Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/33**

Paper 3 Advanced Practical Skills 1 **October/November 2021**

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.

[Turn over

Before you proceed, read carefully through the **whole** of Question 1 and Question 2.

Plan the use of the **two hours** to make sure that you finish the whole of Question 1 and Question 2.

1 During the manufacture of a fruit juice, an unwanted colour can sometimes appear in the juice. An enzyme can be used to remove this colour.

You will carry out an investigation to determine the concentration of enzyme that is most effective at removing the colour in mock fruit juice, **J**. Solution **J** is not real fruit juice, so is **not** safe to drink.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
J	mock fruit juice	harmful	60
E	2.0% enzyme solution	harmful irritant	25
W	distilled water	none	100

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

It is recommended that you wear suitable eye protection.

(a) You will need to carry out a **serial** dilution of the 2.0% enzyme solution, **E**, to reduce the concentration by **half** between each successive dilution.

You will need to prepare **four** concentrations of enzyme solution in addition to the 2.0% enzyme solution, **E**.

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

(i) Complete Fig. 1.1 to show how you will prepare your serial dilution.

Fig. 1.1 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 enzyme solution transferred.
- the volume of distilled water, **W**, added.

Under each beaker, state the concentration of enzyme solution.

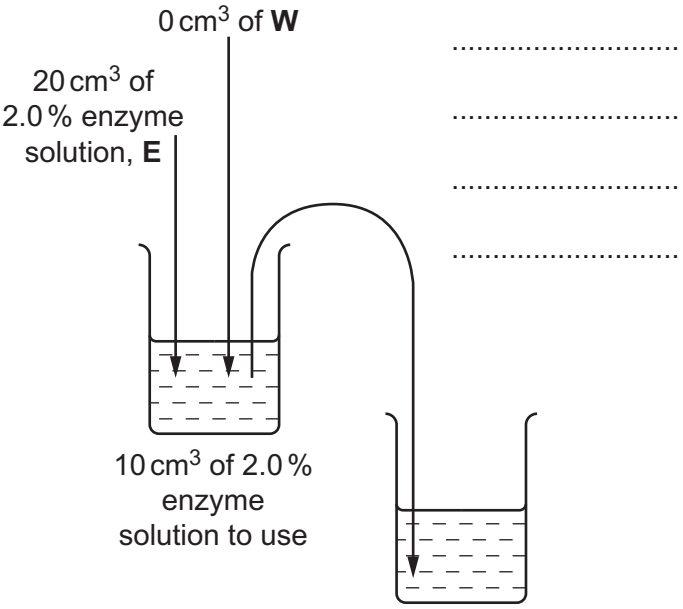

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Fig. 1.1

[3]

Carry out steps 1 to 10.

1. Prepare the concentrations of enzyme solution, as decided in **(a)(i)**, in the beakers provided.

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

3. Put 5 cm^3 of **J** into each test-tube.

4. Using the beakers labelled **hot water** and **cold water**, set up a water-bath with water at approximately 40 °C. Maintain the water-bath at approximately 40 °C during step 5 to step 8.

5. Put the test-tubes from step 3 into the water-bath. Leave the test-tubes for 3 minutes.

6. Put 5 cm^3 of the 2.0% enzyme solution into the appropriately labelled test-tube. Shake gently to mix.

7. Repeat step 6 with the other concentrations of enzyme solution you prepared in step 1.

8. Start timing and leave the test-tubes in the water-bath for 10 minutes.

While you are waiting carry on with Question 1.

9. After 10 minutes (step 8) remove the test-tubes from the water-bath. Observe the colour of the solution in each test-tube.
   To see the colour more clearly, it may help to hold a piece of white paper behind the test-tube.
   You may see the same colour in more than one test-tube.

10. Record your results in **(a)(ii)** using the symbols shown in Table 1.2.

Table 1.2

intensity of colour	symbol
dark blue	**+++++**
	++++
decreasing intensity of blue colour	**+++**
	++
no colour	**+**

(ii) Record your results in an appropriate table.

You may use the same symbols for more than one test-tube.

[5]

(iii) Using your results in **(a)(ii)**, state which concentration of enzyme removed the colour most effectively.

..... [1]

(iv) Using your knowledge of enzymes, explain the trend in your results.

.....

.....

..... [1]

(v) State **one** variable, **other than** temperature, that needs to be controlled in this investigation.

..... [1]

(vi) The procedure used in this investigation has several sources of error. Table 1.3 shows one of these sources of error.

Complete Table 1.3 by:

- stating **two** other sources of error
- describing an improvement to the procedure for each of the **three** sources of error.

