Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2780300147

BIOLOGY **9700/35**

Paper 3 Advanced Practical Skills 1 **October/November 2022**

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.

1 Yeast cells contain the enzyme catalase which catalyses the breakdown of hydrogen peroxide, releasing oxygen.

You will investigate the effect of substrate concentration on the activity of catalase in yeast.

You will need to immobilise the yeast in sodium alginate beads.

When a bead containing yeast is dropped into hydrogen peroxide solution the bead will sink. As oxygen is released the bead will rise. The faster the oxygen is released, the faster the bead will rise.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
Y	7.0% yeast cell suspension	none	15
H	6.0% hydrogen peroxide solution	harmful irritant	30
S	2.0% sodium alginate solution	none	30
W	distilled water	none	100
C	1.5% calcium chloride solution	none	30

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

It is recommended that you wear suitable eye protection.

Carry out step 1 to step 7 to immobilise the yeast.

step 1 Put 10 cm^3 of **C** into a large test-tube.

step 2 Put 5 cm^3 of **S** into a small beaker.

step 3 Stir **Y** and put 3 cm^3 of **Y** into the beaker used in step 2. Mix well.

step 4 Use a 5 cm^3 syringe to collect 2 cm^3 of the mixture of **S** and **Y** (prepared in step 3).

step 5 Position the 5 cm^3 syringe over the large test-tube containing **C** as shown in Fig. 1.1.

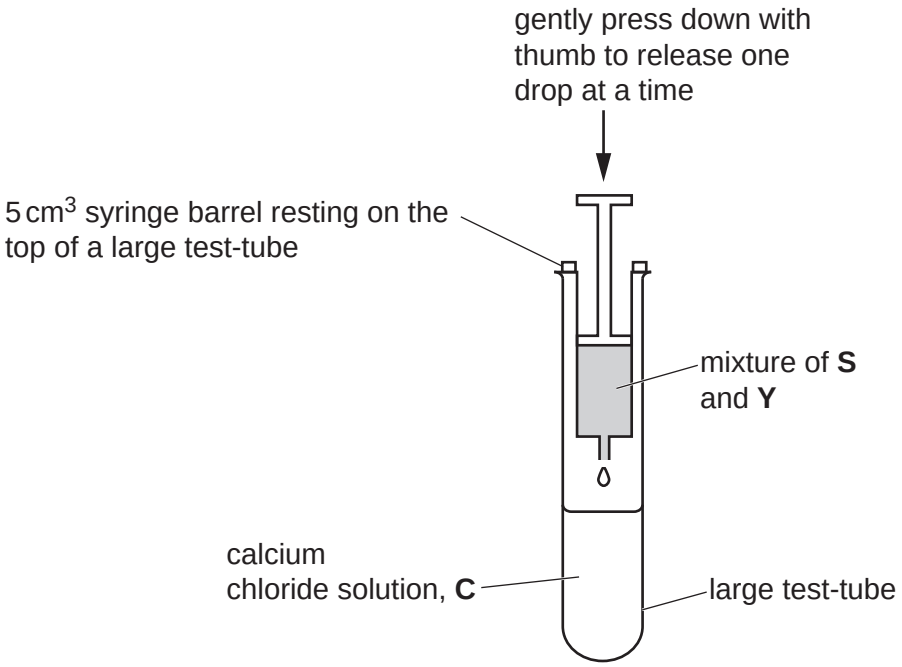

Fig. 1.1

step 6 Gently press down on the plunger of the 5 cm^3 syringe with your thumb to release one drop into solution **C**. The drop should form a bead.

step 7 Repeat step 6 until you have used all 2 cm^3 of the mixture.

You will use these beads in step 11.

You will need to carry out a **serial** dilution of the 6.0% hydrogen peroxide solution, **H**, to reduce the concentration by **half** between each successive dilution.

You will need to prepare **four** concentrations of solution in addition to the 6.0% hydrogen peroxide solution, **H**.

