Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4891602066

COMBINED SCIENCE 0653/61

Paper 6 Alternative to Practical

October/November 2022

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 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 [ ].

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

1 A student investigates the effect of temperature on the rate of respiration in yeast cells.

When yeast cells respire, they produce carbon dioxide gas.

(a) Procedure

The student:

step 1 adds 10 cm^3 of yeast cell suspension to a clean boiling tube (large test-tube)

step 2 sets up the apparatus shown in Fig. 1.1

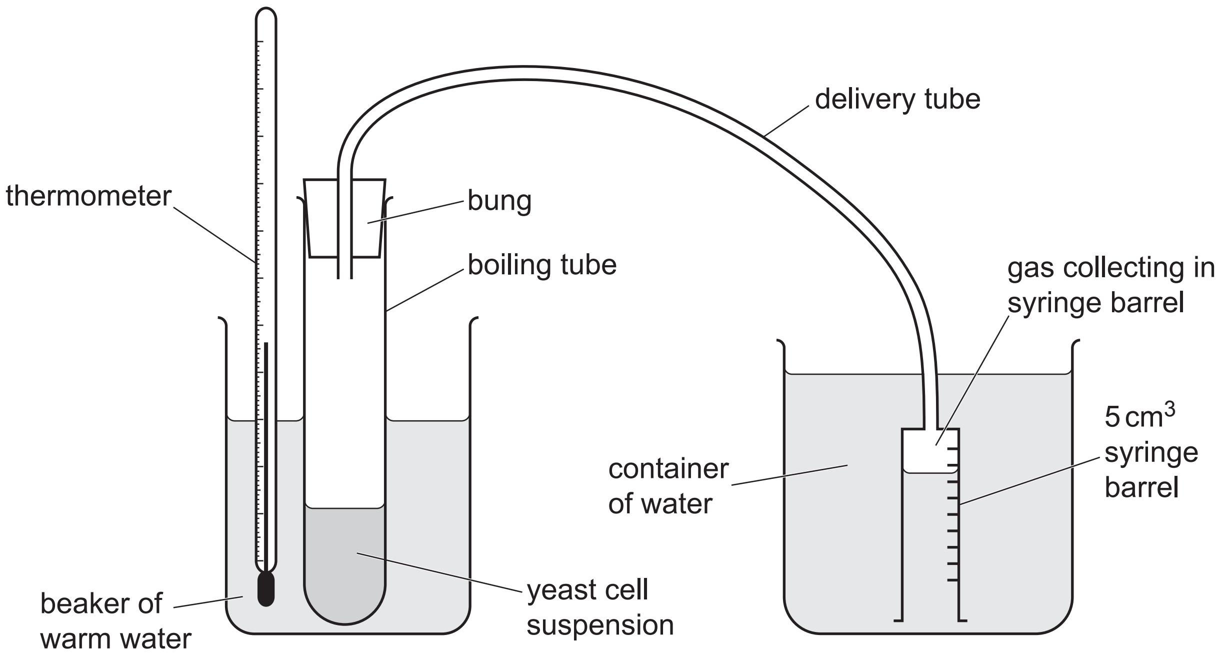

Fig. 1.1

step 3 measures the temperature of the warm water in the beaker

step 4 measures the initial volume of gas in the syringe barrel and records the value in Table 1.1

step 5 starts a stop-clock and leaves the apparatus for 5 minutes

step 6 measures the final volume of gas in the syringe barrel and records the value in Table 1.1

step 7 repeats **step 1** to **step 6** using **cold water** instead of warm water in the beaker.

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(i) Suggest a piece of apparatus suitable for measuring 10 cm^3 of yeast cell suspension.

.... [1]

(ii) Fig. 1.2 shows the readings on the thermometer for the warm water and the cold water.

Fig. 1.2

Record in Table 1.1 the temperatures to the nearest 0.5 °C.

Table 1.1

	temperature / °C	initial volume of gas / cm^3	final volume of gas / cm^3	volume of gas collected / cm^3
warm water		0.1	5.0	4.9
cold water		0.2		

[2]

(iii) As the yeast cells respire, the gas made collects in the syringe barrel.

Fig. 1.3 shows the **final** volume of gas in the syringe barrel for the **cold water** experiment.

