Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

6453291273

BIOLOGY **9700/33**

Paper 3 Advanced Practical Skills 1 **May/June 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 When plant tissue is placed into a solution of sodium chloride, water moves between the sodium chloride solution and the cells in the plant tissue.

You will investigate the effect of surface area of plant tissue on the movement of water between a sodium chloride solution and the cells in a sample of plant tissue.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
P	5 cylinders of plant tissue in distilled water	none	–
S	2.0 mol dm^{-3} sodium chloride solution	none	200

It is recommended that you wear suitable eye protection.

You will need to:

- cut cylinders of plant tissue into different lengths
- soak different lengths of plant tissue in sodium chloride solution for 20 minutes
- measure the final length of the plant tissue.

Carry out step 1 to step 12.

step 1 Using the forceps, put the cylinders of plant tissue onto the white tile.

step 2 Cut each cylinder of plant tissue to 40 mm length.

The cylinders of plant tissue all have the same diameter, as shown in Fig. 1.1. The radius is calculated by dividing the diameter by 2.

Fig. 1.1

(a) **(i)** Measure the diameter of one cylinder of plant tissue **and** calculate the radius, *r*.

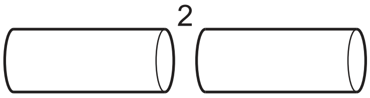
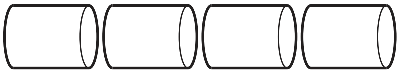
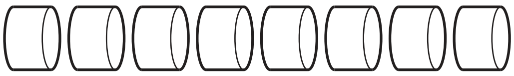
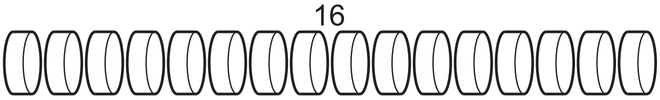
diameter = ...

r = ...
[1]

To investigate the effect of surface area, you will use one whole cylinder of plant tissue and cut the other cylinders into a different number of pieces.

step 3 Label five beakers with the number of pieces of plant tissue (**n**) as shown in Table 1.2.

Table 1.2

beaker labelled	number of pieces of plant tissue (n)	length (h) of each small piece / mm
1	1 	40
2	2 	20
4	4 	10
8	8 	5
16	16 	2.5

step 4 Put **one** whole cylinder of plant tissue into the beaker labelled **1**.

step 5 Cut each of the other **four** cylinders of plant tissue into the number of pieces shown in Table 1.2 and put them into the appropriately labelled beaker.

In step 6 you will use a syringe to measure the volume of sodium chloride solution, **S**, you will put into each beaker.

(ii) State the volume of **S** that you will put into each beaker **and** give a reason for the volume that you have stated.

volume of **S** .... cm^3

reason ....

....
[1]

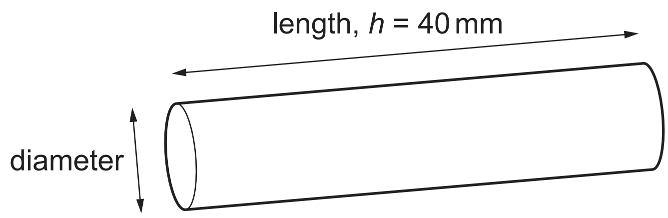
step 6 Put the volume of **S** you stated in **(a)(ii)** into each of the beakers.

step 7 Start timing and wait for 20 minutes.

Use this time to continue with other parts of Question 1.

Fig. 1.2 shows an example of how to calculate the total surface area of plant tissue placed in each beaker.

EXAMPLE: a cylinder with a length of 40 mm



surface area of cylinder = $2\pi r^2 + 2\pi r\,h$

$$= (2 \times 3.14 \times r^2) + (2 \times 3.14 \times r \times 40)$$

where:
$\pi = 3.14$
r = radius of cylinder = diameter ÷ 2
h = height or length of cylinder

The total surface area depends on the number of pieces, n.

Total surface area = surface area of one cylinder × number of pieces

$$= (2\pi r^2 + 2\pi rh)n$$

Fig. 1.2

(iii) Complete Table 1.3 by calculating the total surface area of the **whole** piece of plant tissue (**1**) **and** the total surface area for the plant tissue cut into **16** pieces. Use the formulae shown in Fig. 1.2.

