Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7657540442

COMBINED SCIENCE **0653/62**

Paper 6 Alternative to Practical **May/June 2021**

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.

DC (CJ/CB) 208291/3

1 **(a)** A student investigates the rate of respiration in yeast cells.

Yeast is a single-celled organism similar to plant and animal cells.

The student uses methylene blue indicator. A solution of methylene blue loses its blue colour as the yeast cells respire.

Procedure

The student:

- puts 5 cm^3 yeast suspension into each of three test-tubes labelled **A**, **B** and **C**
- adds the volumes of water, 5% glucose solution and methylene blue to test-tubes **A**, **B** and **C** as shown in Table 1.1

Table 1.1

test-tube	volume of water / cm^3	volume of 5% glucose solution / cm^3	volume of methylene blue / cm^3
A	5	0	1
B	4	1	1
C	0	5	1

- places the test-tubes in a water-bath at 40 °C
- records the time taken for the methylene blue to lose its blue colour in each test-tube
- if the time taken is longer than 5 minutes then the student records this value as **>300**
- repeats the procedure.

(i) The student's results for test-tubes **B** and **C** for **trial 2** are shown in Fig. 1.1.

Record these values in Table 1.2.

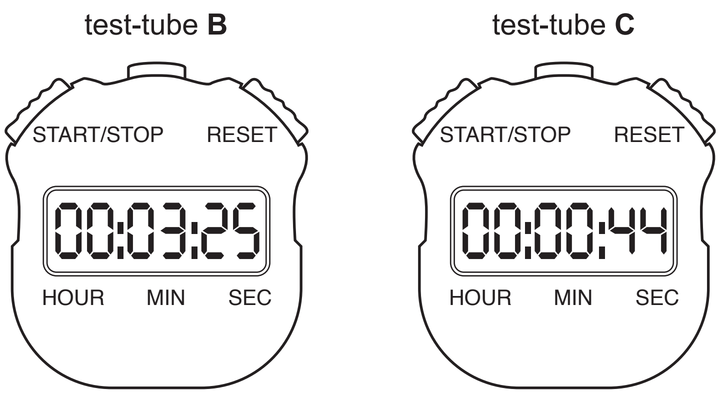


Fig. 1.1

Table 1.2

test-tube	volume of 5% glucose solution / cm^3	time taken to lose blue colour / seconds	
		trial 1	trial 2
A	0	>300	>300
B	1	187	
C	5	53	

[2]

(ii) State a conclusion for the results in Table 1.2.

....

.... [1]

(iii) Suggest why the student repeats the investigation.

....

.... [1]

(iv) Identify **one** variable that is kept constant during this investigation.

....

.... [1]

(v) The student wants to find out if all of the glucose in test-tube **C** has been used up.

Name the testing solution the student uses and give the colour observed for a **negative** result.

testing solution ....

colour for **negative** result ....
[1]

(b) The student thinks that carbon dioxide gas is given off when yeast cells respire.

State the test for carbon dioxide and include the observation for a positive result.

test ....

observation ....
[1]

(c) Fig. 1.2 shows a yeast cell. The yeast cell has a cell wall and a large vacuole similar to a plant cell. The yeast cell is magnified 5000 times.

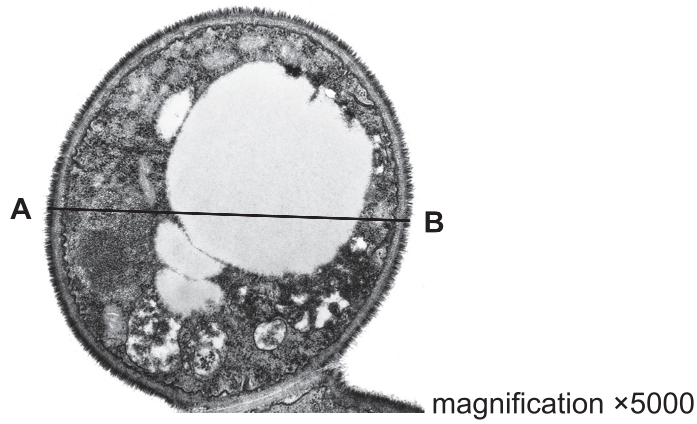


Fig. 1.2

(i) Measure the length of the cell, line **AB**, on Fig. 1.2 in millimetres to the nearest millimetre.

