Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/33**

Paper 3 Advanced Practical Skills 1 **May/June 2024**

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 enzymes that catalyse the breakdown of sugars, such as glucose and sucrose, to produce ethanol and carbon dioxide.

As the sugars are broken down, the yeast cells in a suspension will sink slowly to the bottom of the container, forming a sediment with a clear liquid above. This process is called sedimentation.

You will investigate the effect of different concentrations of ethanol on the sedimentation of yeast cells.

(a) Test-tube **R** in Fig. 1.1 shows how a test-tube will be set up at the start of the investigation.

(i) Decide what you expect the contents of the test-tube to look like after sedimentation.

On test-tube **S** in Fig. 1.1, draw:

- lines to show the layers that you expect to see after sedimentation
- a label line and label to identify the sediment.

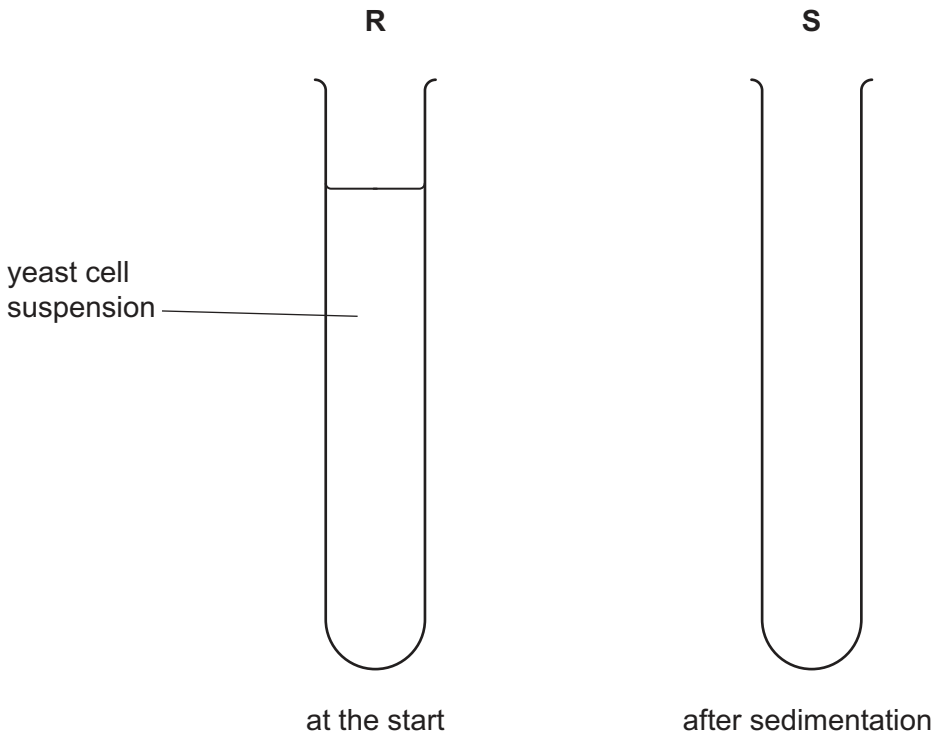

Fig. 1.1

[2]

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
E	100% ethanol	flammable harmful	50
A	calcium chloride solution	irritant	15
W	distilled water	none	150
Y	dried yeast	none	

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

You should wear suitable eye protection.

You will investigate the effect of different concentrations of ethanol on the sedimentation of yeast cells.

You will need to:

- prepare different concentrations of ethanol
- measure the height of the yeast sediment in each concentration of ethanol every four minutes.

You will use proportional dilution to make different concentrations of ethanol.

You will prepare 10 cm^3 of each concentration, using **E** and **W**.

Table 1.2 shows how to prepare **two** of the concentrations you will use.

Decide which other concentrations of ethanol you will use.

(ii) Complete Table 1.2 to show how you will prepare the concentrations of ethanol you will use.

Table 1.2

percentage concentration of ethanol	volume of E / cm^3	volume of W / cm^3
100	10.0	0.0
60	6.0	4.0

[2]

Carry out step 1 to step 15.

step 1 In the beakers provided, prepare the concentrations of ethanol as shown in Table 1.2.

step 2 Label **one** test-tube with the label **C**.

step 3 Label the other test-tubes with the concentrations of ethanol prepared in step 1.

step 4 Put 1 cm^3 of **A** into each of the test-tubes labelled in step 2 and step 3.

step 5 Put 7 cm^3 of **W** into the test-tube labelled **C**.

step 6 Put 7 cm^3 of the 100% ethanol, **E**, into the test-tube labelled **100%**.

step 7 Repeat step 6 for each of the other concentrations you prepared in step 1.

step 8 Put 100 cm^3 of **W** into the beaker labelled **Y** and stir until all of the dried yeast forms a suspension.

step 9 Stir the yeast cell suspension and put 7 cm^3 of the yeast cell suspension into the test-tube labelled **100%**.

step 10 Repeat step 9 for each of the other labelled test-tubes, including **C**.

step 11 Put a clean bung into one of the test-tubes and invert the test-tube to mix the contents.

step 12 Repeat step 11 for all the other test-tubes.

step 13 Start timing and immediately measure the height of the sediment in each test-tube. These are the results at the start (0 minutes).
Record your results in **(a)(iii)**.

step 14 After 4 minutes, measure the height of the sediment in each test-tube.
Record your results in **(a)(iii)**.

step 15 Repeat step 14 so that results are recorded every 4 minutes until the final results are recorded at 20 minutes.