After the serial dilution is completed, you will 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.

Fig. 1.2 shows the first two beakers you will use to make your serial dilution. You will need to draw **three** additional beakers.

For each beaker add labelled arrows to show:

- the volume of hydrogen peroxide solution transferred
- the volume of distilled water, **W**, added.

Under each beaker, state the concentration of hydrogen peroxide solution.

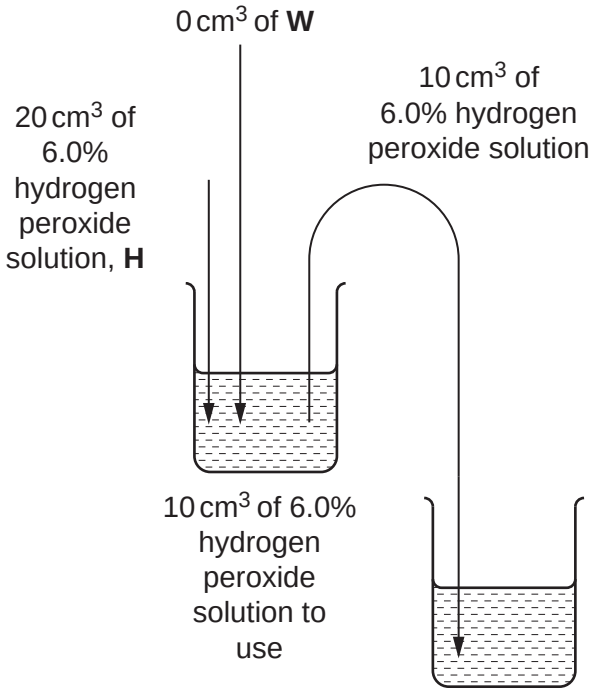
0 cm3 of W
20 cm3 of 6.0% hydrogen peroxide solution, H
10 cm3 of 6.0% hydrogen peroxide solution
10 cm3 of 6.0% hydrogen peroxide solution to use

Fig. 1.2

[3]

Carry out step 8 to step 16.

step 8 Prepare the concentrations of hydrogen peroxide solution, as decided in **(a)(i)**, in the beakers provided.

step 9 Label the **small** test-tubes with the concentrations you prepared in step 8.

step 10 Put 10 cm^3 of each hydrogen peroxide concentration into the appropriately labelled test-tube. Leave these test-tubes in a test-tube rack.

step 11 Tip the contents of the large test-tube from step 7 into a Petri dish.

step 12 Pick up a bead using blunt forceps.

step 13 Drop the bead into the test-tube containing 6.0% hydrogen peroxide solution, **H**. Start timing when the bead reaches the bottom of the test-tube. If the bead does **not** sink to the bottom of the test-tube, record the time as zero.

step 14 Time how long it takes for the bead to reach the surface of the hydrogen peroxide solution.
If the bead does not reach the surface after 180 seconds, stop timing and record as 'more than 180'.

step 15 Record the result from step 14 in **(a)(ii)**.

step 16 Repeat step 12 to step 15 with the remaining concentrations of hydrogen peroxide solution.

(ii) Record your results in an appropriate table.

[5]

(iii) State **one** significant source of error in this investigation.

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..... [1]

(iv) Suggest how you could make an improvement to this investigation to reduce the error stated in **(a)(iii)**.

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.....

..... [1]

You will need to estimate the concentration of hydrogen peroxide in **U**.

You are provided with **U**, as shown in Table 1.2.

Table 1.2

labelled	contents	hazard	volume / cm^3
U	unknown concentration of hydrogen peroxide solution	harmful irritant	30

If **U** comes into contact with your skin, wash off immediately under cold water.

It is recommended that you wear suitable eye protection.

