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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6213794834

BIOLOGY **9700/38**

Paper 3 Advanced Practical Skills 2 **October/November 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.

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1 Yeast cells contain enzymes that hydrolyse sucrose into reducing sugars, as shown in Fig. 1.1.

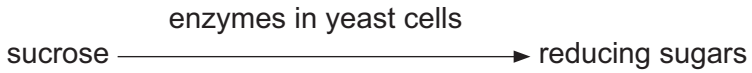


Fig. 1.1

You will investigate the activity of the enzymes in yeast cells that are immobilised in sodium alginate beads and yeast cells that are in a suspension ('free' yeast cells).

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
Y	yeast cell suspension	low	20
A	sodium alginate solution	low	20
C	calcium chloride solution	low	20
S	sucrose solution	low	50
Benedict's	Benedict's solution	harmful irritant	20
W	distilled water	low	50

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

It is recommended that you wear suitable eye protection.

You will need to:

- immobilise some of the yeast cells in sodium alginate
- put the immobilised yeast cells and some 'free' yeast cells into sucrose solution
- test both solutions for reducing sugars
- compare the activity of immobilised yeast cells and 'free' yeast cells.

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Investigating the activity of the enzymes in immobilised yeast cells

Carry out step 1 to step 20.

step 1 Put 10 cm^3 of sodium alginate, **A**, into a beaker.

step 2 Stir the yeast cell suspension, **Y**, and put 10 cm^3 of **Y** into the beaker containing **A**. Mix well.

step 3 Use a 1 cm^3 syringe to collect 1 cm^3 of the mixture of **A** and **Y**. Wipe the outside of the syringe.

step 4 Hold this syringe over the beaker containing calcium chloride solution, **C**, as shown in Fig. 1.2.

step 5 Slowly press down on the plunger so that a drop of the mixture is released into **C**. The drop will form a bead.

step 6 Repeat step 5 until all of the mixture in the syringe has been formed into beads.

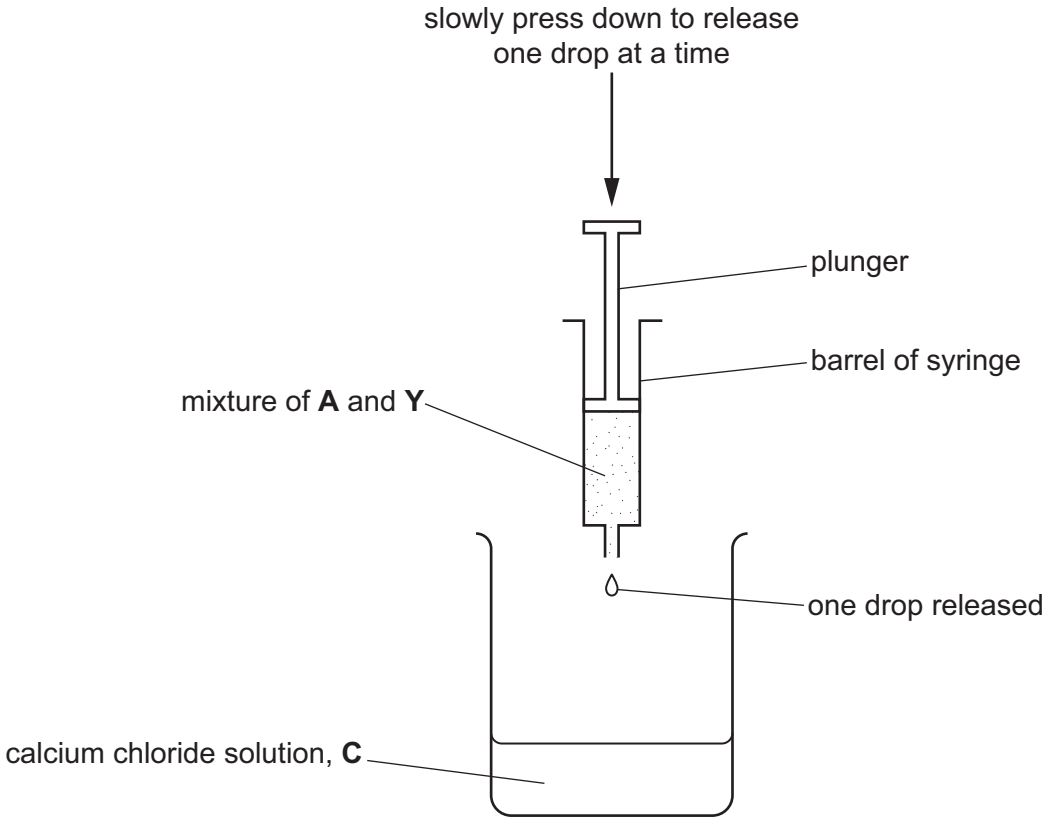


Fig. 1.2

step 7 Leave the beads in the beaker for at least 5 minutes.

