Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/34**

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 **16** pages. Any blank pages are indicated.

[Turn over

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1 Catalase is an enzyme found in yeast cells. It catalyses the breakdown of hydrogen peroxide to produce water and oxygen, as shown in Fig. 1.1.

$$\text{hydrogen peroxide} \xrightarrow{\text{catalase}} \text{water + oxygen}$$

Fig. 1.1

You will investigate the effect of copper sulfate on the progress of this reaction. You will do this by stopping the reaction after 5 minutes and measuring the concentration of hydrogen peroxide remaining.

Potassium manganate(VII) is used to measure the concentration of hydrogen peroxide.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
Y	yeast suspension	none	20
H	hydrogen peroxide solution	irritant	20
C	1.0% copper sulfate solution	irritant	30
A	dilute sulfuric acid	irritant	30
P	potassium manganate(VII) solution	harmful	30
W	distilled water	none	150

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

You should wear suitable eye protection.

It is recommended that you wear gloves when using **A** and **P**.

You will need to carry out a serial dilution of the 1.0% copper sulfate solution, **C**, to reduce the concentration by **half** between each successive dilution.

You will need to prepare **four** concentrations of copper sulfate solution in addition to the 1.0% copper sulfate solution, **C**.

After the serial dilution is completed, you need to have 10 cm^3 of each concentration available to use.

(a) (i) Complete Fig. 1.2 to show how you will prepare your serial dilution.

Each beaker should have:

- a labelled arrow to show the volume of copper sulfate solution transferred
- a labelled arrow to show the volume of distilled water, **W**, added
- a label under each beaker to show the concentration of the copper sulfate solution.

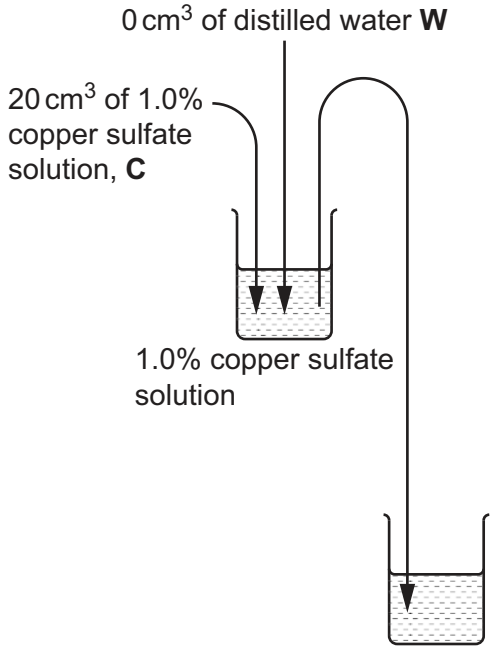

Fig. 1.2

[3]

Carry out step 1 to step 7.

step 1 Prepare the concentrations of copper sulfate solution as shown in Fig. 1.2.

step 2 Label test-tubes with the concentrations prepared in step 1.

step 3 Put 1 cm^3 of the 1.0% copper sulfate solution into the appropriately labelled test-tube.

step 4 Put 1 cm^3 of each of the other concentrations of copper sulfate solution, as prepared in step 1, into the appropriately labelled test-tube.

step 5 Stir the yeast suspension, **Y**, and put 1 cm^3 of **Y** into each test-tube. Shake the test-tubes gently to mix. Wait for 2 minutes.

step 6 Put 1 cm^3 of hydrogen peroxide solution, **H**, into each test-tube. Shake gently to mix. Wait for 5 minutes.

step 7 After 5 minutes, put 2 cm^3 of sulfuric acid, **A**, into each test-tube. Shake gently to mix.

The addition of sulfuric acid stops the breakdown of hydrogen peroxide.

You will now compare the concentration of hydrogen peroxide remaining in each test-tube using potassium manganate(VII) solution, **P**.

- When a drop of **P** is added to hydrogen peroxide solution, you will see a pink colour that quickly turns colourless as **P** reacts with the hydrogen peroxide.
- You will continue adding **P**, one drop at a time, until the end-point is reached.
- The end-point is when the pink colour stays for at least 5 seconds.
- You will count the number of drops to reach the end-point.
- The greater the concentration of hydrogen peroxide, the more drops of **P** are needed to reach the end-point.

Carry out step 8 to step 14.

step 8 Fill the syringe labelled **P** with solution **P**.

step 9 Wipe the outside of the syringe with a paper towel.

step 10 Hold the syringe labelled **P** over the test-tube containing the **lowest** concentration of copper sulfate solution. Release **one** drop of **P** into the test-tube.

step 11 Shake the test-tube to mix. Observe the colour to see if the end-point is reached. The end-point is when the pink colour stays for at least 5 seconds.

step 12 Repeat step 10 and step 11, counting the total number of drops released until the end-point is reached. You may need to refill the syringe with **P**.

step 13 Record in **(a)(ii)** the number of drops of **P** added. If the end-point has **not** been reached with 30 drops, record the result as 'more than 30'.

step 14 Repeat step 8 to step 13 with each of the other concentrations of copper sulfate solution prepared in step 1.

