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CANDIDATE NAME

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* 3 1 7 5 4 8 2 9 9 8 *

COMBINED SCIENCE **0653/62**

Paper 6 Alternative to Practical **May/June 2026**

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. 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 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.

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1 **(a)** You are going to investigate the structure of a tomato.

Figure 1.1 shows a section of a tomato.

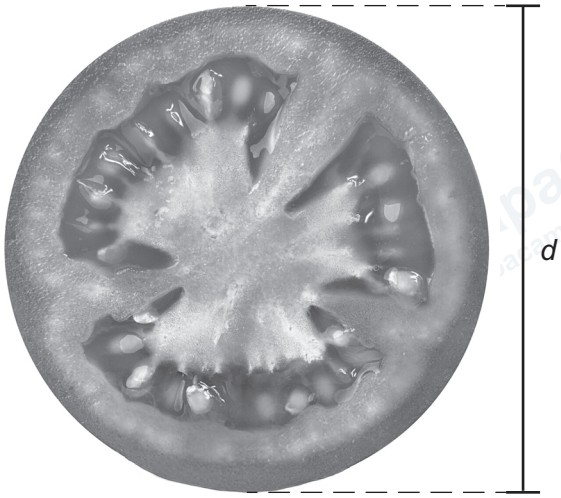


Figure 1.1

(i) In the box, make a large clear pencil drawing of the cut surface of the tomato.

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(ii) Line *d* represents the diameter of the tomato in Figure 1.1.

Measure the diameter *d* on Figure 1.1.

Record your value to the nearest mm.

d = ... mm [1]

(iii) Draw a line on your drawing in **1(a)(i)** to show the diameter of the tomato.

Measure the diameter *D* of your drawing in **1(a)(i)**.

Record your value to the nearest mm.

D = ... mm [1]

(iv) Calculate the magnification of your drawing.

Use the equation shown.

$$\text{magnification} = \frac{D}{d}$$

magnification = ... [1]

(b) Tomatoes contain vitamin C.

DCPIP is a blue solution used to test for vitamin C.

State the final colour observed for a positive test with DCPIP.

..... [1]

[Total: 7]

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2 A student states,

'Unripe tomatoes do **not** contain reducing sugars. Ripe tomatoes do contain reducing sugars.'

Figure 2.1 shows an unripe (green) tomato and a ripe (red) tomato.

unripe (green) tomato



ripe (red) tomato



Figure 2.1

Plan an investigation to test whether the student's statement is correct.

You are provided with:

- a supply of green and red tomatoes
- Benedict's solution

You may use any common laboratory apparatus.

In your plan, include:

- the apparatus needed
- a brief description of the method
- what you will measure and the observations you will make
- which variables you will keep constant
- how you will process your results to form a conclusion.

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

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3 A student investigates solid zinc carbonate.

When heated, zinc carbonate breaks down to make zinc oxide and carbon dioxide gas.

Procedure

The student:

step 1 records in Table 3.1 the mass of a clean dry test-tube M_1

step 2 adds solid zinc carbonate to the test-tube

step 3 records in Table 3.1 the mass of the test-tube and zinc carbonate M_3

step 4 heats the test-tube using a blue Bunsen burner flame

step 5 leaves the test-tube to cool down

step 6 records in Table 3.1 the mass of the test-tube and zinc oxide M_6.

The student uses a balance to measure each mass.

(a) Figure 3.1 shows the three readings on the balance.

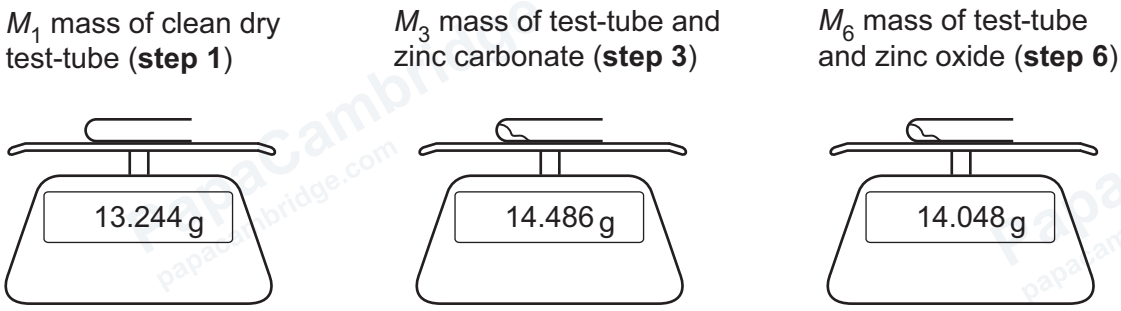


Figure 3.1

Record in Table 3.1 each of these readings to **two** decimal places.

