Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME										
CENTRE NUMBER						CANDIDATE NUMBER				

5137724148

COMBINED SCIENCE **0653/52**

Paper 5 Practical Test **October/November 2022**

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 (DE) 318478

1 You are going to investigate the effect of temperature on the rate of respiration in yeast cells.

When yeast cells respire, they produce carbon dioxide gas.

(a) You are provided with a suspension of respiring yeast cells in a beaker labelled **yeast**.

Procedure

step 1 Half-fill the empty beaker labelled **warm water** with warm water.

(i) Record the temperature of the warm water in the beaker.

temperature of warm water = ... °C [1]

step 2 Stir the yeast suspension.

step 3 Use a syringe to add 10 cm^3 of yeast suspension to a clean boiling tube (large test-tube).

step 4 Place the boiling tube of yeast suspension in the beaker of warm water.

step 5 Fig. 1.1 shows the apparatus. Make sure the syringe barrel contains water and is fully submerged in the container of water.

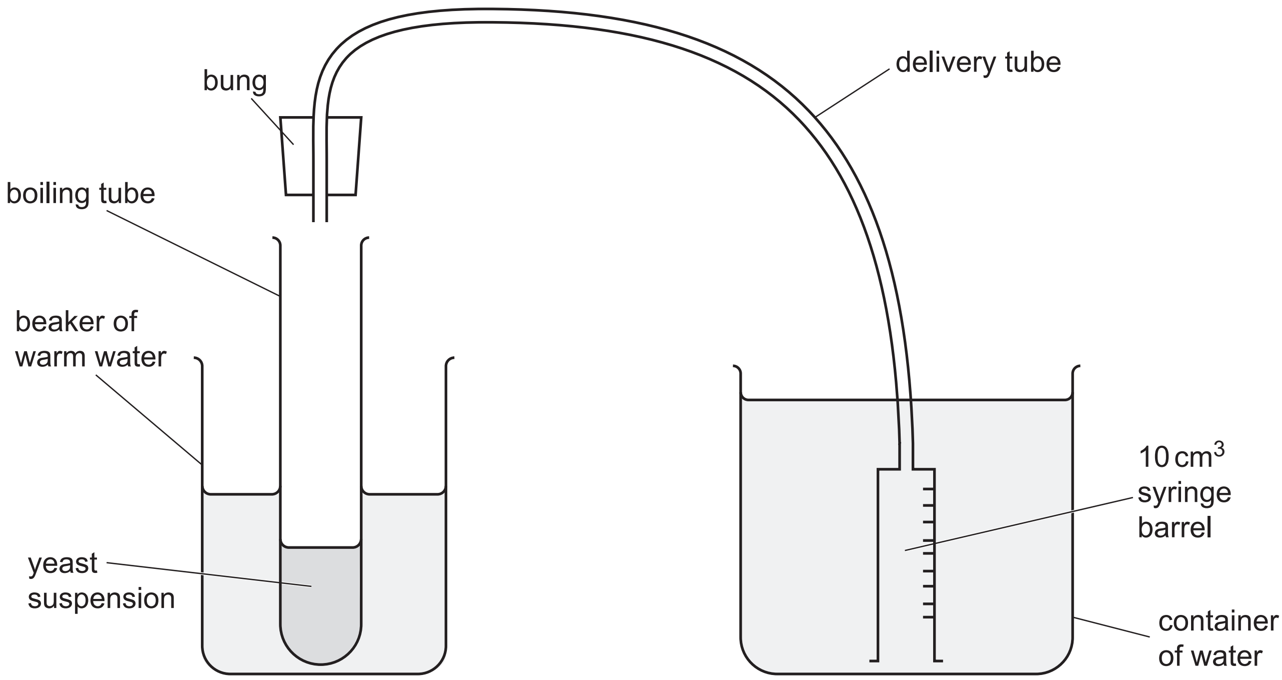


Fig. 1.1

step 6 Keep the syringe barrel fully submerged in the container of water and place the bung in the boiling tube of yeast suspension.

step 7 Measure the **initial** volume of gas in the syringe barrel.

(ii) Record in Table 1.1 this value to the nearest $0.5\,cm^3$. [1]

step 8 Start the stop-clock and wait for 5 minutes.
Continue with **(b)** while you are waiting.

step 9 After 5 minutes, measure the **final** volume of gas in the syringe barrel.

(iii) Record in Table 1.1 this value to the nearest $0.5\,cm^3$. [1]

Table 1.1

beaker	initial volume of gas / cm^3	final volume of gas / cm^3	volume of gas collected / cm^3
warm water			
cold water			

step 10 Remove the bung from the boiling tube of yeast suspension.

step 11 Repeat **step 2** to **step 9** using the beaker of **cold water**.

