Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/32**

Paper 3 Advanced Practical Skills 2 **May/June 2025**

2 hours

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 [ ].

For Examiner's Use	
1	
2	
Total	

This document has **12** pages. Any blank pages are indicated.

[Turn over

1 Invertase is an enzyme that catalyses the breakdown of sucrose into glucose and fructose.

Invertase can be extracted from yeast cells.

You will investigate the effect of an invertase extract on a sucrose solution and estimate the concentration of reducing sugars produced.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
E	invertase extract	irritant	20
R	0.5% reducing sugar solution	none	40
W	distilled water	none	100
S	0.2% sucrose solution	none	20
Benedict's	Benedict's solution	harmful irritant	20

If any solution comes into contact with your skin, wash off immediately under cold water.

It is recommended that you wear suitable eye protection.

You will need to make the different concentrations of reducing sugar solution using the 0.5% reducing sugar solution, **R**.

You will need to prepare 20 cm^3 of each concentration, using **R** and **W**.

Table 1.2 shows the concentrations of reducing sugar you will use.

Decide which volumes of **R** and **W** you will use.

(a) (i) Complete Table 1.2 to show how you will prepare the concentrations of reducing sugar using **R** and **W**.

Table 1.2

percentage concentration of reducing sugar	volume of R / cm^3	volume of W / cm^3
0.5	20.0	0.0
0.1		
0.05		
0.01	0.4	
0	0.0	20.0

[2]

Preparing reducing sugar standards.

Carry out step 1 to step 8.

step 1 Set up a water-bath and heat it to boiling, ready for step 6 and step 15.

step 2 In the beakers provided, prepare the concentrations of reducing sugar shown in Table 1.2.

step 3 Label test-tubes with the concentrations of reducing sugar stated in Table 1.2.

step 4 Put 2 cm^3 of **Benedict's** solution into each labelled test-tube.

step 5 Put 2 cm^3 of the 0.5% reducing sugar solution, **R**, into the appropriately labelled test-tube.

step 6 Put the test-tube containing **R** into the water-bath and start timing.

step 7 Record in **(a)(ii)** the time taken to the first appearance of a colour change.
If there is **no** colour change after 120 seconds, stop timing and record the results as 'more than 120'.

step 8 Repeat step 5 to step 7 with the other concentrations of reducing sugar.

(ii) Record your results in an appropriate table.

[5]

Investigating invertase.

Carry out step 9 to step 16.

step 9 Label **one** test-tube **W** and label **one** test-tube **E**.

step 10 Put 1.0 cm^3 of 0.2% sucrose solution, **S**, into these test-tubes.

step 11 Add 1.0 cm^3 of distilled water, **W**, to test-tube **W** and mix well.

step 12 Add 1.0 cm^3 of invertase extract, **E**, to test-tube **E** and mix well.

step 13 Leave the test-tubes for 5 minutes.

step 14 After the 5 minutes, put 2 cm^3 of **Benedict's** solution into each test-tube.

step 15 Put the test-tubes in the water-bath prepared in step 1.

step 16 Record in **(a)(iii)** the time taken to the first appearance of a colour change.
If there is **no** colour change after 120 seconds, stop timing and record the results as 'more than 120'.

(iii) Record the time taken to the first appearance of a colour change in test-tube **W** and test-tube **E**.

result for **W** ..... s

result for **E** ..... s
[1]

(iv) Use your results in **(a)(ii)** and **(a)(iii)** to estimate the concentration of reducing sugar in test-tube **W** and test-tube **E**.

concentration in test-tube **W** = ... %

concentration in test-tube **E** = ... %
[1]

(v) With reference to the invertase extract, distilled water and sucrose solution, explain the results in **(iv)**.

test-tube **W** .....

.....

.....

test-tube **E** .....

.....
[3]

(vi) Suggest **two** improvements to the procedure that would give you a more accurate value for your estimated concentration of reducing sugar in test-tube **E**.

1 .....

.....

2 .....

.....