(iii) Record your results in an appropriate table.

[5]

(iv) Using your results in **(a)(iii)**, state **one** conclusion that can be made about the effect of the concentration of ethanol on the sedimentation of yeast cells.

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..... [1]

(v) A student suggested the hypothesis:

ethanol is needed for sedimentation of yeast cells to occur.

Using your results in **(a)(iii)**, state whether you support **or** reject this hypothesis.

Explain how your results provide evidence for this decision.

support **or** reject .....

explanation .....

.....

.....

[1]

(vi) Using the results at 20 minutes, state the concentration, or concentrations, of ethanol that caused the most sedimentation.

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Suggest how you could modify this procedure to obtain a more accurate estimate of the concentration that causes the most sedimentation.

modification .....

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[3]

(vii) Identify the main source of error in the investigation into the effect of different concentrations of ethanol on the sedimentation of yeast cells.

.....

..... [1]

(viii) Another possible source of error, when carrying out step 6 of the investigation, is shown in Table 1.3.

Complete Table 1.3 by stating whether the type of error is systematic **or** random **and** the effect the error may have on the trend seen in the results.

Table 1.3

source of error	systematic error or random error	effect on the trend
the 7 cm^3 mark on the syringe used to measure the volume of ethanol actually measured 7.1 cm^3		

[1]

(b) In fermentation, the action of yeast converts some of the carbohydrates in plants to ethanol and carbon dioxide.

A scientist investigated the production of ethanol during the fermentation of carbohydrates from different sources.

The investigation was carried out at 30 °C and at pH 5, using the yeast *Saccharomyces cerevisiae*. All other variables were kept constant.

The results are shown in Table 1.4.

Table 1.4

source of carbohydrate	percentage ethanol produced per 100 g of carbohydrate
molasses	3.80
oranges	1.05
grapes	2.65
beetroot	3.35
rice	4.70

(i) Draw a bar chart of the data in Table 1.4 on the grid in Fig. 1.2.

Use a sharp pencil.

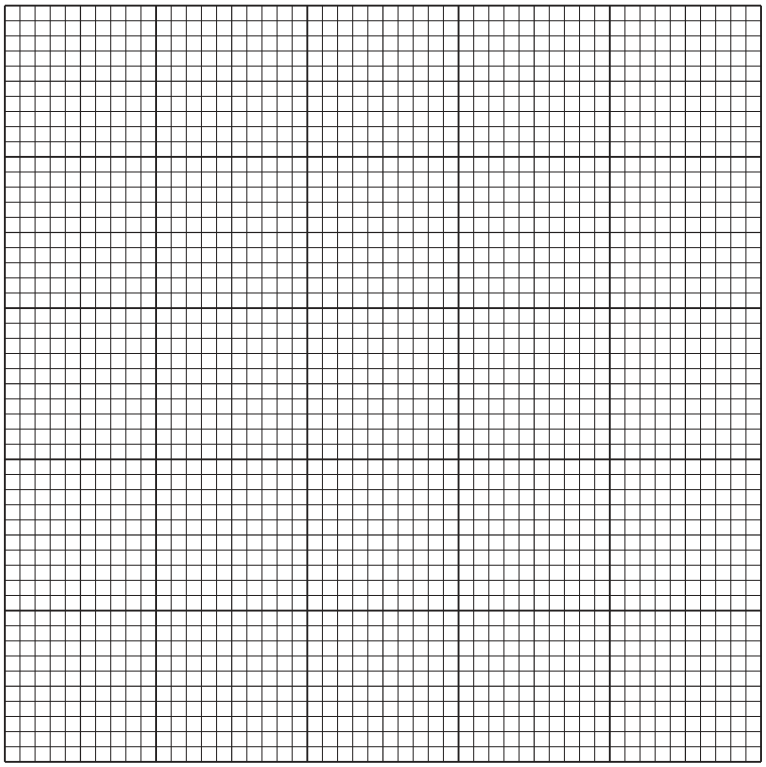

Fig. 1.2

[4]

The investigation was repeated using a different yeast, *Schizosaccharomyces pombe*.

All the variables were kept the same as in the first investigation.

The percentage of ethanol produced using *Schizosaccharomyces pombe* was found to be lower with all of the sources of carbohydrate.

The results are shown in Table 1.5.

Table 1.5

source of carbohydrate	**percentage ethanol produced per 100 g of carbohydrate**	
	Saccharomyces cerevisiae	*Schizosaccharomyces pombe*
molasses	3.80	3.68
oranges	1.05	1.00
grapes	2.65	2.57
beetroot	3.35	3.29
rice	4.70	4.34

(ii) Suggest why the percentage of ethanol produced by *Schizosaccharomyces pombe* is lower than the percentage of ethanol produced by *Saccharomyces cerevisiae* for all sources of carbohydrate.