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(ii) Record your results in an appropriate table.

[5]

(iii) Describe the effect of changing the concentration of copper sulfate solution on the concentration of hydrogen peroxide remaining in the test-tubes.

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..... [1]

(iv) Describe **one** source of error in step 10 to step 12.

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.....

..... [1]

River water can sometimes be contaminated with copper sulfate from factories.

You will use the procedure described in step 5 to step 12 to estimate the concentration of copper sulfate in a sample of river water, **R**.

You are provided with the materials shown in Table 1.2.

Table 1.2

labelled	contents	hazard	volume / cm^3
R	sample of river water with unknown concentration of copper sulfate	irritant	20

step 15 Label a test-tube **R**. Put 1 cm^3 of **R** into the test-tube.

step 16 Repeat step 5 to step 12. Record the number of drops of **P** needed to reach the end-point in **(a)(v)**.

(v) State the number of drops needed to reach the end-point for sample **R**.

..... [1]

(vi) Use your results in **(a)(ii)** and **(a)(v)** to estimate the concentration of copper sulfate in the sample of river water, **R**.

..... [1]

Question 1 continues on page 10.

(b) Some scientists investigated a possible treatment for controlling blood sugar levels in humans. The scientists measured the effect of an inhibitor found in green tea on the activity of the enzyme sucrase. This enzyme hydrolyses sucrose into glucose and fructose.

The results are shown in Table 1.3.

Table 1.3

concentration of inhibitor / mg cm^{-3}	percentage inhibition of sucrase
0.50	8.0
1.00	27.5
1.50	44.5
2.00	51.0
2.50	52.5

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

Use a sharp pencil.

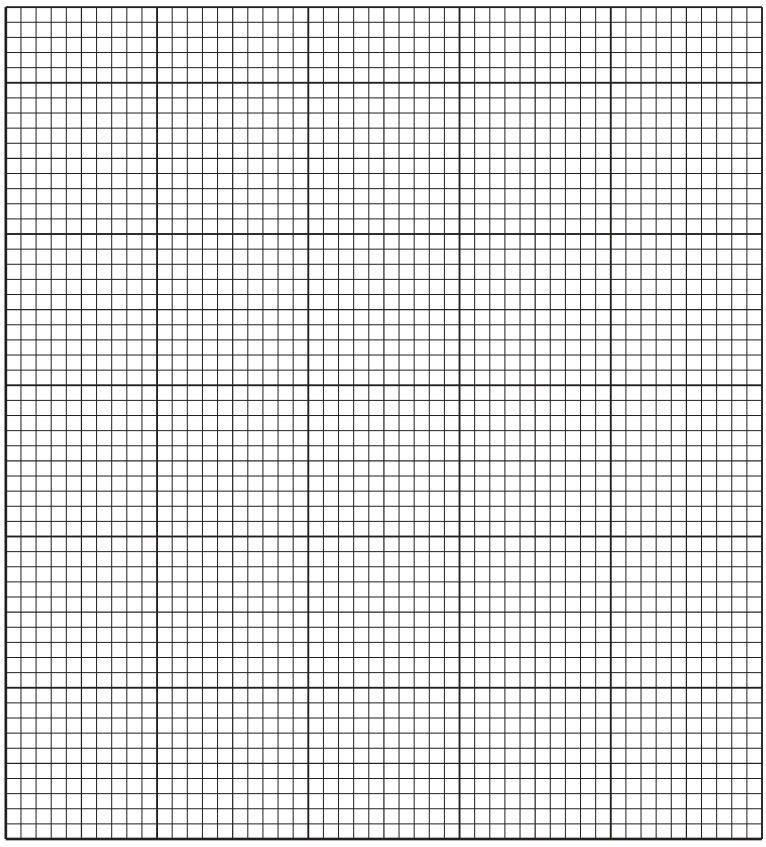

Fig. 1.3

[4]

(ii) Draw **two** lines on your graph in Fig. 1.3 to show the concentration of inhibitor that causes 24% inhibition of sucrase. [1]

(iii) Suggest how the inhibitor in green tea reduces the activity of the enzyme sucrase.

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..... [2]

(iv) The scientists calculated the percentage inhibition of sucrase by measuring the concentration of reducing sugars in the solution after 5 minutes.

Describe how the scientists could determine the concentration of reducing sugars in the solution.