[2]

(b) Yeast cells also produce the enzyme catalase. Catalase breaks down hydrogen peroxide into oxygen gas and water.

A student added different concentrations of catalase enzyme to hydrogen peroxide and counted the number of oxygen bubbles produced in 5 minutes.

Table 1.3 shows the results of the investigation.

Table 1.3

percentage concentration of catalase	number of bubbles of oxygen in 5 minutes
0.0	1
2.0	22
4.0	44
6.0	50
8.0	94
10.0	118

(i) Plot a graph of the data shown in Table 1.3 on the grid in Fig. 1.1.

Use a sharp pencil.

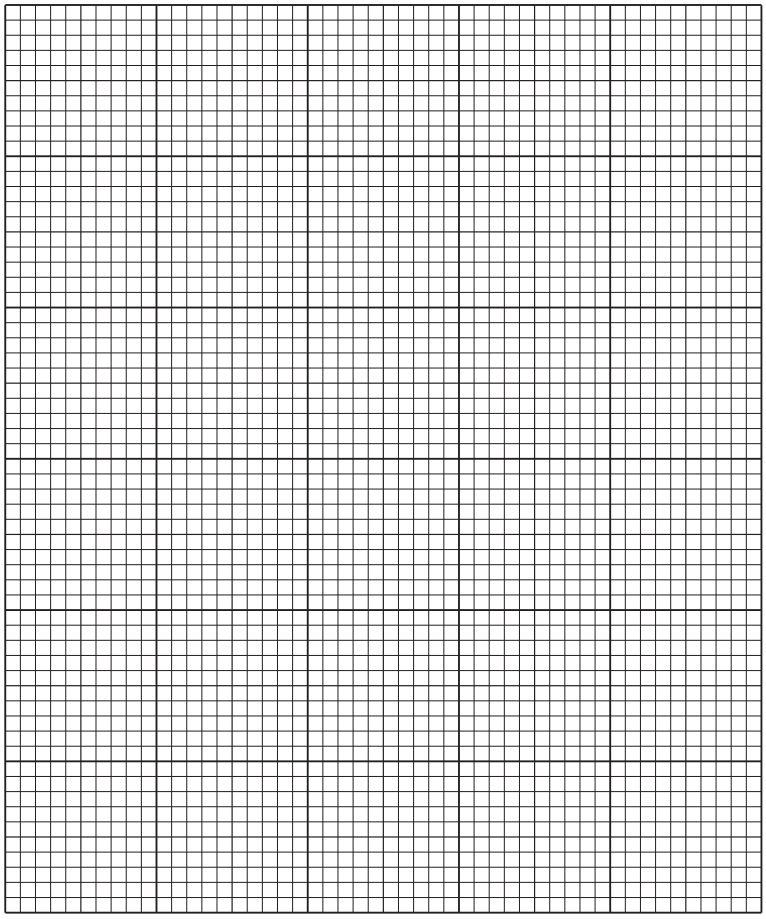


Fig. 1.1

[4]

(ii) State the percentage concentration of catalase that gave an anomalous result.

..... percentage concentration
[1]

(iii) Describe the trend shown by the results.

.....

.....

..... [1]

(iv) Suggest an explanation for the result at 0% concentration of catalase.

.....

.....

..... [1]

(v) The student observed that the size of the bubbles varied.

Suggest a more accurate method of measuring the oxygen produced.

.....

.....

..... [1]

[Total: 22]

2 **K1** is a slide of a stained transverse section through a plant stem.

(a) **(i)** Draw a large plan diagram of the region of the stem on **K1** indicated by the shaded area in Fig. 2.1. Use a sharp pencil.