step 8 Set up a boiling water-bath ready for step 18.

step 9 Label a beaker **B**.

step 10 Put 20 cm^3 of sucrose solution, **S**, into the beaker labelled **B**.

step 11 Label 5 test-tubes **1**, **2**, **3**, **4** and **5**.

step 12 Put 1 cm^3 of **Benedict's** into each of the test-tubes.

step 13 After at least 5 minutes (step 7), separate the beads from solution **C** using the apparatus shown in Fig. 1.3.

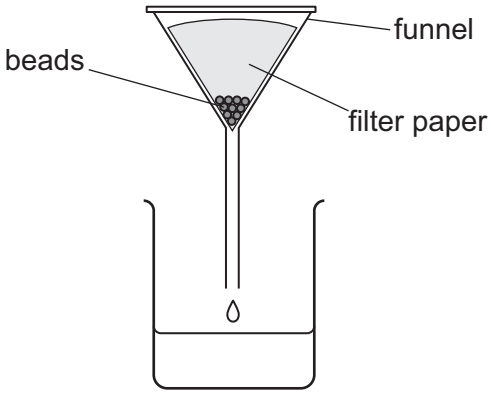


Fig. 1.3

After step 14 you will remove a sample from **B** every minute for 5 minutes.

step 14 Put all of the beads into the beaker labelled **B**. Stir and then start timing.

step 15 At 1 minute, stir the contents of beaker **B** and use a syringe to transfer 1 cm^3 of the solution surrounding the beads into the test-tube labelled **1**.

step 16 At 2 minutes, stir the contents of beaker **B** and use a syringe to transfer 1 cm^3 of the solution surrounding the beads into the test-tube labelled **2**.

step 17 Continue taking samples at 3, 4 and 5 minutes using the test-tubes labelled **3**, **4** and **5**.

step 18 Put test-tube **1** into the boiling water-bath and measure the time to the first colour change. Record your result in **(a)(i)**.

If there is no colour change after 60 seconds, stop timing and record the time as 'more than 60'.

step 19 Remove the test-tube from the boiling water-bath.

step 20 Repeat step 18 and step 19 for the test-tubes labelled **2**, **3**, **4** and **5**.

Investigating the activity of the enzymes in 'free' yeast cells

To investigate the activity of the enzymes in 'free' yeast cells, you will need to test the samples with Benedict's solution **immediately** after the sample is taken.

The water-bath should be boiling throughout this part of the investigation.

Carry out step 21 to step 32.

step 21 Label a beaker **F**.

step 22 Put 20 cm^3 of sucrose solution, **S**, into the beaker labelled **F**.

step 23 Label 5 clean test-tubes **1**, **2**, **3**, **4** and **5**.

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step 24 Put 1 cm^3 of **Benedict's** into each of the test-tubes.

step 25 Stir the yeast cell suspension, **Y**, and put 0.5 cm^3 of **Y** into the beaker labelled **F**. Mix well and start timing.

The timer should **not** be stopped until you have completed step 32 – keep the timer running continuously.

step 26 At 1 minute, use a syringe to transfer 1 cm^3 of the solution in **F** into the test-tube labelled **1**. Do **not** stop the timer.

step 27 **Immediately** put test-tube **1** into the boiling water-bath and measure the time to the first colour change. Record your result in **(a)(i)**.

If there is no colour change after 60 seconds, record the time as 'more than 60'.

step 28 Remove the test-tube from the boiling water-bath.

step 29 At 2 minutes, use a syringe to transfer 1 cm^3 of the solution in **F** into the test-tube labelled **2**. Do **not** stop the timer.

step 30 **Immediately** put test-tube **2** into the boiling water-bath and measure the time to the first colour change. Record your result in **(a)(i)**.

If there is no colour change after 60 seconds, record the time as 'more than 60'.

step 31 Remove the test-tube from the boiling water-bath.

step 32 Repeat step 30 **and** step 31 at 3, 4 and 5 minutes using the test-tubes labelled **3**, **4** and **5**.