Table 3.1

M_1 mass of clean dry test-tube (**step 1**)/g	
M_3 mass of test-tube and zinc carbonate (**step 3**)/g	
M_6 mass of test-tube and zinc oxide (**step 6**)/g	

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(b) Describe how the student changes the procedure to confirm that **all** the zinc carbonate has been broken down into zinc oxide.

.....

..... [1]

(c) **(i)** Use Table 3.1 to calculate the mass of zinc carbonate heated.

mass of zinc carbonate = ... g [1]

(ii) Use Table 3.1 to calculate the mass of zinc oxide made.

mass of zinc oxide = ... g [1]

(iii) Calculate the percentage by mass of zinc oxide formed from the zinc carbonate.

Use the equation shown.

$$\text{percentage} = \frac{\text{mass of zinc oxide}}{\text{mass of zinc carbonate}} \times 100$$

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

percentage = ... [2]

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(d) In **step 4** it is important to heat the test-tube with a blue Bunsen burner flame and **not** a yellow flame.

Suggest why.

.....

..... [1]

(e) The student does some tests on solid zinc carbonate.

Procedure

The student:

step 7 places some zinc carbonate into a boiling tube

step 8 adds dilute nitric acid to form a solution

step 9 divides the solution into two separate test-tubes

step 10 adds drops of aqueous ammonia to one of the test-tubes until ammonia is in excess

step 11 adds drops of aqueous sodium hydroxide to the other test-tube until sodium hydroxide is in excess.

Draw a table to show the results the student obtains.

Include:

- the reagents for the tests in **step 8**, **step 10** and **step 11**
- the predicted observations for each test.

[4]

[Total: 13]

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4 A student investigates the period T of a V-shaped pendulum.

(a) Figure 4.1 shows the V-shaped pendulum. Each end of a piece of string is attached to the rod of a clamp. In the middle of the string is a pendulum bob.

