Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0857378572

BIOLOGY **5090/41**

Paper 4 Alternative to Practical **October/November 2025**

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 **12** pages. Any blank pages are indicated.

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1 Apple juice is made by cutting up and crushing apples. When apple tissue is cut up and crushed, it can become a darker colour and go brown.

Some students investigated the effect of vitamin C on the colour change in apples when they are cut up and crushed.

The students followed these instructions:

- Label a large test-tube and add 5 cm^3 of vitamin C solution.
- Label a second large test-tube and add 5 cm^3 of distilled water.
- Label a third large test-tube and do **not** add any liquid.
- Cut three cubes of apple each 1 cm × 1 cm × 1 cm. Do **not** include any skin or core.
- Cut each cube into many small pieces. Take care to keep the pieces from each cube separate.
- Add the pieces of one cube to the test-tube containing vitamin C solution.
- Add the pieces of the second cube to the test-tube containing distilled water.
- Add the pieces of the third cube to the test-tube with **no** added liquid.
- Use a glass rod to gently crush the pieces of apple in the bottom of each test-tube.
- Clean the glass rod between using it in each test-tube.
- Start timing.

(a) (i) Describe the most appropriate piece of apparatus to measure the required volumes of vitamin C solution and distilled water.

..... [2]

(ii) Explain why the students were told to clean the glass rod.

.....

..... [1]

The students noted that the apple tissue in each test-tube was white when they started timing.

They observed the colour of the apple tissue in each test-tube at 5, 10 and 15 minutes and recorded this in their notebooks.

Fig. 1.1 shows one of their notebooks.

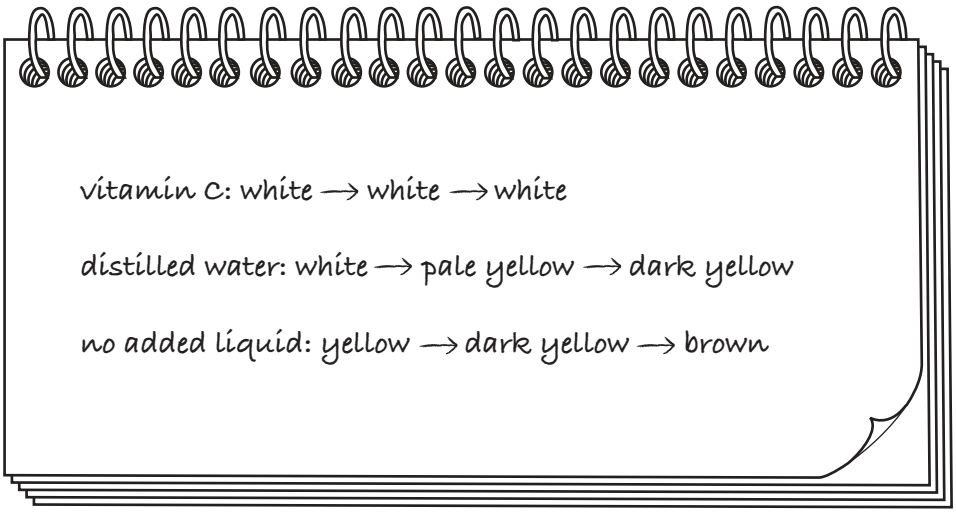

Fig. 1.1

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(iii) Complete the headings in Table 1.1 and use the observations in Fig. 1.1 to complete the table.

Table 1.1

.....	.....		
	vitamin C	**distilled water**	**no added liquid**
0	white	white	white
5			
10			
15			

[3]

(iv) Using your observations in Table 1.1, state what can be concluded about the effect of vitamin C on the colour change when apple is cut up and crushed.

.....

..... [1]

(v) Using your observations in Table 1.1, state what can be concluded about the effect of distilled water on the colour change when apple is cut up and crushed.

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.....

..... [2]

(vi) The students were aware that there may have been sources of error in the method used which affected their observations.

Suggest **one** possible source of error and suggest how it could be overcome.

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..... [2]

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(b) (i) The students then measured the pH of the vitamin C solution and the pH of the distilled water using universal indicator paper, with these results:

distilled water: pH 6

vitamin C solution: pH 4.

Describe how you would use universal indicator paper to determine the pH of a liquid.

.....

.....

.....

..... [2]

(ii) When apple tissue is cut up and crushed, an enzyme comes into contact with oxygen in the air. In the presence of oxygen, the enzyme catalyses the reaction of a colourless molecule in the cells of the apple tissue to cause the change in colour.

Suggest how this might explain the effect of:

distilled water .....

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vitamin C .....

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[2]

[Total: 15]

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2 Yeast is used to produce bread. Flour is mixed with water and yeast to produce dough. The yeast breaks down starch in the flour to produce sugar. The yeast uses the sugar for respiration, giving off bubbles of carbon dioxide. The bubbles of carbon dioxide are trapped in the dough, making it increase in volume before it is baked.

(a) Some students tested the effect of yeast in four doughs, each made from a different type of flour – wheat, rye, buckwheat and maize. The effect of the yeast in the dough was evaluated by measuring how much the dough increased in volume.