Carry out step 17 to step 22.

step 17 Label a clean test-tube **U**.

step 18 Put 10 cm^3 of **U** into the test-tube labelled **U**.

step 19 Pick up a bead using blunt forceps.

step 20 Drop the bead into the test-tube containing **U**. Start timing when the bead reaches the bottom of the test-tube.

step 21 Time how long it takes for the bead to reach the surface of solution **U**.
If the bead does not reach the surface after 180 seconds, stop timing and record as 'more than 180'.

step 22 Record the result from step 21 in **(a)(v)**.

(v) State the result for **U**.

result for **U** ..... [1]

(vi) Using your results from **(a)(ii)** and **(a)(v)**, estimate the concentration of hydrogen peroxide in **U**.

concentration of hydrogen peroxide in **U** ..... % [1]

(vii) In the procedure described in step 1 to step 16, the effect of the concentration of hydrogen peroxide on catalase activity was investigated.

Describe how you would modify this procedure to investigate the effect of **temperature** on the time taken for the beads to rise.

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..... [2]

(b) Immobilised enzymes are often used in industry, for example in the production of lactose-free milk. This can increase productivity and reduce costs, as the enzyme is easy to reuse and the product is not contaminated by the enzyme.

A student investigated the effect of bead diameter on the hydrolysis of lactose. The beads contained the enzyme lactase. Lactase catalyses the hydrolysis of lactose into glucose and galactose.

The student:

- put beads with a diameter of 2 mm into a syringe, up to the 5 cm^3 line
- put 5 cm^3 of milk containing lactose into this syringe
- left the syringe for 5 minutes
- measured the concentration of lactose in the milk after 5 minutes.

The student used this method with the bead diameters shown in Fig. 1.3.

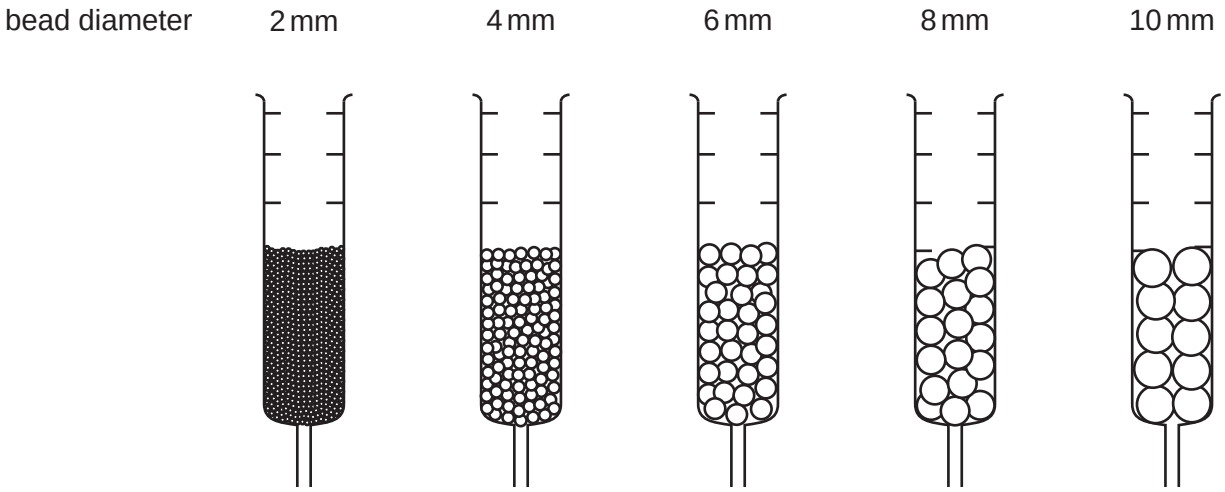

Fig. 1.3

Table 1.3 shows the results of this investigation.

Table 1.3

bead diameter / mm	percentage concentration of lactose after 5 minutes
2	20.5
4	21.0
6	29.5
8	40.5
10	69.0

(i) Plot a graph of the data shown in Table 1.3 on the grid in Fig. 1.4.