.....

.....

..... [2]

[Total: 22]

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2 **L1** is a slide of a stained transverse section through a plant stem.

(a) **(i)** Draw a large plan diagram of the whole section on **L1**. Use a sharp pencil.

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

[5]

(ii) Observe the cells in the cortex on the section of the stem on **L1**.

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

Each cell must touch at least **two** other 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]

(b) Fig. 2.1 is a photomicrograph of a stained transverse section through a different plant.

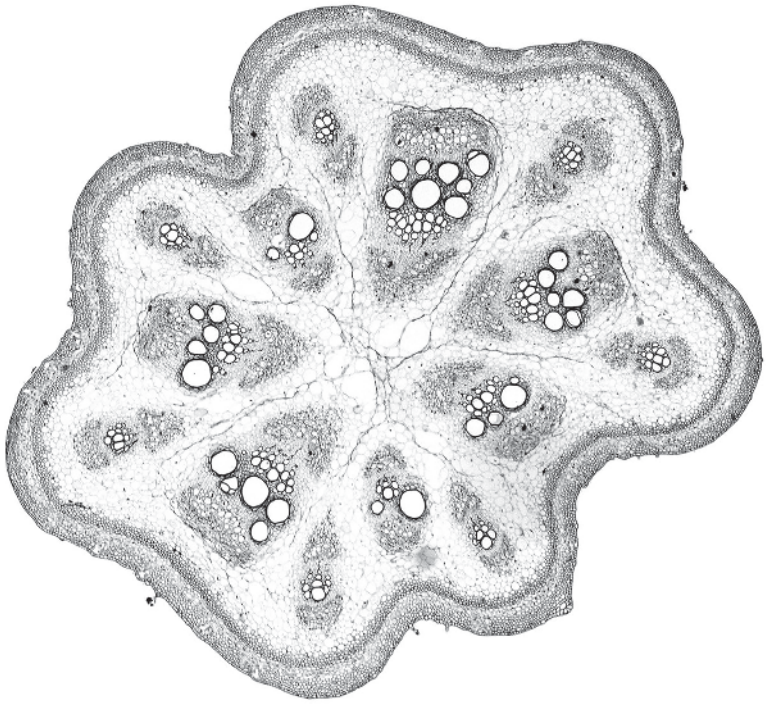


Fig. 2.1

Identify **three** observable features, other than colour, that are different between the section on **L1** and the section in Fig. 2.1.

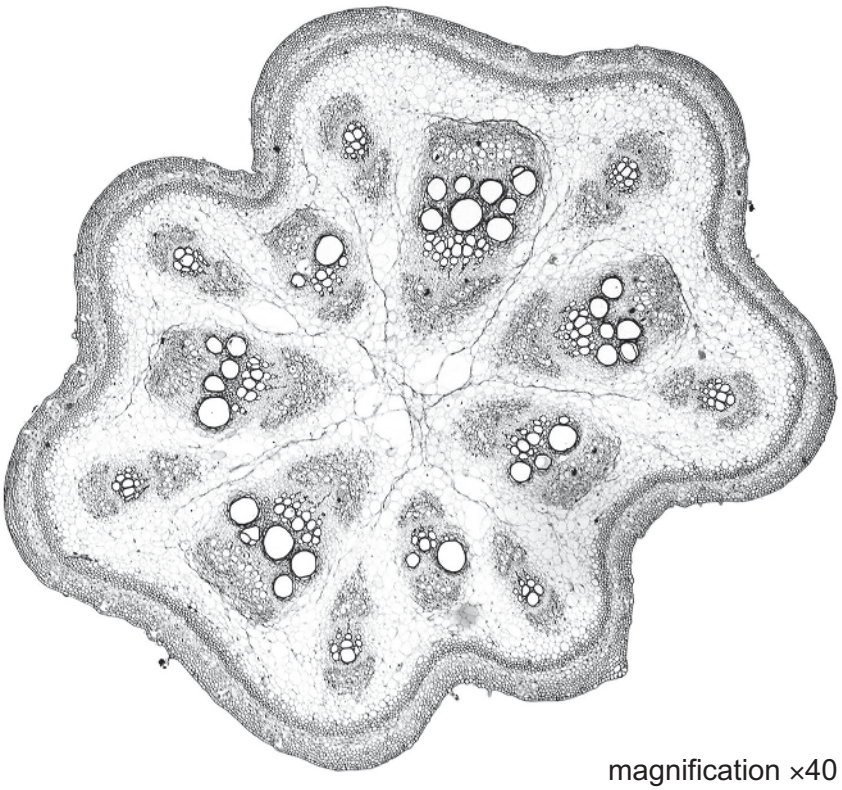
Record the differences between these **three** observable features in Table 2.1.

Table 2.1

feature	L1	Fig. 2.1

[4]

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



magnification ×40

Fig. 2.2

Determine the **mean** actual diameter of the stem in Fig. 2.2.

Show your working.

mean actual diameter .....
[4]

[Total: 18]

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