Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME	

CENTRE NUMBER							CANDIDATE NUMBER					

4782496838

COMBINED SCIENCE **0653/52**

Paper 5 Practical Test **May/June 2021**

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 (MB/CB) 208267/3

1 You are going to investigate the rate of respiration in living cells. You are provided with a suspension of yeast cells.

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

You will use methylene blue indicator. A solution of methylene blue loses its blue colour as the yeast cells respire.

(a) **Procedure**

- Set up and maintain a water-bath at approximately 40 °C.
- Label three test-tubes **A**, **B** and **C**.
- Stir the yeast suspension for about 10 seconds.
- Put 5 cm^3 yeast suspension into each test-tube, **A**, **B** and **C**.
- Place all three test-tubes into the water-bath.

(i) Suggest why the yeast suspension is stirred immediately before it is added to test-tubes **A**, **B** and **C**.

....

.... [1]

(ii) **Procedure**

- Label three more test-tubes **A1**, **B1** and **C1**.
- Use separate syringes to add the volumes of water, 5% glucose solution and methylene blue to test-tubes **A1**, **B1** and **C1** as shown in Table 1.1.
- Swirl each test-tube to mix its contents.

Table 1.1

test-tube	volume of water / cm^3	volume of 5% glucose solution / cm^3	volume of methylene blue / cm^3
A1	0	5	1
B1	4	1	1
C1	5	0	1

- Pour the contents of test-tube **A1** into test-tube **A**, swirl to mix, and return test-tube **A** to the water-bath.
- Pour the contents of test-tube **B1** into test-tube **B**, swirl to mix, and return test-tube **B** to the water-bath.
- Pour the contents of test-tube **C1** into test-tube **C**, swirl to mix, and return test-tube **C** to the water-bath.
- Start the stop-clock.

In Table 1.2, record the time taken to the nearest second for the methylene blue to lose its blue colour.

If the blue colour remains after 8 minutes record this time as **>480**.

Table 1.2

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

[3]

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

....

.... [1]

(iv) Suggest why it is difficult to decide when to stop timing.

Suggest an improvement to help overcome this difficulty.

difficulty ....

....

improvement ....

....

[2]

(b) Fig. 1.1 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.

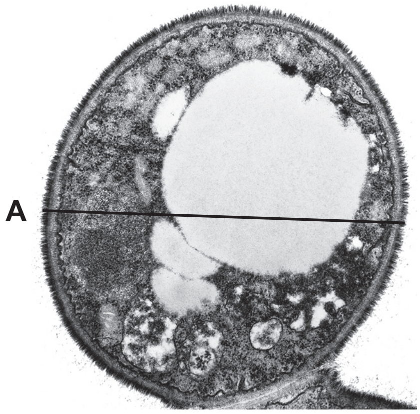

Fig. 1.1

(i) Measure the length of the cell, line **AB**, on Fig. 1.1 in millimetres to the nearest millimetre.

length of line **AB** on Fig. 1.1 = ... mm [1]

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

$$\text{actual length of cell} = \frac{\text{length of line } \mathbf{AB} \text{ on Fig. 1.1}}{\text{magnification}}$$

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

(iii) In the box provided, make a large, clear line drawing of the yeast cell in Fig. 1.1 showing the cell wall and vacuole.

[4]

[Total: 13]

2 You are going to investigate solid **F**.

(a) **(i)** **Procedure**

- Add approximately 5 cm depth of distilled water to a small test-tube.
- Measure and record, in Table 2.1, the temperature of the water to the nearest 0.5 °C.
- Add two spatula loads of solid **F** to the water in the test-tube.
- Stir the mixture with the thermometer until all of solid **F** dissolves.
- Measure and record in Table 2.1, the temperature of the solution to the nearest 0.5 °C.
- Divide the solution between two large test-tubes (boiling tubes) for use in **(b)** and **(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) To one large test-tube containing the solution of **F**, add three drops of Universal Indicator solution, swirl to mix, and observe the colour.

(i) Record the colour of the solution of **F** with Universal Indicator.

.... [1]

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

....

.... [1]

(c) To the other large test-tube containing the solution of **F**, add an equal volume of aqueous sodium hydroxide.

Warm the mixture carefully, and test the gas formed with a piece of damp red litmus paper.

(i) Describe what happens to the piece of damp red litmus paper.

.... [1]

(ii) Name the gas formed in this experiment.

.... [1]

[Total: 7]

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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.

You are not required to do this investigation.

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 You are going to determine the cross-sectional area of a piece of resistance wire. Fig. 4.1 shows the cross-sectional area of a wire.

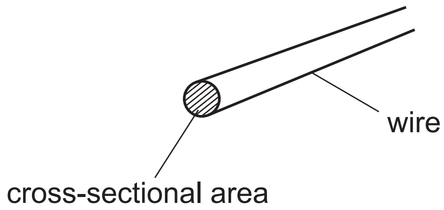


Fig. 4.1

(a) **(i)** The circuit shown in Fig. 4.2 has been set up for you.

