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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/33**

Paper 3 Advanced Practical Skills 1 **February/March 2023**

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 **(a)** You will investigate the effect of different temperatures on the permeability of the cell surface membrane of beetroot cells.

Beetroot is a vegetable that contains a red pigment in its cells.

When beetroot tissue is put into water, the red pigment can move out of the cells through the cell surface membrane, changing the water to a red colour.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
B	2 pieces of beetroot	none	–
W	distilled water	none	100

The red pigment in beetroot cells can stain clothing and skin. Use blunt forceps to handle beetroot tissue and, if any pigment comes into contact with your skin, wash it off immediately under cold water.

It is recommended that you wear suitable eye protection.

You will need to:

- put beetroot tissue in water at different temperatures
- leave the beetroot tissue in the water for a period of time
- record the intensity of colour in the water at each temperature.

(i) The temperature range that you will use must include a minimum temperature of 25 °C and a maximum temperature of 65 °C.

State **three other** temperatures that you will use in your investigation.

25 °C, ... °C, ... °C, ... °C and 65 °C [1]

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Carry out step 1 to step 18.

step 1 Cut the beetroot pieces into 2 mm thick discs. You will need at least 25 discs.

step 2 Put all the discs that you have cut into the beaker labelled **D** and cover them with approximately 30 cm^3 distilled water, **W**.

step 3 Stir with a glass rod.

step 4 Pour off the water into the beaker labelled **For waste**, leaving the discs in the beaker labelled **D**.

step 5 Put all the discs on a paper towel and blot them to remove excess water.

step 6 Set up and maintain a water-bath at 25 °C, using the beaker labelled **water-bath**. The water-bath will be needed in step 10.

step 7 Label two test-tubes with the temperature of the water-bath.

step 8 Put five discs into **one** of the labelled test-tubes.

step 9 Put 10 cm^3 of distilled water, **W**, into the test-tube with the five discs.

step 10 Put this test-tube into the water-bath for four minutes. You will need to maintain the water-bath at the correct temperature throughout these four minutes.

step 11 After four minutes, remove the test-tube with the discs from the water-bath.

step 12 Pour the water from this test-tube into the second test-tube that you labelled in step 7, leaving the discs in the first test-tube.

step 13 Put the test-tube containing the water into the test-tube rack.

step 14 Put the test-tube containing the discs into the beaker labelled **D**.

step 15 Set up the water-bath at the next higher temperature stated in **(a)(i)**.

step 16 Repeat step 7 to step 15 until all of the temperatures stated in **(a)(i)** have been tested, finishing with the maximum temperature of 65 °C.

step 17 Observe the colour intensity of the water in each of the test-tubes in the test-tube rack.

Placing a piece of white paper or card behind each test-tube may help with your observations.

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step 18 Using only the symbols shown in Table 1.2 to represent intensity of colour, decide the intensity of colour in each of the test-tubes in the test-tube rack. Record your results in **(a)(ii)**.

Table 1.2

intensity of colour	symbol
dark red	++++++
↓ decreasing intensity of red colour	+++++
	++++
	+++
	++
no colour	+

(ii) Record your results in an appropriate table, using only the symbols shown in Table 1.2.

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

[5]

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(iii) State the independent variable in this experiment.

.....

..... [1]

(iv) Use your knowledge of cell surface membranes to explain the results that you recorded in **(a)(ii)**.

.....

.....

.....

.....

.....

.....

..... [3]

(v) Step 2 to step 4 improve the validity of the results by removing the pigment that was released when the beetroot tissue was cut.

State how you could confirm that **all** the pigment released when the beetroot tissue was cut has been removed.

.....

.....

..... [1]

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(vi) Two significant sources of error in this investigation are shown in Table 1.3.

Complete Table 1.3 to suggest how to make an improvement to reduce each of the sources of error identified.

Table 1.3

significant source of error	how to make an improvement
difficult to judge the intensity of colour	
difficult to maintain the temperature of the water-bath	

[2]

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Question 1 continues on page 8.

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(b) A scientist investigated changes in the mean width of stomata in the leaves of a plant growing in hot, dry conditions. The scientist measured the widths of stomata at different times of day, from 02:00 hours to 22:00 hours. Fig. 1.1 shows where the scientist measured the width of each stoma.

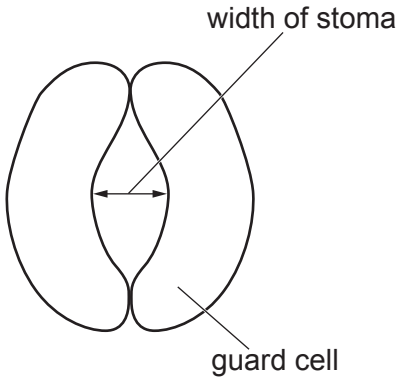


Fig. 1.1

The scientist calculated the mean width of stomata for each time of day.