Show your working in Table 1.3.

Table 1.3

n	h / mm	surface area of one piece / mm^2	total surface area / mm^2
1	40		
16	2.5		

[2]

(iv) Describe what happens to the **total** surface area when one whole cylinder of plant tissue is cut into 16 smaller pieces.

....

.... [1]

step 8 After the 20 minutes (step 7), pour the sodium chloride solution from around the cylinder of plant tissue in beaker **1** into the container labelled **For waste**. Put the plant tissue onto the white tile.

step 9 Measure the length of the cylinder of plant tissue. Record this length in **(a)(v)**.

step 10 Repeat step 8 for beaker **2**.

step 11 Place the cylinders of plant tissue end-to-end so that they are touching. Measure their total length, as shown in Fig. 1.3. Record this length in **(a)(v)**.

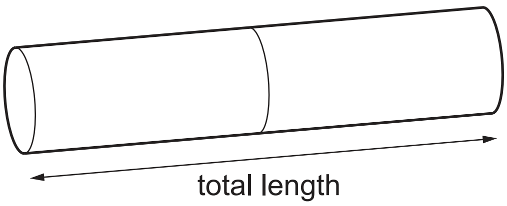


Fig. 1.3

step 12 Repeat step 10 and step 11 using the plant tissue in beaker **4**, beaker **8** and beaker **16**.

(v) Record your results in an appropriate table.

[5]

(vi) With reference to the total surface area, describe the trend in your results.

....

....

.... [1]

(vii) Explain the trend you described in **(a)(vi)**.

....

....

....

....

....

....

....

.... [2]

(viii) State **one** source of error in this investigation when measuring the dependent variable in step 11 and step 12.

....

.... [1]

(ix) Suggest how you could modify this procedure to investigate the effect of temperature on the movement of water between the sodium chloride solution and the cells in the plant tissue.

....

....

....

....

.... [2]

(b) A student investigated the effect of different concentrations of sodium chloride solution on red blood cells.

The student:

- counted the number of whole red blood cells in six samples of blood
- put each sample into a different concentration of sodium chloride solution for 10 minutes
- counted the number of whole red blood cells remaining in each concentration
- calculated the number of red blood cells remaining as a percentage of the number of red blood cells in each sample at the start.

The results are shown in Table 1.4.

Table 1.4

percentage concentration of sodium chloride	percentage number of whole red blood cells remaining
0.00	0.0
0.40	3.0
0.50	10.0
0.65	46.0
0.80	96.0
0.90	100.0

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

Use a sharp pencil.

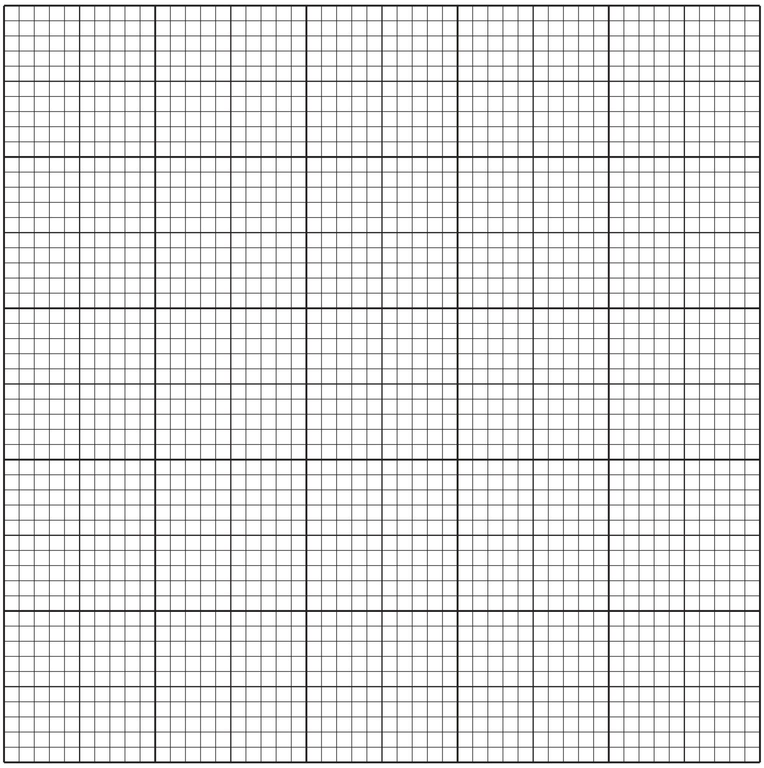


Fig. 1.4

[4]