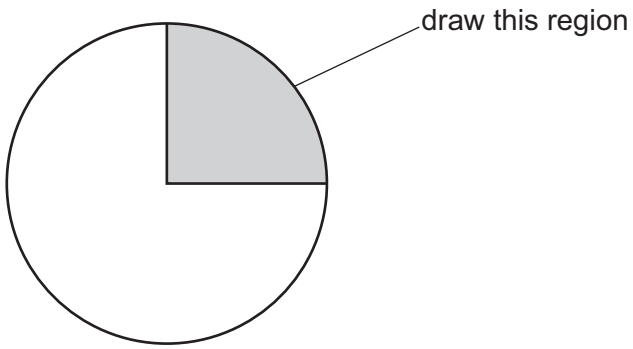


Fig. 2.1

Use **one** ruled label line and label to identify a vascular bundle.

[5]

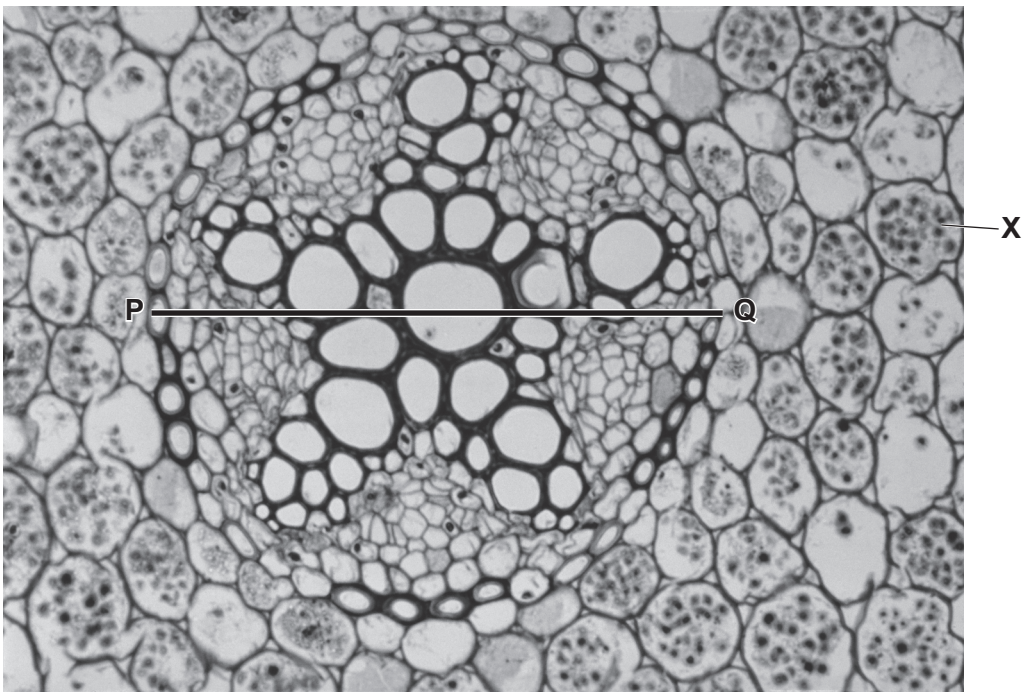
(ii) Observe one vascular bundle of the section on **K1**.

Select **one** large xylem vessel element and a group of **three** adjacent smaller xylem vessel elements.

- Make a large drawing of this group of **four** xylem vessel elements.
- Use **one** ruled label line and label to identify the wall of one xylem vessel element.

[5]

(b) Fig. 2.2 is a photomicrograph of a vascular bundle from the root of the same plant species as the stem on **K1**.



magnification ×350

Fig. 2.2

(i) Line **P–Q** represents the width of the vascular bundle.

Use the magnification and the line **P–Q** to calculate the actual width of the vascular bundle.

Show your working **and** give your answer in micrometres (μm).

actual width = ... μm
[3]

(ii) Identify **one** observable similarity and **two** observable differences between the vascular bundle in Fig. 2.2 and the vascular bundle on **K1**.

similarity

.....

.....

differences

1 .....

.....

2 .....

.....

[4]

(iii) The cell labelled **X** on Fig. 2.2 has structures that contain a storage polysaccharide.

State a suitable reagent for identifying this polysaccharide.

..... [1]

[Total: 18]

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