The results are shown in Table 1.4.

Table 1.4

time of day / hours	mean width of stomata / arbitrary units (au)
02:00	86
04:00	36
07:00	4
15:00	2
22:00	95

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

Use a sharp pencil.

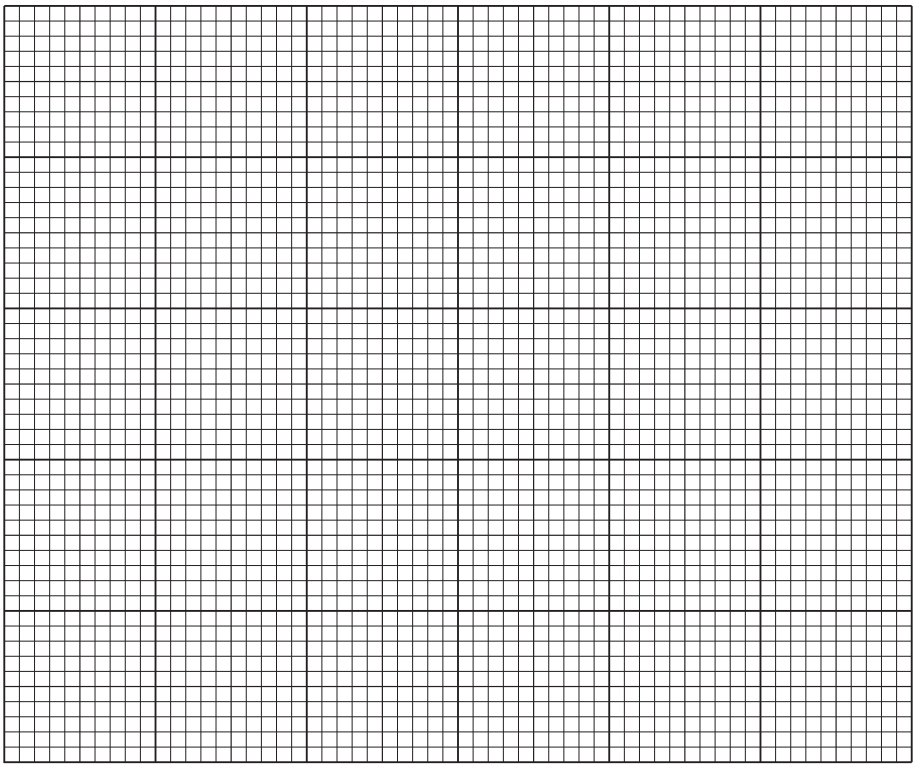


Fig. 1.2

[4]

(ii) Use your graph to estimate the mean width of stomata at 03:00 hours.

Show on your graph how you estimated your answer.

mean width = ... arbitrary units
[2]

(iii) With reference to Table 1.4 and Fig. 1.2, describe the change in mean width of stomata between 02:00 hours and 22:00 hours.

.....

.....

.....

.....

.....

..... [2]

[Total: 21]

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2 **P1** is a slide of a stained transverse section through a plant root.

(a) **(i)** Draw a large plan diagram of the region of the root on slide **P1** indicated by the shaded area in Fig. 2.1. Use a sharp pencil.

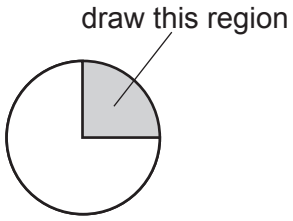


Fig. 2.1

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

[5]

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(ii) Observe the cells in the centre of the root on slide **P1**.

Select a group of four adjacent cells.

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]

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(b) Fig. 2.2 shows a photomicrograph of a transverse section through a root. This root is different to the root on slide **P1**. You are **not** expected to be familiar with this root section.