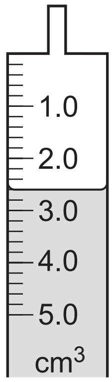


Fig. 1.3

Record in Table 1.1 the final volume of gas in the syringe barrel. [1]

(iv) Calculate the volume of gas collected for the **cold water** experiment.

Use the equation shown.

volume of gas collected = final volume – initial volume

Record this value in Table 1.1. [1]

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

....

.... [1]

(vi) The student observes that the **warm water** cools during the 5 minutes.

Suggest what the student can do to reduce this cooling.

....

.... [1]

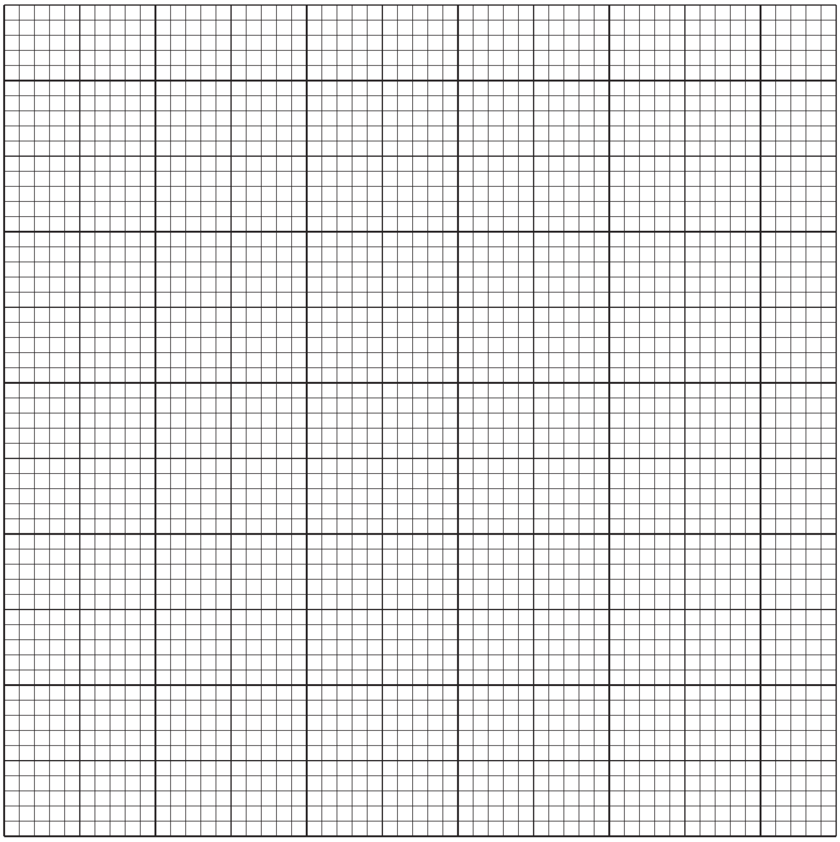
(b) The student repeats the procedure in **(a)** at five different temperatures.

The results are shown in Table 1.2.

Table 1.2

temperature / °C	volume of gas collected / cm^3
5.0	0.4
10.0	2.2
15.0	4.2
20.0	5.0
25.0	5.0

(i) On the grid, plot a graph of volume of gas collected (*y*-axis) against temperature using the data in Table 1.2.



[3]

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

(iii) State and explain whether the results in Table 1.2 support your answer in **(a)(v)**.

Place a tick (✓) in the appropriate box.

☐ support

☐ do not support

explanation ....

....

.... [1]

(iv) Suggest why the volume of gas collected does **not** go above 5 cm^3.

....

.... [1]

[Total: 13]

2 A student investigates the reaction of dilute hydrochloric acid with three solids, **K**, **L** and **M**.

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

The student:

- puts some solid **K** into a clean test-tube
- adds some dilute hydrochloric acid to the test-tube.

Solid **K** reacts slowly. After ten minutes a pale blue solution is seen in the test-tube.

Suggest **two** ways the student can make the reaction faster.

1 ....

2 ....
[2]

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

The student:

- puts some solid **L** into a clean test-tube
- adds some dilute hydrochloric acid to the test-tube.

The mixture fizzes and a blue solution is seen in the test-tube.

The gas made in this reaction turns limewater milky.

(i) State the name of the gas made in this reaction.