length of line **AB** on Fig. 1.2 = ... mm [1]

(ii) Calculate the actual length of the cell using the equation shown.

$$\text{actual length of cell} = \frac{\text{length of line } \mathbf{AB} \text{ on Fig. 1.2}}{\text{magnification}}$$

actual length of cell = ... mm [1]

(iii) In the box provided, make a large, clear line drawing of the yeast cell in Fig. 1.2 showing the cell wall and vacuole.

[4]

[Total: 13]

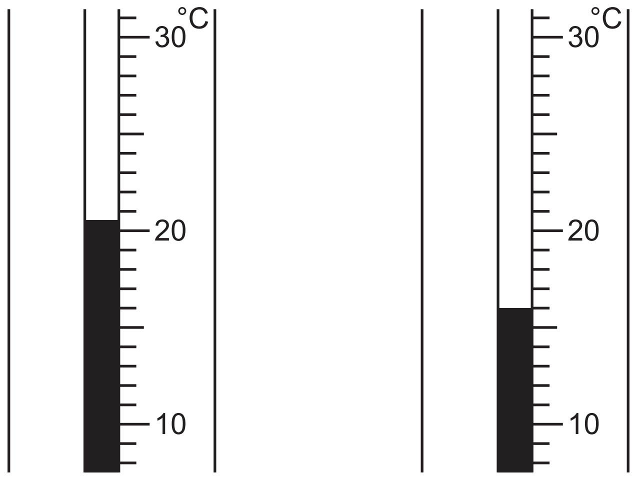
2 A student investigates solid **F**.

(a) Procedure

The student:

- adds some water to a test-tube
- measures the temperature of the water to the nearest 0.5 °C
- adds two spatula loads of solid **F** to the water
- stirs the mixture until all of solid **F** dissolves
- measures the temperature of the solution to the nearest 0.5 °C
- pours the solution into two test-tubes for use in **(b)** and **(c)**.

(i) Fig. 2.1 shows the two thermometer readings.



temperature of water   temperature of solution

Fig. 2.1

Record in Table 2.1 these two temperatures to the nearest 0.5 °C.

Table 2.1

temperature of water/°C	
temperature of solution/°C	

[2]

(ii) In an endothermic process heat energy is taken in from the surroundings.

State if solid **F** dissolving in water is an endothermic process.

Explain your answer using the results in Table 2.1.

....

.... [1]

(b) The student adds three drops of Universal Indicator solution to one of the test-tubes containing the solution of **F**.

The Universal Indicator turns red-orange.

Fig. 2.2 shows a pH colour chart.

red	orange	yellow	green	blue-green	blue	purple
1	4	6	7	8	10	14

Fig. 2.2

(i) Use the pH colour chart in Fig. 2.2 to estimate the pH of the solution of **F**.

.... [1]

(ii) Explain why using a pH colour chart does not give the student an accurate value for the pH of the solution of **F**.

....

.... [1]

(c) The student adds an equal volume of aqueous sodium hydroxide to the other test-tube containing a solution of **F**.

The student warms the mixture carefully and tests the gas formed with damp red litmus paper. The student concludes that ammonia gas is formed.

(i) Describe what happens to the piece of damp red litmus paper during the test for ammonia gas.

.... [1]

(ii) Identify the positive ion present in the solution of **F**.

.... [1]

[Total: 7]

3 Sodium hydrogencarbonate is a white solid that reacts with dilute nitric acid as shown in the word equation.

sodium hydrogencarbonate	+	nitric acid	→	sodium nitrate	+	carbon dioxide	+	water

When sodium hydrogencarbonate is added to dilute nitric acid the reaction mixture fizzes (bubbles). When the fizzing stops the reaction is complete.