(ii) State the concentration of sodium chloride solution that has the same water potential as the red blood cells.

sodium chloride concentration = ... % [1]

(iii) With reference to water potential, explain the effect of 0.4% sodium chloride solution on red blood cells.

....

....

....

.... [1]

[Total: 22]

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

(a) **(i)** Draw a large plan diagram of a region of the organ on **L1** to include the epidermis and **two** vascular bundles. Use a sharp pencil.

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

[5]

(ii) Observe the xylem on the section of the plant organ on **L1**.

Select a line of **four** adjacent xylem vessel elements.

Each xylem vessel element must touch at least **one** of the other xylem vessel elements.

- Make a large drawing of this line of **four** xylem vessel elements.
- Use **one** ruled label line and label to identify the lumen.

[5]

(b) Fig. 2.1 is a diagram of a stage micrometer scale that is being used to calibrate an eyepiece graticule.

One division, on either the stage micrometer scale or the eyepiece graticule, is the distance between two adjacent lines.

The length of one division on this stage micrometer is **0.1 mm**.

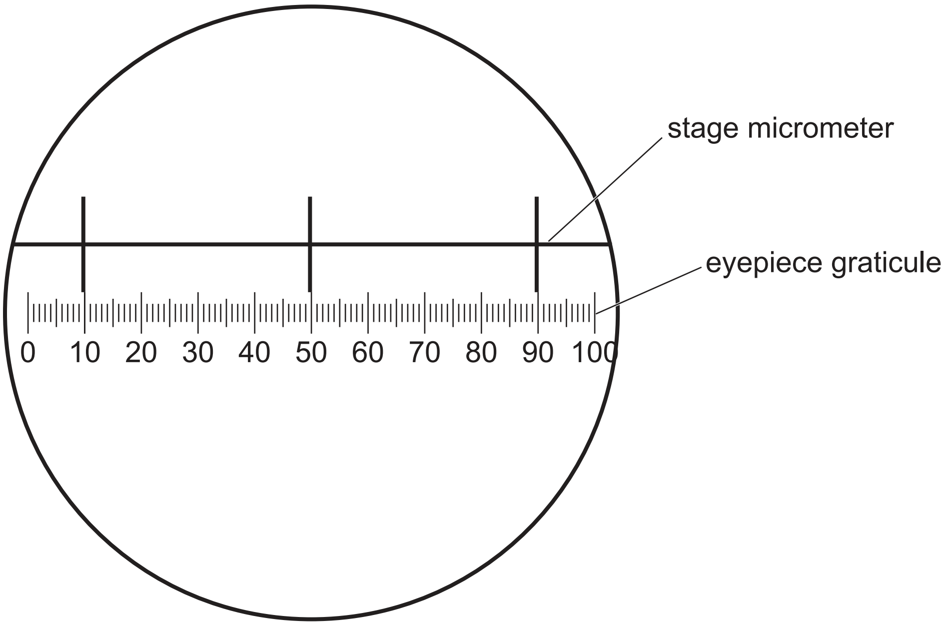


Fig. 2.1

(i) Use Fig. 2.1 to calculate the actual length of **one** eyepiece graticule unit.

Show your working and give your answer in micrometres (μm).

actual length = ... μm [2]

Fig. 2.2 is a photomicrograph of a stained transverse section of the same plant organ as the section on **L1** but from a different plant.

This was taken using the same microscope and eyepiece graticule as in Fig. 2.1.

The eyepiece graticule scale has been placed across one of the larger sections of vascular tissue, labelled **T** in Fig. 2.2.