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..... [3]

[Total: 22]

2 **M1** is a slide of a stained transverse section through a leaf.

(a) (i) Draw a large plan diagram of the region of the leaf on **M1** indicated by the shaded area in Fig. 2.1. Use a sharp pencil.

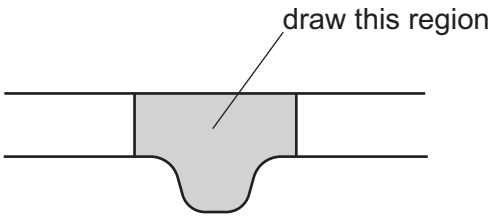

Fig. 2.1

Use **one** ruled label line and label to identify the lower epidermis.

[5]

(ii) Observe the xylem vessel elements in the leaf on **M1**.

Select a line of **four** adjacent xylem vessel elements.

Each xylem vessel element must touch at least **one** other xylem vessel element.

- Make a large drawing of this line 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 shows a photomicrograph of a transverse section through a different leaf from that on **M1**.

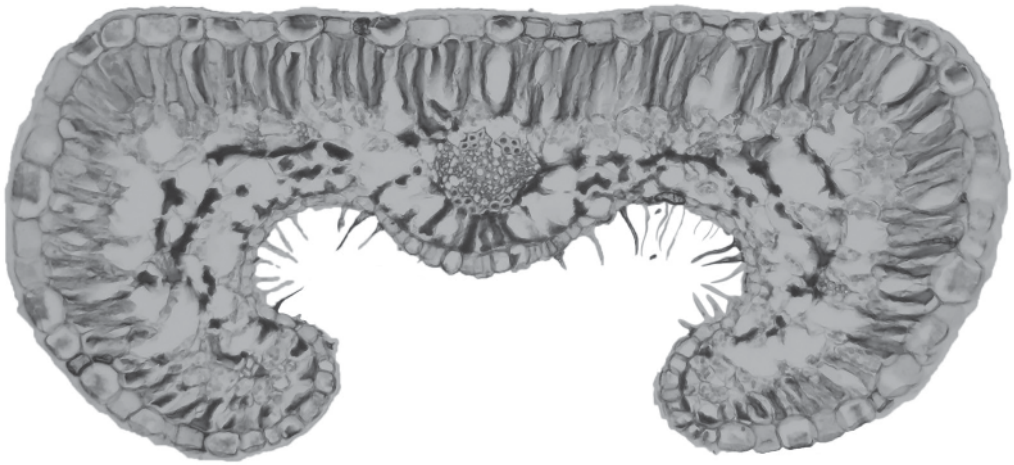

Fig. 2.2

Identify **three** observable differences, other than colour, between the section on **M1** and the section in Fig. 2.2.

Record these **three** observable differences in Table 2.1.

Table 2.1

feature	M1	Fig. 2.2

[4]

(c) Fig. 2.3 is the same photomicrograph as that shown in Fig. 2.2.

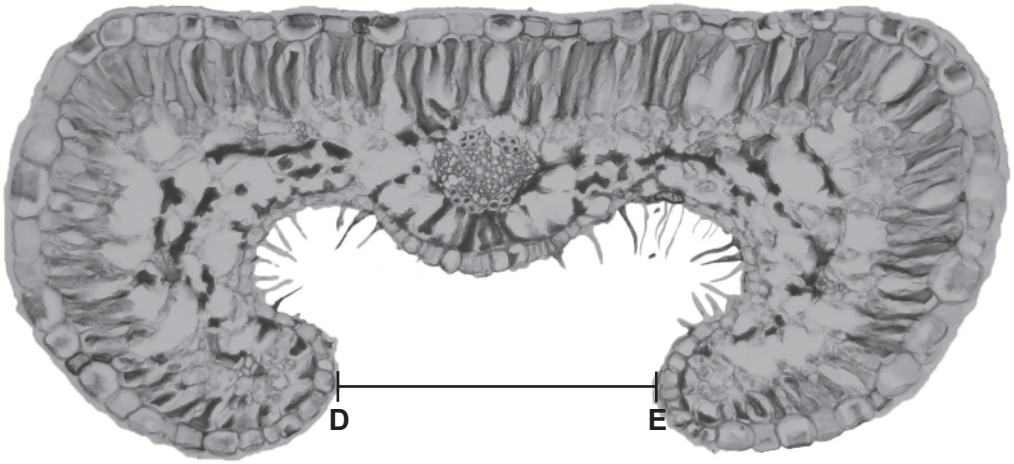

Fig. 2.3

Use the scale bar on Fig. 2.3 and the line **D**–**E** to calculate the actual length of the gap between the ends of the leaf.

Show your working, including units and give your answer in micrometres (μm).

actual length of gap = ... μm [4]

[Total: 18]

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