The time it takes for the reaction to be completed is called the reaction time.

Plan an investigation to find out how the reaction time depends on the concentration of the dilute nitric acid.

You are provided with:
- sodium hydrogencarbonate powder
- dilute nitric acid
- distilled water

You may use any common laboratory apparatus in your plan.

In your plan, include:

- the apparatus needed
- a brief description of the method and explain any safety precautions you would take
- what you would measure
- which variables you would keep constant
- how you would process your results to draw a conclusion.

You may include a labelled diagram if you wish.

You may include a table that can be used to record the results if you wish.

.... [7]

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4 A student determines the cross-sectional area of a piece of resistance wire using measurements of current and voltage.

Fig. 4.1 shows the cross-sectional area of a wire.

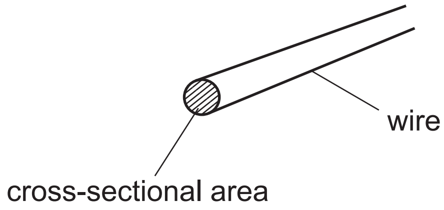


Fig. 4.1

(a) Procedure

The student:

- sets up the circuit shown in Fig. 4.2

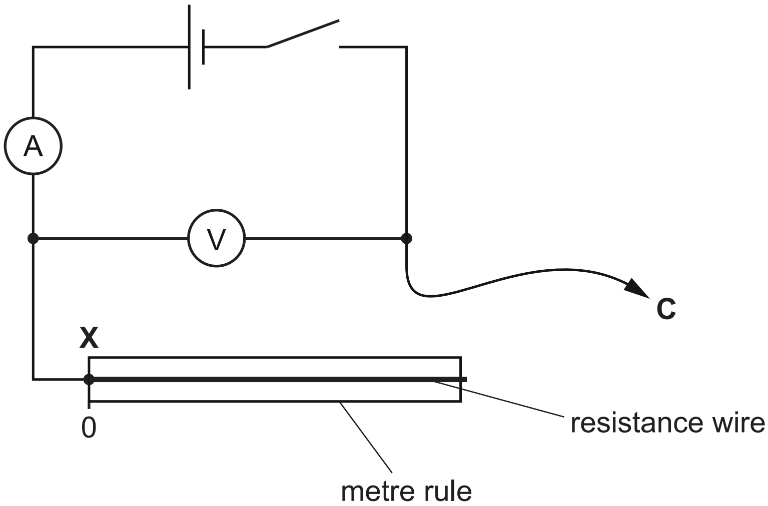


Fig. 4.2

- completes the circuit by connecting **C** to the resistance wire at length l = 400 mm from point **X**, the zero end of the metre rule.
- closes the switch
- records in Table 4.1 the current I flowing in the circuit and the potential difference V between **X** and **C**
- opens the switch.

(i) Fig. 4.3 shows the voltmeter and ammeter readings for l = 400 mm. Record these values in Table 4.1.

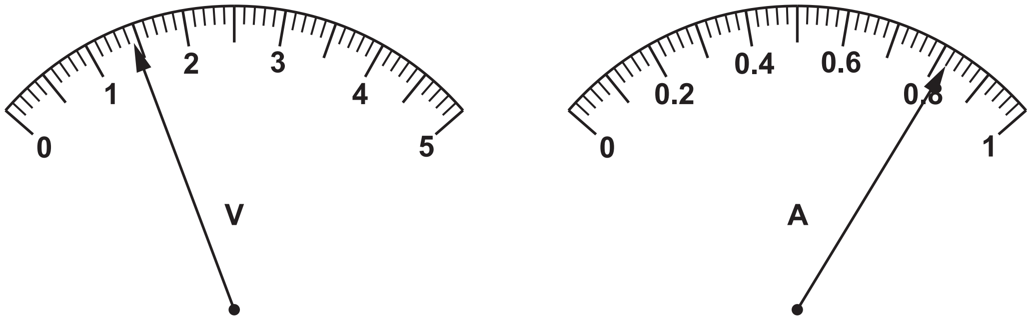


Fig. 4.3

Table 4.1

length, l / mm	potential difference, V / V	current, I / A	resistance, R / Ω
400			
500	1.60	0.73	2.2
700	1.85	0.59	3.1
800	1.90	0.54	3.5
900	1.95	0.50	3.9
1000	2.05	0.46	4.5