Table 1.3

source of error	how to improve the procedure
the test-tube with 2.0% enzyme was left for longer than the other test-tubes	

[5]

(b) Grapes are a type of fruit that can be eaten freshly picked or dried.

Table 1.4 shows the sugar content of fresh grapes and dried grapes.

Table 1.4

type of sugar	sugar content / g per 100 g of grapes	
	fresh	dried
glucose	6.5	27.0
fructose	7.5	29.5
sucrose	0.5	1.0

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

Use a sharp pencil for drawing graphs.

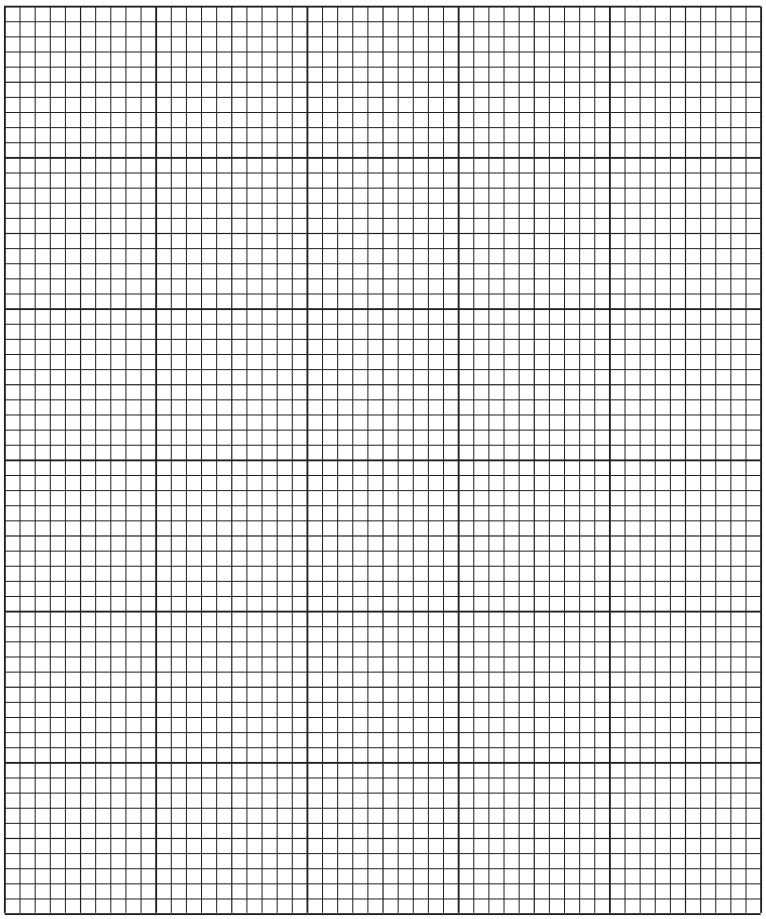

Fig. 1.2

[4]

(ii) The concentration of all sugars in dried grapes is higher than in fresh grapes.

Calculate the percentage increase in the concentration of glucose in dried grapes.

Show your working.

answer = ...% [2]

(iii) Suggest why the glucose concentration is higher in the dried grapes than in the fresh grapes.

.....

.....

..... [1]

[Total: 23]

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

(a) Set up the microscope so that you can observe the section on **K1**.

Observe the different tissues in the area on **K1** shown by the shaded region in Fig. 2.1.

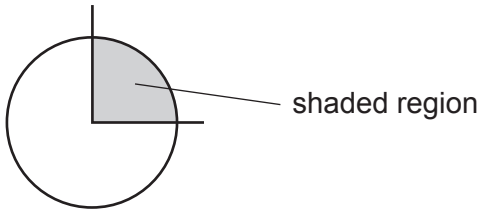

Fig. 2.1

Use a sharp pencil for drawing.

(i) Draw a large plan diagram of the area of the section on **K1** shown by the shaded region in Fig. 2.1.

Your drawing should show the correct shapes and proportions of the different tissues.

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

[5]

(ii) Observe the vascular tissue of the section of the stem on **K1**.

Select **one** large xylem vessel element and **three** adjacent smaller cells.

Each smaller cell must touch the large xylem vessel element and at least **one** of the other smaller cells.

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

[5]

(b) Fig. 2.2 is a photomicrograph of a stained transverse section through a root of a different type of plant.