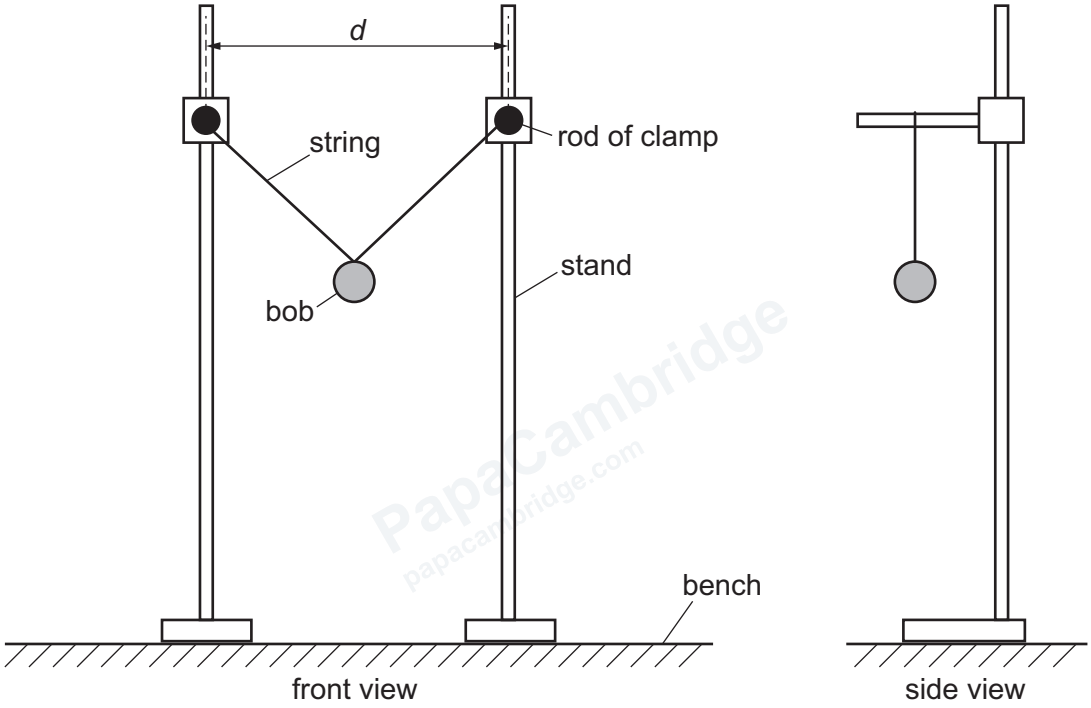


Figure 4.1

The distance d is the horizontal distance between the centre of the two rods on Figure 4.1.

(i) Measure the distance d on Figure 4.1.

Record your value to the nearest 0.1 cm.

d = ... cm [1]

(ii) Figure 4.1 is drawn to one-tenth full scale.

Calculate the actual distance, D.

Record this value of D in Table 4.1. [1]

(iii) The student measures the actual distance D with a ruler.

Suggest **one** practical difficulty in measuring D.

.....

..... [1]

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(iv) Calculate D^2 for your value of D.

Record in Table 4.1 this value of D^2.

Table 4.1

distance D /cm	D^2 /cm^2	time for 10 oscillations /s		average time for 10 oscillations /s	period T /s	T^4 /s^4
		trial 1	trial 2			
10	100	11.8	12.2	12.0	1.20	2.1
20	400	12.0	11.8	11.9	1.19	2.0
30	900	11.5	11.7	11.6	1.16	1.8
50	2500	10.0	10.4	10.2	1.02	1.1

[1]

(b) The bob oscillates when the bob is pulled a short distance away from the stands and is then released.

Figure 4.2 shows three positions **A**, **B** and **C** during the oscillation of the bob when viewed from the side.

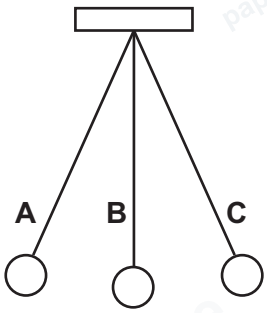


Figure 4.2

On Figure 4.3 tick (✓) the box to indicate which diagram represents **one** complete oscillation of the bob.

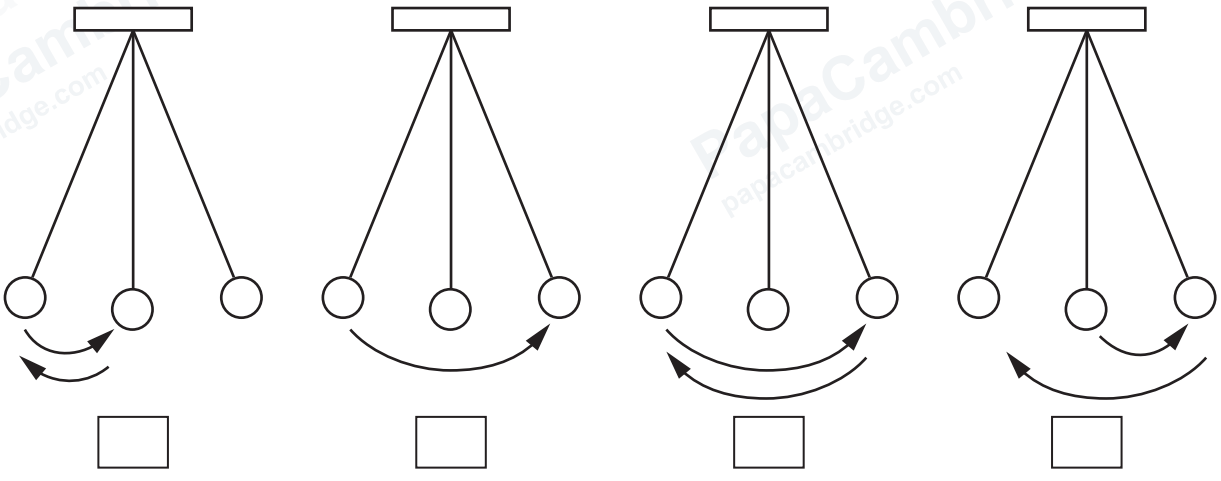


Figure 4.3

[1]

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(c) Procedure

The student:

- measures the time for 10 oscillations of the pendulum for each of the values of D shown in Table 4.1
- repeats each measurement.