(iv) Record in Table 1.1 the initial and final volumes of gas for cold water. [1]

(v) Calculate the volume of gas collected in each experiment.

Use the equation shown.

volume of gas collected = final volume of gas – initial volume of gas

Record these values in Table 1.1. [1]

(vi) State the effect of temperature on the rate of respiration in yeast cells.

....

.... [1]

(vii) The yeast suspension is stirred in **step 2** to mix it. Suggest why this is important.

....

.... [1]

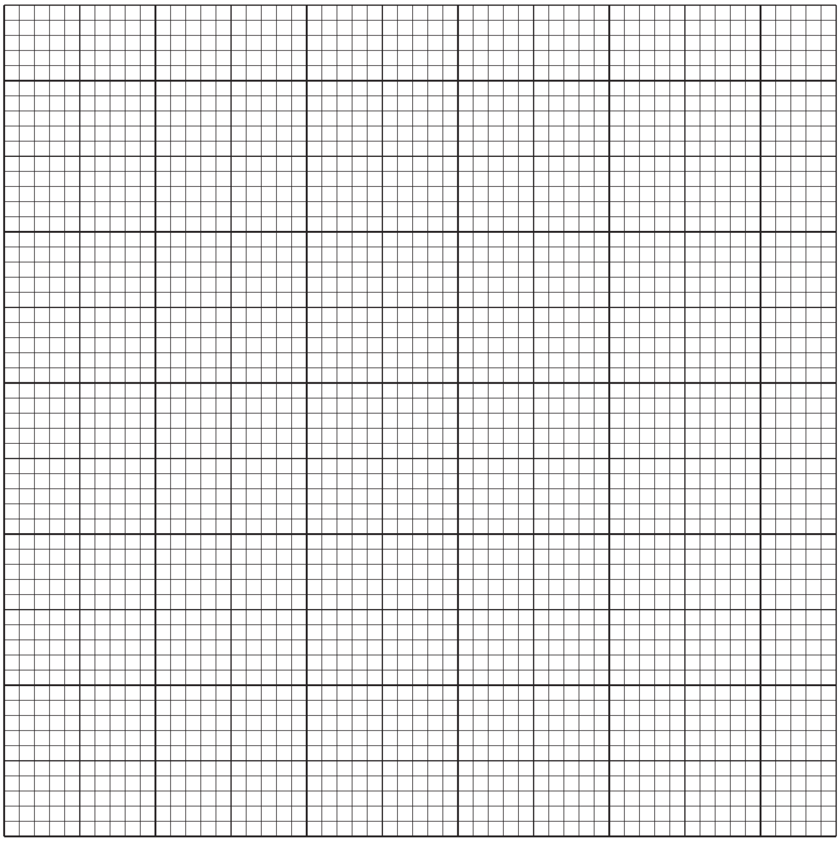
(b) A student repeats the procedure in **(a)** at five different temperatures.

The student's results are shown in Table 1.2.

Table 1.2

temperature / °C	volume of gas collected / cm^3
5	2.0
10	4.5
15	8.5
20	10.0
25	10.0

(i) On the grid, plot a graph of volume of gas collected (vertical axis) against temperature.



[3]

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

(iii) State and explain whether the student's results in Table 1.2 support your answer in **(a)(vi)**.

Place a tick (✓) in the appropriate box.

☐ support

☐ do not support

explanation ....

....

.... [1]

(iv) Suggest why the volume of gas collected by the student does **not** go above 10 cm^3.

....

.... [1]

[Total: 13]

Check that you have completed 1(a).

2 You are going to investigate the reaction of dilute hydrochloric acid with three solids, **K**, **L** and **M**.

You are provided with the three solids, **K**, **L** and **M**.

(a) **Procedure** for solid **K**

- Put a spatula of **K** into a clean test-tube.
- Add approximately 3 cm depth of dilute hydrochloric acid to the test-tube.
- Gently swirl the test-tube and its contents.
- Leave the test-tube for about four minutes while you do parts **(b)** and **(c)**.

Record your observations of the contents of the test-tube after four minutes.

....

.... [1]

(b) **Procedure** for solid **L**

- Put a spatula of **L** into a clean test-tube.
- Add approximately 3 cm depth of dilute hydrochloric acid to the test-tube.

(i) Record your observations.

....

....

.... [2]

(ii) Explain how your observations in **(b)(i)** show that solid **L** contains carbonate ions.

....

.... [1]

(c) **Procedure** for solid **M**

- Put a piece of **M** into a clean test-tube.
- Add approximately 3 cm depth of dilute hydrochloric acid to the test-tube.
- Test the gas made with a glowing splint.

(i) One observation is that the mixture fizzes.