.... [1]

(ii) Circle the negative ion present in **L**.

carbonate **chloride** **nitrate** **sulfate**
[1]

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

The student:

- puts some dilute hydrochloric acid into a clean test-tube
- places a thermometer into the dilute hydrochloric acid
- adds a small piece of solid **M**
- tests the gas made.

All of solid **M** reacts.

Hydrogen gas is made, and heat energy is released.

The student observes a colourless solution.

Describe **three** other observations the student makes.

1 ....

2 ....

3 ....
[3]

[Total: 7]

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.

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).

....

....

....

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.... [7]

4 A student uses a balancing method to determine the mass of a metre rule.

Fig. 4.1 shows the apparatus at balance.

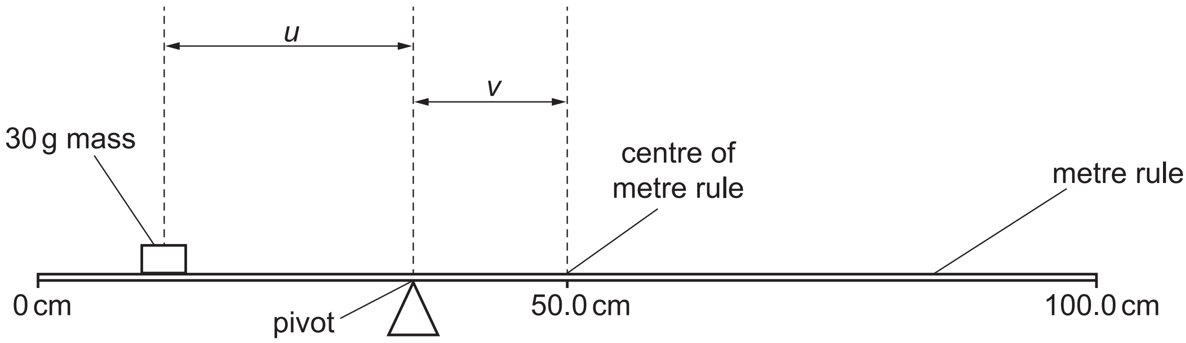

Fig. 4.1 (not to scale)

(a) The 30 g mass is fixed to the metre rule.

Fig. 4.2 shows the position of the mass on the metre rule.

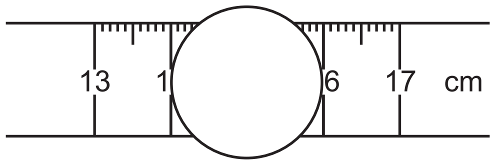

Fig. 4.2

Determine the position *c* of the centre of the 30 g mass on the metre rule.
Explain your answer.

c = ... cm

explanation ....

....

[2]

(b) Fig. 4.3 shows part of the metre rule with the position of the pivot p at balance.

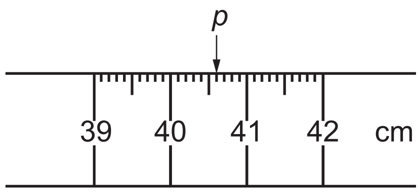

Fig. 4.3

(i) Record p to the nearest 0.1 cm. p = ... cm [1]

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

Use your answers in **(a)** and **(b)(i)** and the equation shown.

$$u = p - c$$

u = ... cm [1]

(iii) Calculate the distance v between the pivot and the 50.0 cm mark.

Use your answer in **(b)(i)** and the equation shown.

$$v = 50.0 - p$$

v = ... cm [1]

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

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

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

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

m = ... g [2]

(d) The student uses a newton meter to measure the weight *W* of the metre rule.

Fig. 4.4 shows the reading.

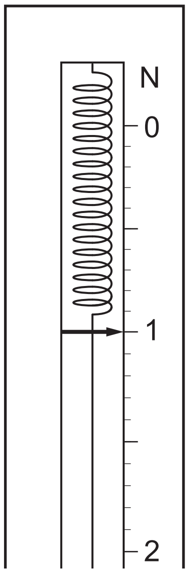

Fig. 4.4

(i) Record the weight *W* of the metre rule shown in Fig. 4.4.

Give your answer to the nearest 0.1 N.

W = ... N [2]

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

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

$$m = W \times 100$$

m = ... g [1]

(e) Suggest a suitable piece of apparatus to measure the mass of the metre rule directly.

.... [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 **(d)(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]

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