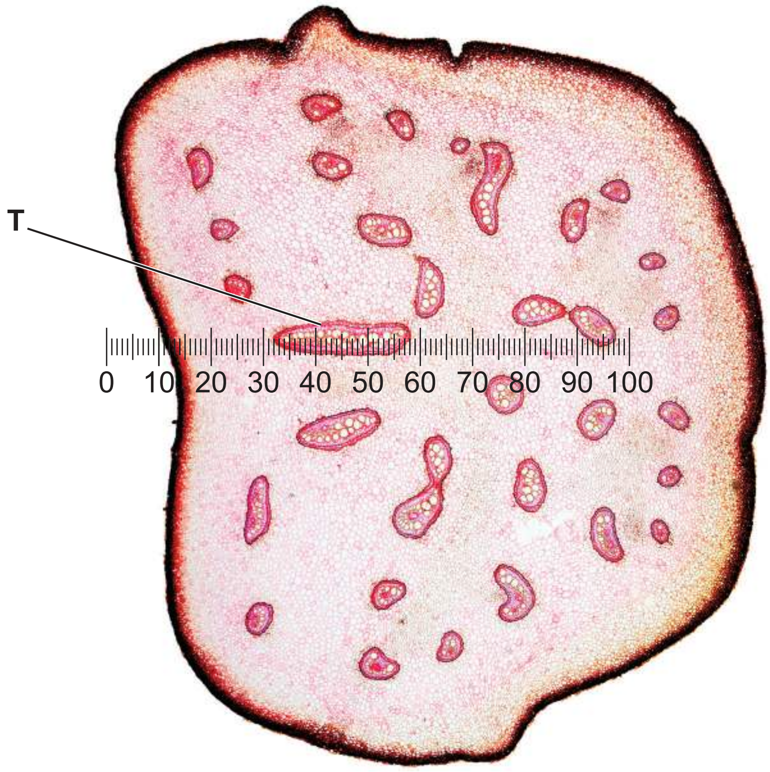


Fig. 2.2

(ii) Use the calibration of the eyepiece graticule unit from **(b)(i)** to calculate the actual length of the section of vascular tissue **T** in Fig. 2.2.

Show your working and use appropriate units.

actual length of the vascular tissue **T** = ... [2]

(c) Fig. 2.3 is the same photomicrograph as that shown in Fig. 2.2.

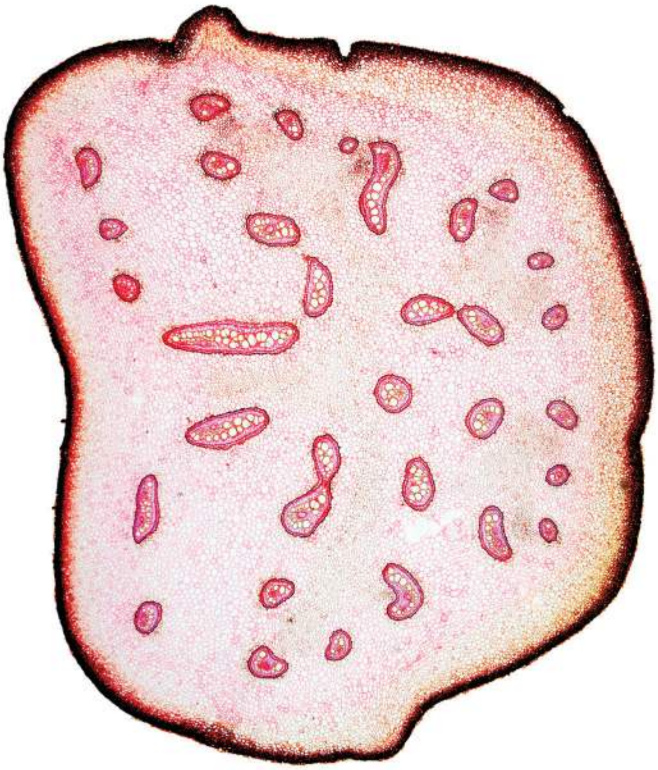


Fig. 2.3

(i) Identify **three** observable differences, other than colour, between the section on **L1** and the section in Fig. 2.3.

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

Table 2.1

feature	L1	Fig. 2.3

[3]

(ii) Identify the plant organ on **L1** and in Fig. 2.3.

State how **one** observable feature helped you to identify the plant organ.

plant organ ....

....

....
[1]

[Total: 18]

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