Use a sharp pencil.

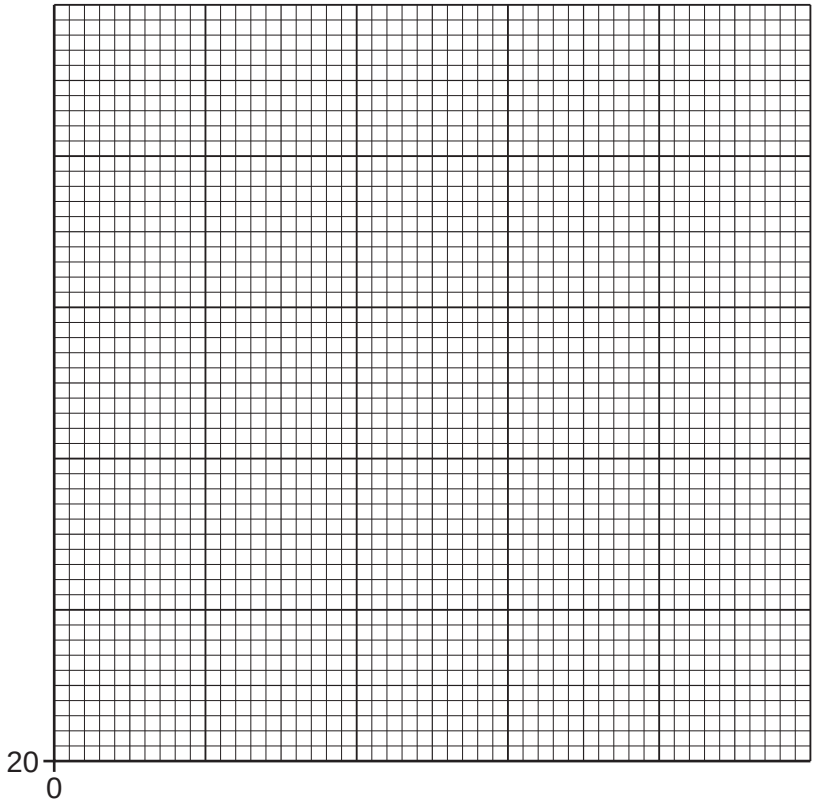

Fig. 1.4

[4]

(ii) Use your graph to find the concentration of lactose in the milk after 5 minutes, when the bead diameter was 5 mm.

concentration of lactose = ... % [1]

(iii) Explain why the percentage concentration of lactose in the milk after 5 minutes increases as the bead diameter increases.

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..... [3]

[Total: 22]

Question 2 starts on page 12.

2 **M1** 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 **M1**, indicated by the shaded area in Fig. 2.1.
Use a sharp pencil.
Your drawing should include three vascular bundles.

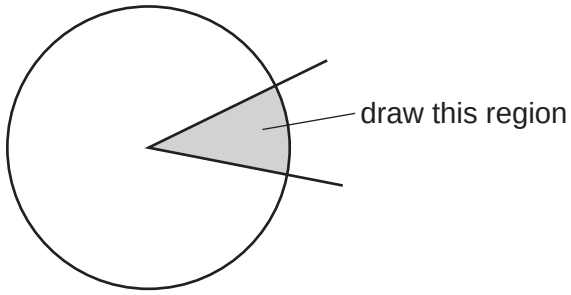

Fig. 2.1

Use **one** ruled label line and label to identify the xylem.

[5]

(ii) Observe the central tissue on the section of the stem on **M1**.

Select a group of four adjacent cells which show observable features of the central tissue.

Each cell must touch at least **two** other cells.

- Make a large drawing of this group of **four** cells.
- Use **one** ruled label line and label to identify the cell wall of **one** cell.

[5]

(b) Fig. 2.2 is a photomicrograph of a stained transverse section of a different stem.