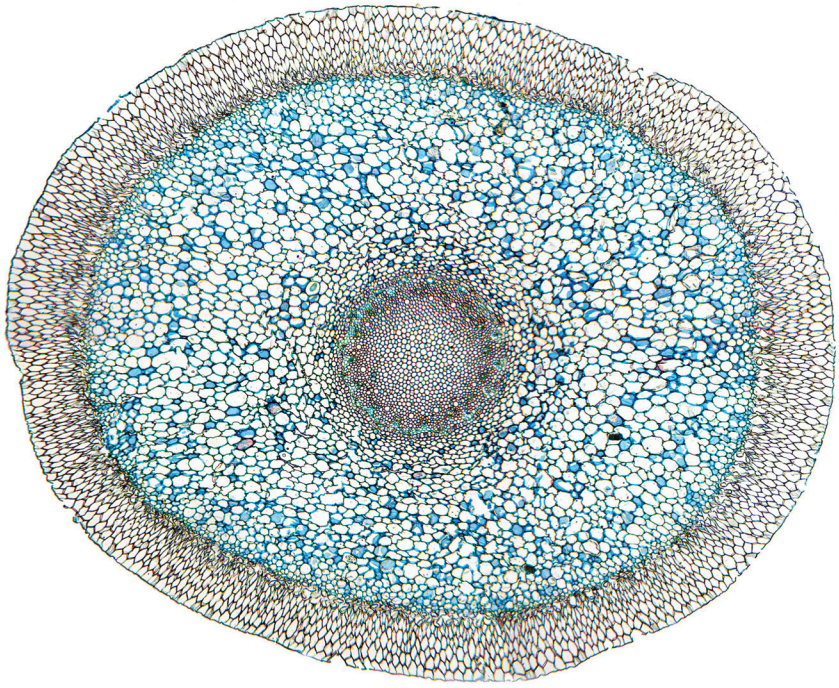

Fig. 2.2

Identify the observable differences between the section on **K1** and the section in Fig. 2.2.

Record the observable differences in Table 2.1.

Table 2.1

feature	K1	Fig. 2.2

[4]

(c) Fig. 2.3 is a photomicrograph of the same root section as in Fig. 2.2, viewed using a microscope with an eyepiece graticule placed across the section.

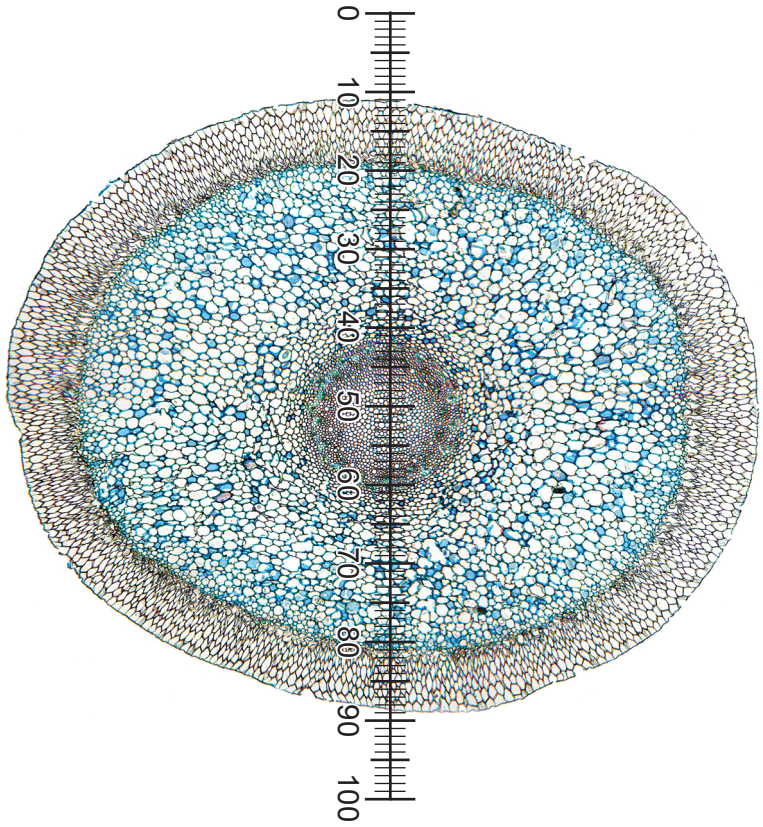

Fig. 2.3

An eyepiece graticule is shown on Fig. 2.3.
The calibration of the eyepiece graticule scale is:
1 eyepiece graticule division = 67.0 μm.

Use the calibration of the eyepiece graticule scale to calculate the actual diameter of the section in Fig. 2.3.

Show all the steps in your working and use appropriate units.

actual diameter = ... [3]

[Total: 17]