The same mass of each type of flour was mixed with the same volume of water and the same mass of yeast to form a dough. Four 100 cm^3 measuring cylinders were labelled and dough was added to each. The volume of the dough in each of the cylinders was measured and recorded at 15-minute intervals. Some of the results are shown in Table 2.1.

(i) Fig. 2.1 shows the measuring cylinder with dough made from wheat flour after 30 minutes. Record the volume of the dough in Table 2.1. [1]

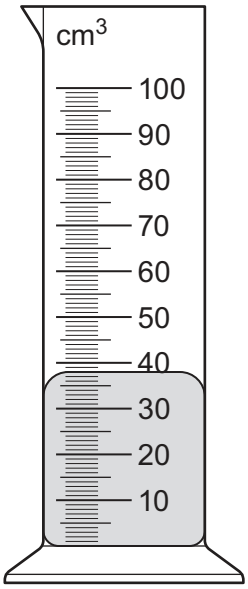

Fig. 2.1

(ii) Complete Table 2.1 by calculating the total increase in volume of each dough after 45 minutes.

Table 2.1

time / minutes	volume of dough in measuring cylinder / cm^3			
	wheat flour	rye flour	buckwheat flour	maize flour
0	20	21	21	20
15	24	23	21	21
30		27	22	22
45	45	32	23	22
total increase in volume after 45 minutes	25			

[2]

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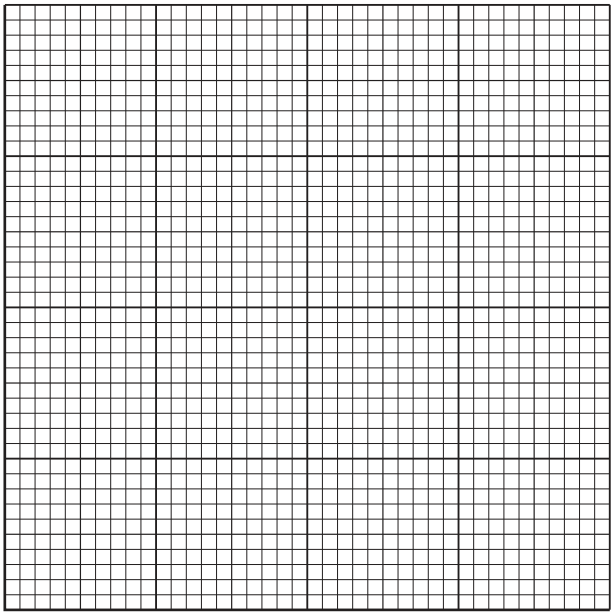
(iii) On the grid draw a bar chart to show the total increase in volume of the four doughs after 45 minutes.



[4]

The students wanted to know why the effect of yeast in the four doughs varied.

Table 2.2 shows some of the biological molecules in the four flours.

Table 2.2

biological molecule	mass / g per 100 g flour			
	wheat flour	rye flour	buckwheat flour	maize flour
starch	54.5	54.1	59.0	74.0
gluten (a protein)	8.9	3.1	0.0	0.0
fibre	10.6	13.7	10.4	4.3

(iv) Using Table 2.2, your bar chart and the information about the process of bread production, suggest and explain how these biological molecules affect the total increase in volume of bread dough.

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..... [3]

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(b) Describe how you would show that each of the four flours contained starch.

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..... [2]

(c) The students made more dough from wheat flour, yeast and water.

Using this dough, plan an investigation based on the method in **2(a)** to determine the effect of temperature on the increase in volume of dough at temperatures between 20 °C and 80 °C.

Predict your expected results.

investigation plan .....

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expected results .....

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[6]

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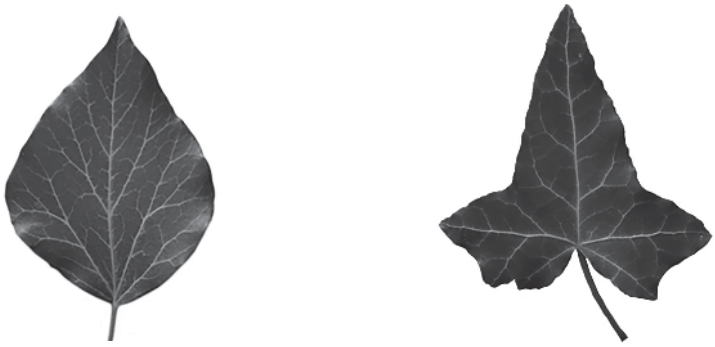
3 A student investigated a plant that had some stems with flowers and some stems with **no** flowers. The student picked one leaf from a stem with flowers and one leaf from a stem with **no** flowers. Fig. 3.1 shows the two leaves.



magnification ×1 magnification ×2

leaf from stem with flowers leaf from stem with **no** flowers

Fig. 3.1

(a) (i) Complete Table 3.1 to compare the size and shape of the leaves.

Table 3.1

feature of leaf	leaf from stem with flowers	leaf from stem with no flowers
size		
shape		

[2]

(ii) Suggest what the student needs to do to be certain that the two leaves they picked are representative of the leaves on the two types of stem.

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..... [2]

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(b) In the space below, make a large drawing of the leaf from the stem with **no** flowers as it appears in Fig. 3.1.

[3]

[Total: 7]

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