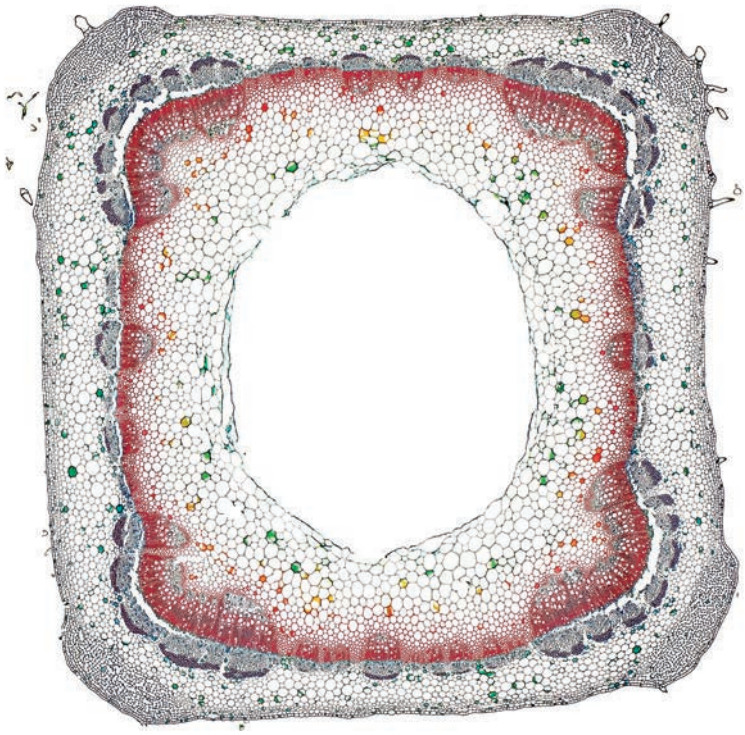

Fig. 2.2

Identify **three** observable **differences** between the stem in Fig. 2.2 and the stem on **M1**.

Record the three observable differences in Table 2.1.

Table 2.1

feature	Fig. 2.2	M1

[4]

(c) Fig. 2.3 is the same photomicrograph as that shown in Fig. 2.2. The line **X**–**Y** is drawn across the width of the stem.

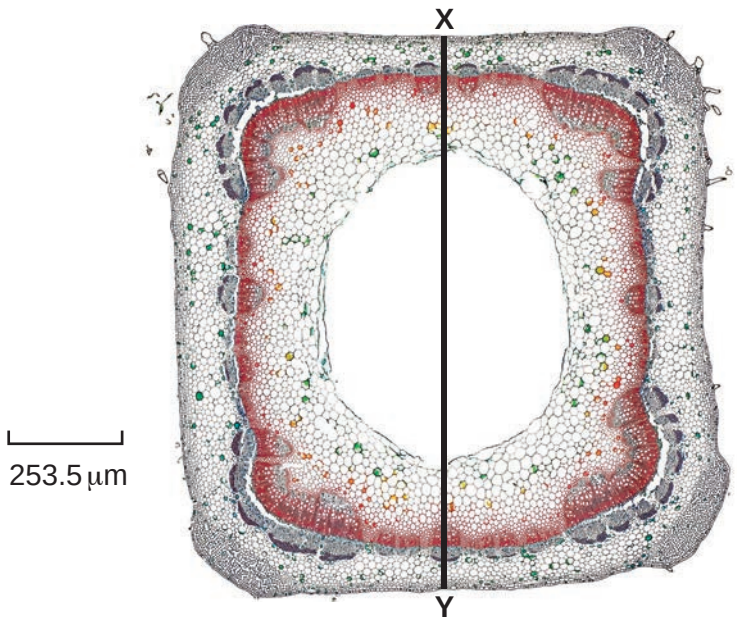

Fig. 2.3

Use the line **X**–**Y** and the scale bar to calculate the actual width of the stem.

Show your working and use appropriate units.

actual width of stem = ... [4]

[Total: 18]

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