(a) (i) Record your results in an appropriate table.

[5]

(ii) Describe **and** compare the trends in your results, with reference to the data in **(a)(i)**.

.....

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.....

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.....

.....

..... [3]

(iii) Suggest an appropriate control for the experiment.

.....

..... [1]

(iv) The samples taken from **B** were tested for the presence of reducing sugars after all 5 samples had been taken.

Suggest why each sample from **F** had to be tested for the presence of reducing sugars immediately.

.....

..... [1]

(v) Suspensions and solutions were stirred throughout the investigation. Explain **two** ways in which stirring increased the accuracy of the results.

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[2]

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(vi) State **one** possible source of error when determining the dependent variable for the 'free' yeast cells. Suggest **one** improvement to the procedure that would increase the accuracy of measuring the dependent variable.

error .....

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improvement .....

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[2]

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(b) A scientist carried out an investigation to determine the effect of pH on the activity of immobilised catalase enzyme and 'free' catalase enzyme.

All other variables were kept constant.

The results are shown in Table 1.2.

Table 1.2

pH	activity of catalase / arbitrary units (au)	
	immobilised	free
5	68	50
6	88	62
7	99	96
8	98	65
9	94	48

(i) Plot a line graph of the data in Table 1.2 on the grid in Fig. 1.4.

Use a sharp pencil.

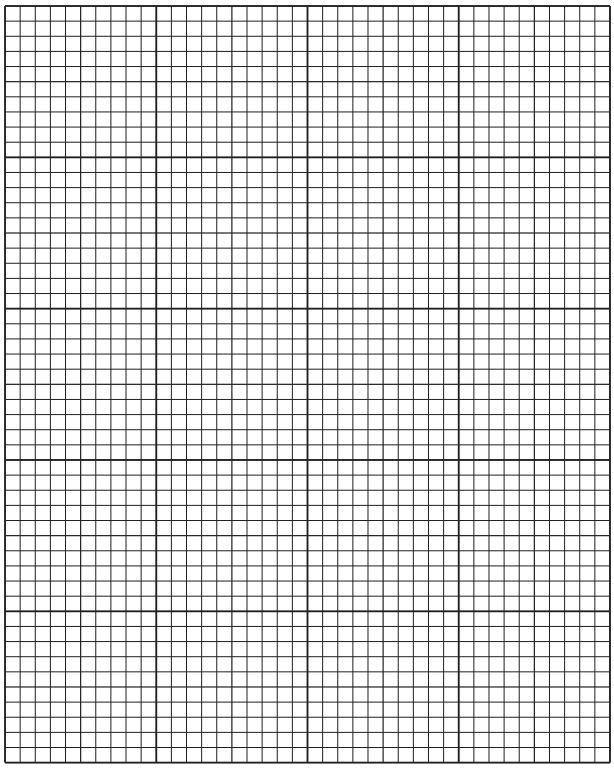


Fig. 1.4

[4]

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(ii) State **two** conclusions about how pH affects the activity of immobilised catalase compared to 'free' catalase.

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2 .....

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[2]

[Total: 20]

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2 **N1** is a slide of a stained transverse section through a plant organ.

(a) **(i)** Draw a large plan diagram of the whole section on **N1**. Use a sharp pencil.

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

[5]

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(ii) Observe the cortex on the section of the plant organ on **N1**. The cortex is the layer beneath the epidermis.

Select a group of **four** adjacent cortex cells.

Each cortex cell must touch at least **two** of the other cortex cells.

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

[5]

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(b) Fig. 2.1 is a photomicrograph of a stained transverse section of the same organ from a different plant to **N1**.