Figure 4.4 shows the readings on the stop-watch, in seconds, for the value of D in **4(a)(ii)**.

reading 1 reading 2

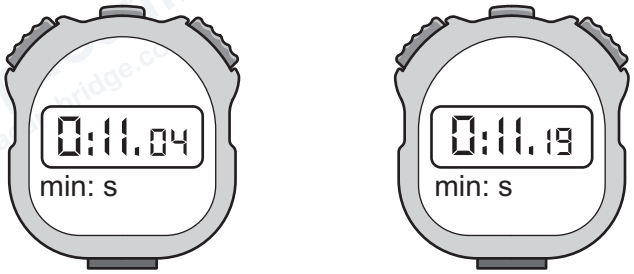


Figure 4.4

(i) Record in Table 4.1 these readings to the nearest 0.1 s. [1]

(ii) Calculate the average time for 10 oscillations.

Record this time in Table 4.1. [1]

(iii) Calculate the period T.

Use the equation shown.

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

Calculate T^4.

Use the equation shown.

$$T^4 = T \times T \times T \times T$$

Record in Table 4.1 your values of T and T^4. [1]

(iv) The student measures the time for 10 oscillations.

Suggest **one** practical reason why the time is measured for 10 oscillations rather than for 1 oscillation.

.....

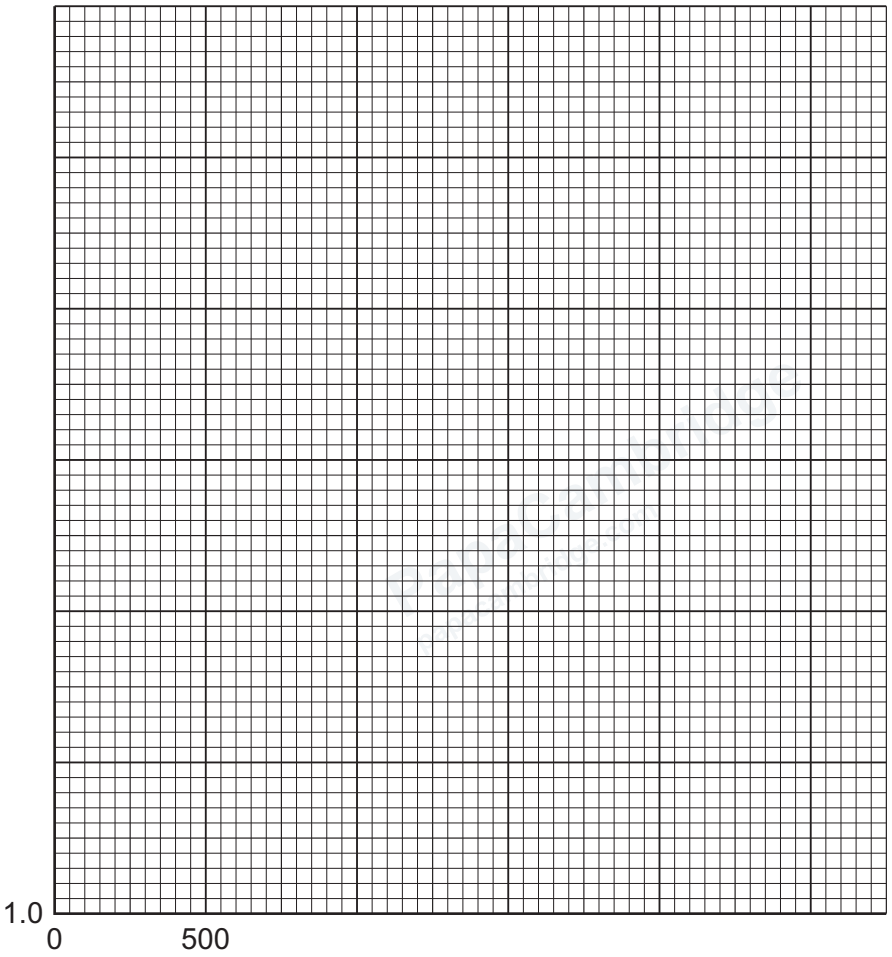
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(d) (i) On the grid, plot a graph of T^4 (vertical axis) against D^2.

.....



.....

[3]

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

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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

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