[2]

(ii) The student repeats the procedure for lengths l = 500 mm, 700 mm, 800 mm, 900 mm and 1000 mm. The results are shown in Table 4.1.

Suggest why it is good experimental technique to open the switch between each reading.

....

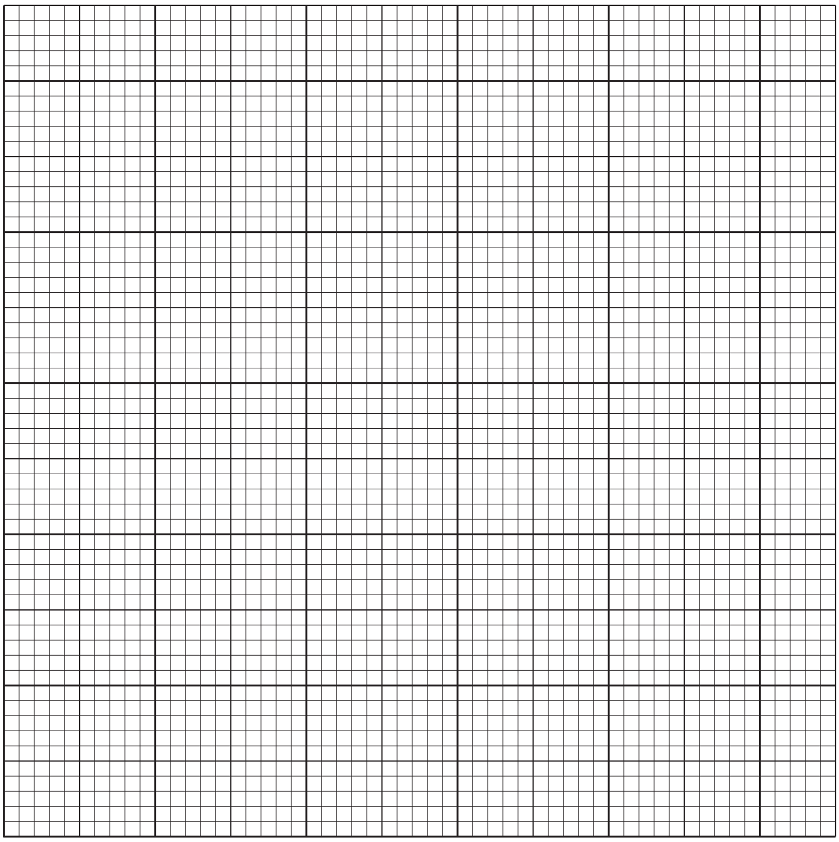
.... [1]

(b) Calculate the resistance R of the 400 mm length of resistance wire. Use the equation shown.

$$R = \frac{V}{I}$$

Record the value of R in Table 4.1. [2]

(c) **(i)** Plot a graph of resistance *R* (vertical axis) against length of wire, *l*.
Start your axes at (0,0).



[3]

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

(iii) Use your graph to estimate the value of *R* at length *l* = 600 mm.

R = ... Ω [1]

(iv) Calculate the gradient *G* of the line.
Indicate on your graph the points that you use to calculate the gradient.

G = ... [2]

(d) Calculate the cross-sectional area *A* of the resistance wire. Use the equation shown.

$$A = \frac{0.00049}{G}$$

If you do not have a value for *G* in **(c)(iv)** use *G* = 0.005 here. This is **not** the correct value for *G*.

A = ... mm^2 [1]

[Total: 13]

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