Describe **one** other observation of the reaction in the test-tube.

....

.... [1]

(ii) Describe the result of the gas test.

....

.... [1]

(iii) Explain why it is **not** possible to use this gas test to identify the gas made in this reaction.

....

.... [1]

[Total: 7]

Check that you have completed 2(a).

3 Aqueous hydrogen peroxide is a colourless solution that decomposes to make water and oxygen gas.

Fig. 3.1 shows the word equation for the decomposition of hydrogen peroxide.

hydrogen peroxide → water + oxygen

Fig. 3.1

Manganese(IV) oxide powder is added to aqueous hydrogen peroxide to allow the decomposition to happen at room temperature.

Plan an investigation to determine the relationship between the mass of manganese(IV) oxide powder added and the volume of oxygen gas made.

You are provided with:

- aqueous hydrogen peroxide
- manganese(IV) oxide powder.

You may use any common laboratory apparatus in your plan.

You are not required to do this investigation.

Include in your plan:

- the apparatus you will use
- a brief description of the method, explaining any safety precautions you will take
- what you will measure
- which variables you will keep constant
- how you will process your results to draw 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).

[7]

4 You are going to use a balancing method to determine the mass of a metre rule.

(a) Place the **centre** of the 30 g mass on the metre rule at the 15.0 cm mark. Use the tape to fix the mass in place.

The mass hides the markings on the metre rule.

Explain how you make sure that the **centre** of the 30 g mass is directly over the 15.0 cm mark.

You may include a diagram in your answer.

....

....

.... [2]

(b) Place the metre rule on the pivot.

Carefully slide the metre rule backwards and forwards on the pivot until the metre rule is balanced (or as close to balance as possible).

Fig. 4.1 shows the metre rule at balance.

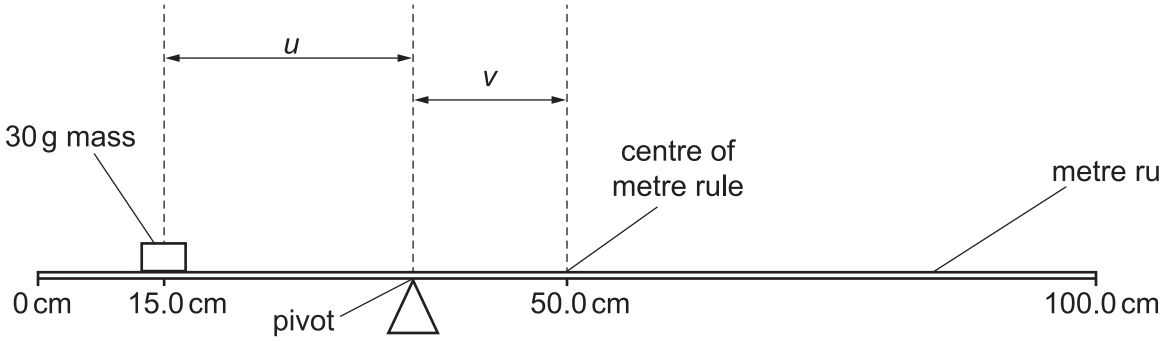


Fig. 4.1 (not to scale)

(i) Record the position of the pivot to the nearest 0.1 cm.

position of pivot = ... cm [2]

(ii) Calculate the distance *u* between the centre of the 30 g mass and the position of the pivot.

Use the equation shown.

$$u = \text{position of pivot} - 15.0$$

u = ... cm [1]

(iii) Use your answer to **(b)(i)** to calculate the distance *v* between the pivot and the 50.0 cm mark, the centre of the metre rule.

Use the equation shown.

$$v = 50.0 - \text{position of pivot}$$

v = ... cm [1]

(c) Calculate the mass *m* of the metre rule.

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

$$m = \frac{30u}{v}$$

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

m = ... g [2]

(d) Suggest **one** practical reason why it is difficult to get an accurate result using this balancing method.

....

.... [1]

(e) Remove the 30 g mass and tape from the metre rule.

(i) Measure the weight *W* of the metre rule using the newton meter.

W = ... N [1]

(ii) Calculate the mass *m* of the metre rule.

Use your answer to **(e)(i)** and the equation shown.

$$m = W \times 100$$

m = ... g [1]

(f) Two values are equal, within the limits of experimental accuracy, if they are within 10% of each other.

Compare your values for m in **(c)** and **(e)(ii)**.

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

Include a calculation in your answer.

explanation ....

.... [2]

[Total: 13]

BLANK PAGE

BLANK PAGE

NOTES FOR USE IN QUALITATIVE ANALYSIS

Tests for anions

anion	test	test result
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify, 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	green ppt., insoluble in excess
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