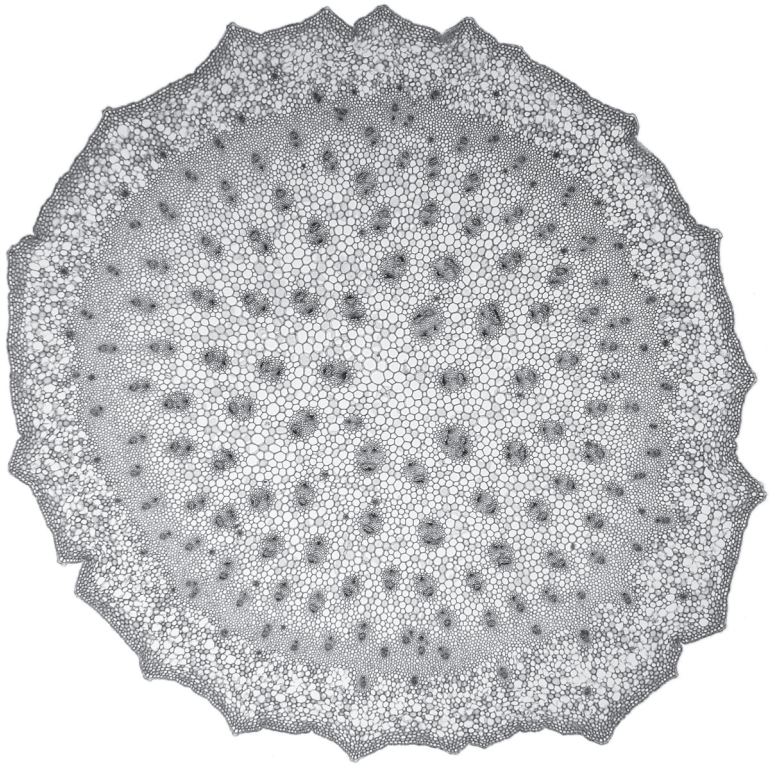


Fig. 2.1

Identify **three** observable differences, other than colour, between the section on **N1** and the section in Fig. 2.1.

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

Table 2.1

feature	N1	Fig. 2.1
1		
2		
3		

[4]

(c) Fig. 2.2 is the same photomicrograph as that shown in Fig. 2.1.

A black dot has been placed at the centre of the section.

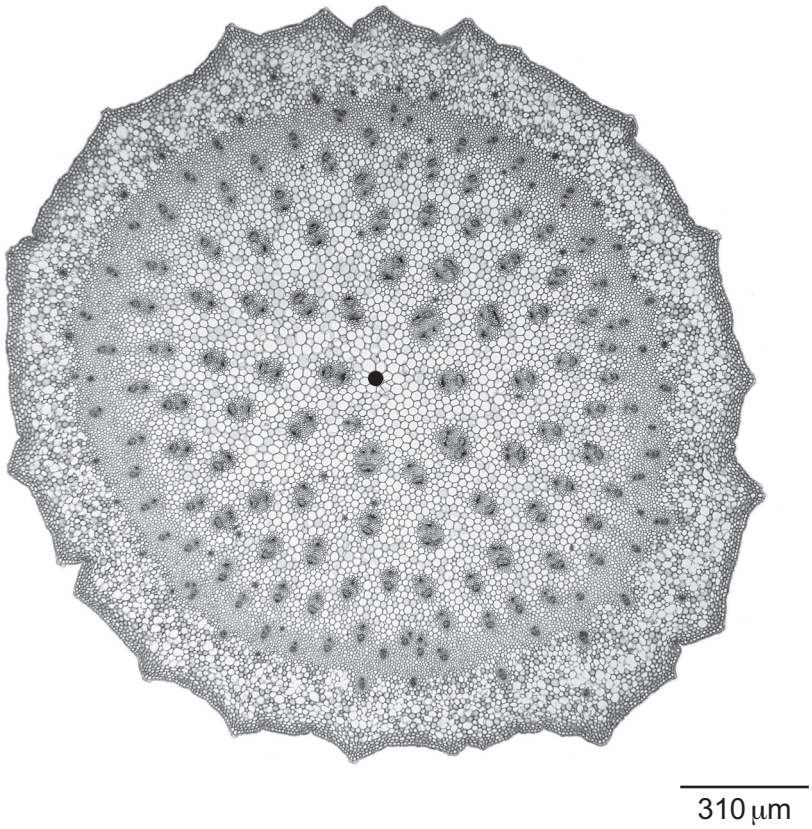


Fig. 2.2

(i) Determine the mean diameter of the section in Fig. 2.2.

Show your working and include units.

mean diameter = ...
[2]

(ii) Use the scale bar to calculate the mean actual diameter of the section in Fig. 2.2.

Show your working and include units.

mean actual diameter = ...
[2]

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(iii) Use the mean actual diameter calculated in **(c)(ii)** to calculate the magnification of Fig. 2.2.

Show your working and give your answer to the nearest whole number.

magnification = ...
[2]

[Total: 20]

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