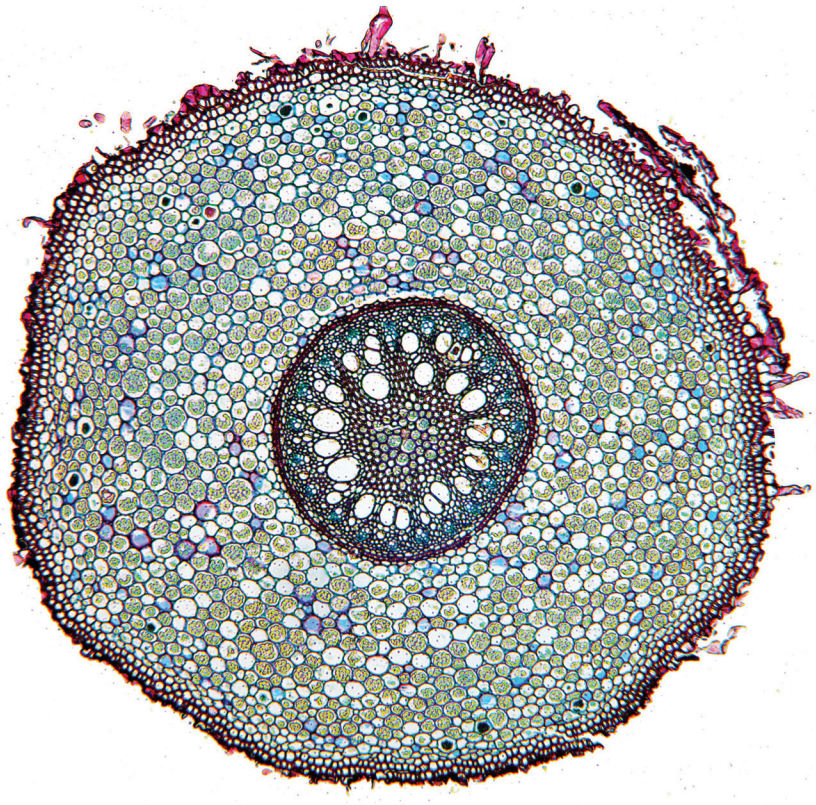


Fig. 2.2

(i) Identify **three** observable differences, other than colour, between the root in Fig. 2.2 and the root on slide **P1**.

Record these **three** observable differences in an appropriate table.

[4]

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(ii) Fig. 2.3 is a photomicrograph of the same root section that is shown in Fig. 2.2.

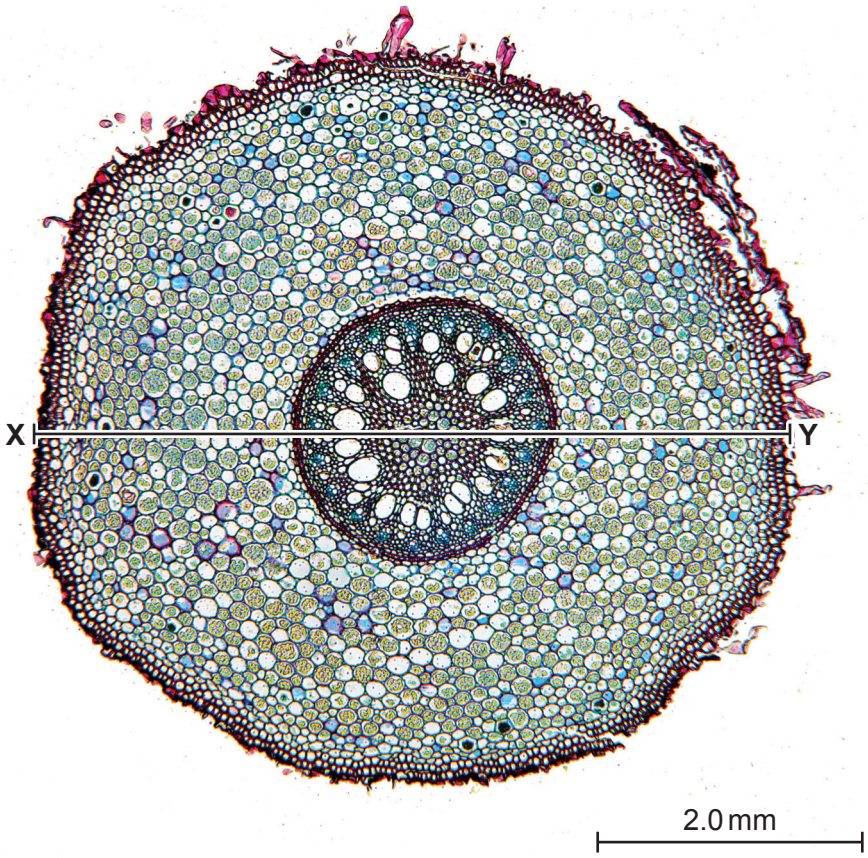


Fig. 2.3

Use the scale bar on Fig. 2.3 to calculate the magnification of the photomicrograph **and** the actual diameter of the root section identified by the line **X–Y**.

Show your working and use appropriate units.

magnification = × .....

actual diameter = ...

[5]

[Total: 19]

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