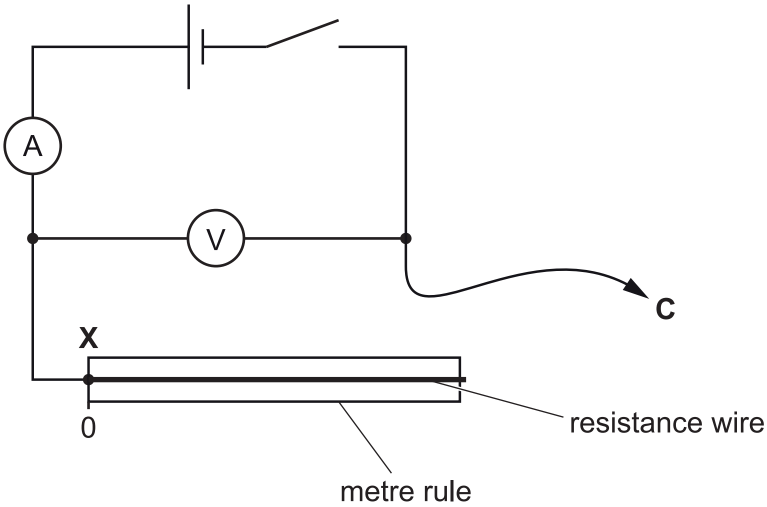


Fig. 4.2

Procedure

- Complete the circuit by connecting **C** at length l = 200 mm from point **X**, the zero end of the metre rule.
- Close the switch.
- Record in Table 4.1 the current I flowing in the circuit and the potential difference V between **X** and **C**.
- Open the switch.

Table 4.1

length, l / mm	potential difference, V / V	current, I / A	resistance, R / Ω
200			
400			
600			
800			
1000			

[2]

(ii) Repeat the procedure for lengths l = 400 mm, 600 mm, 800 mm, and 1000 mm. Record your results in Table 4.1. [2]

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

....

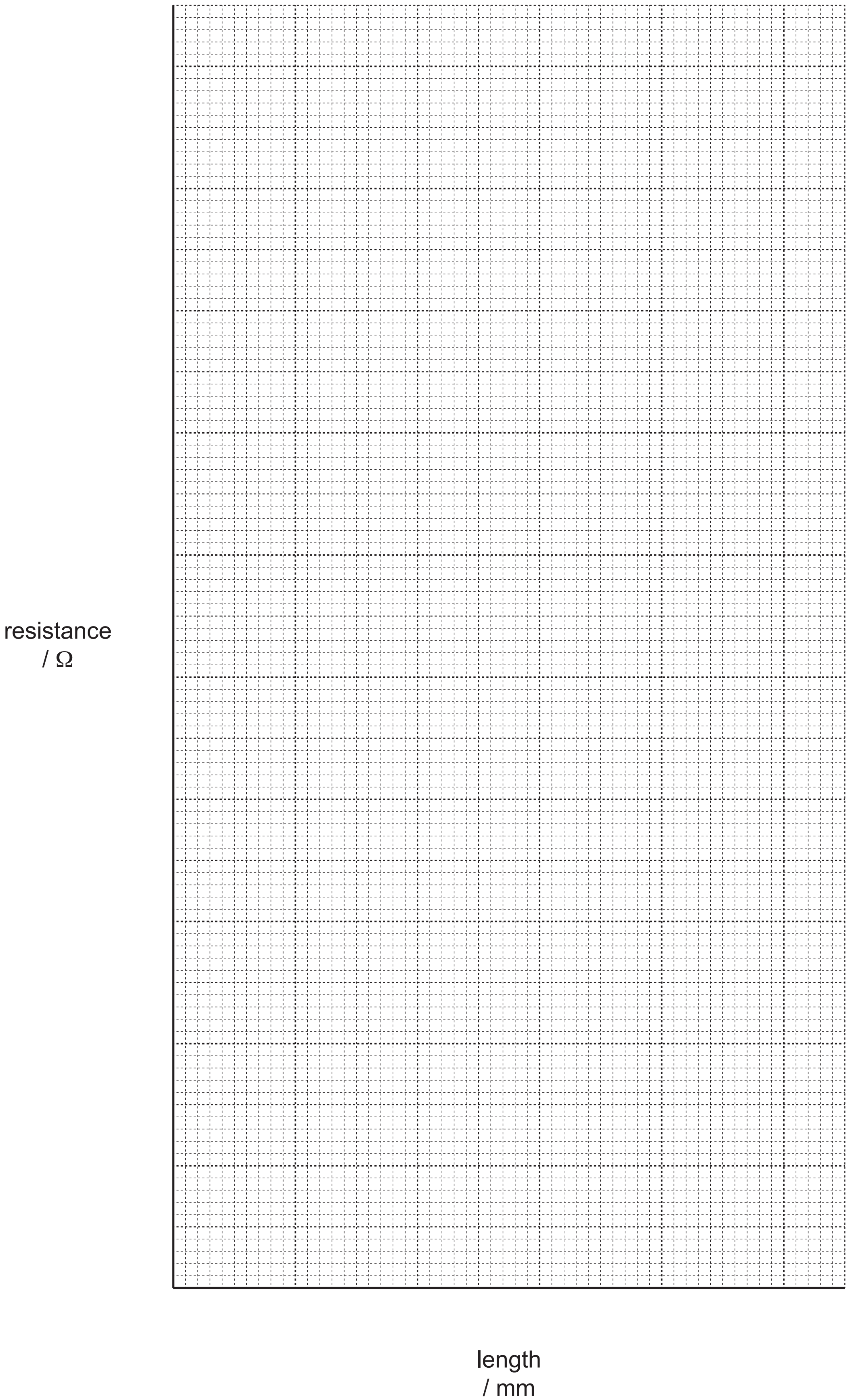
.... [1]

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

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

Record the values of R in Table 4.1. [1]

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



[2]

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

(iii) 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.

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

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

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

A = ... mm^2 [2]

[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	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 (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