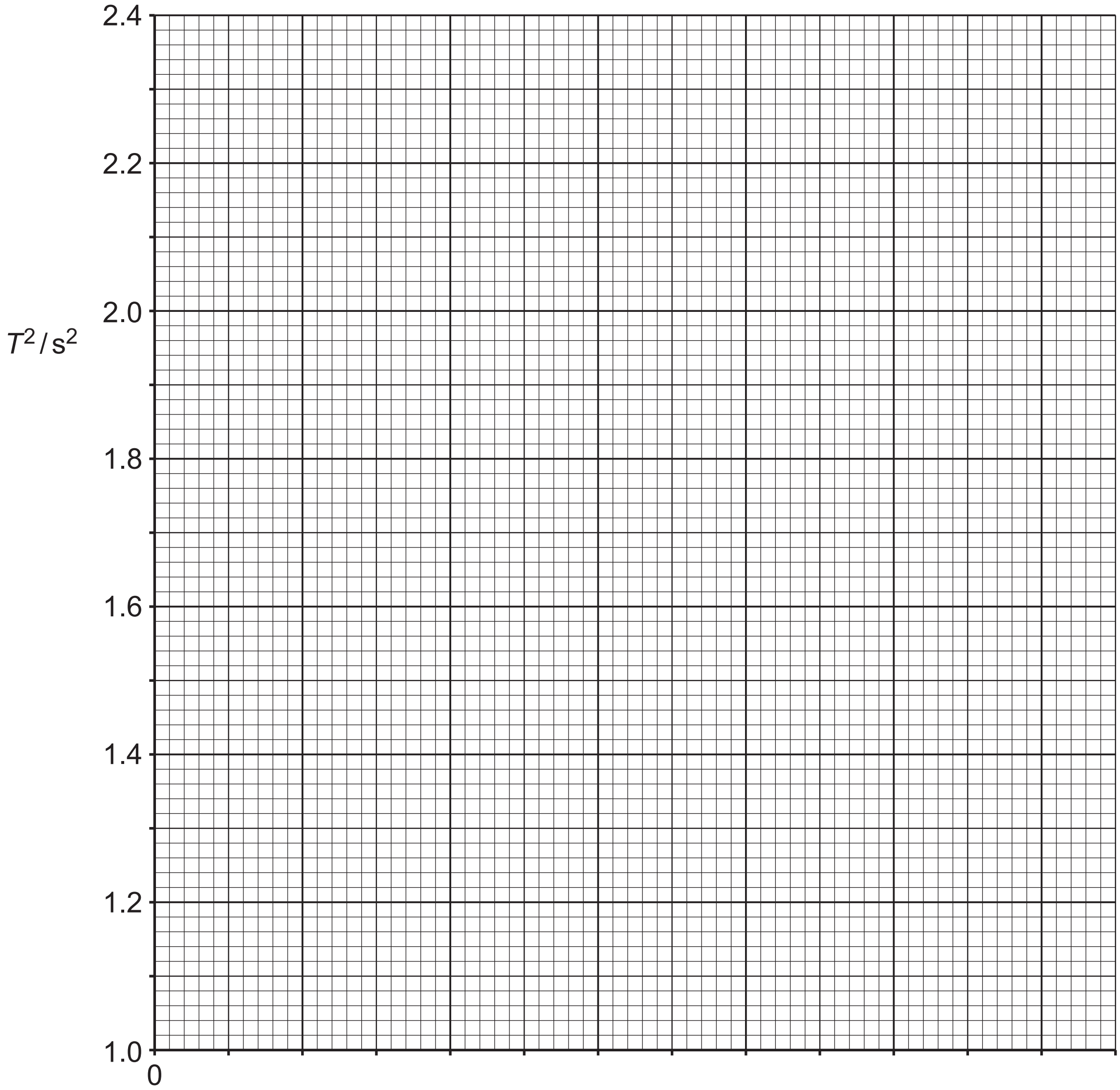
Explain if the two values are equal within the limits of experimental accuracy.

Include a calculation in your answer.

....

.... [2]

(c) (i) On the grid, plot a graph of T^2 (vertical axis) against x.



[2]

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

(iii) Extend your line so that it meets the vertical axis.

Determine the value of T^2 at this point.

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

(d) Your value in **(c)(iii)** represents the value of T^2 when the distance between the centre of the bob and the top of the bench is zero.

It is possible to take this reading by moving the apparatus to the end of the bench.

Fig. 4.3 shows the bench and some of the string.

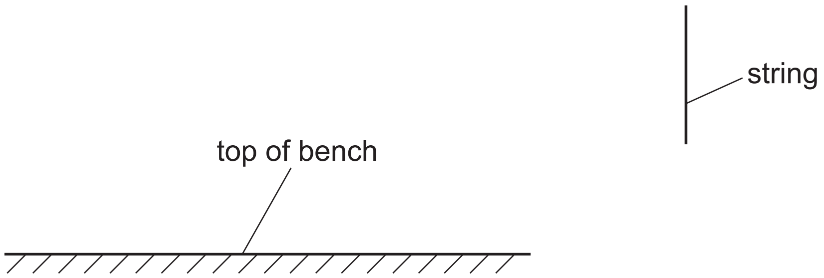


Fig. 4.3

On Fig. 4.3, draw the position of the bob and any extra string. [1]

[Total: 13]

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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