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CANDIDATE NAME

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1060120043

BIOLOGY **9700/37**

Paper 3 Advanced Practical Skills 1 **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 **20** pages. Any blank pages are indicated.

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[Turn over

1 Dialysis tubing is a partially permeable membrane. Some molecules such as glucose molecules can diffuse through pores in the membrane.

You are required to investigate the diffusion of glucose through the pores in dialysis tubing using two different concentrations of glucose.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
R	20.0% glucose solution	low	20
S	10.0% glucose solution	low	20
G	1.0% glucose solution	low	30
W	distilled water	low	100
Benedict's	Benedict's solution	harmful irritant	20
D1	length of dialysis tubing in distilled water	low	–
D2	length of dialysis tubing in distilled water	low	–

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:

- put two different concentrations of glucose solution into dialysis tubing surrounded by water
- take a sample of the water surrounding the dialysis tubing
- test the sample for the presence of glucose.

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Carry out step 1 to step 10.

step 1 Draw a mark 8 cm from the top of a large test-tube, as shown in Fig. 1.1.

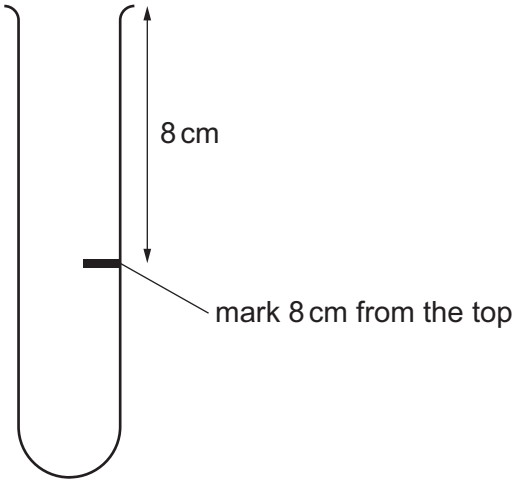

Fig. 1.1

step 2 Remove the dialysis tubing from beaker **D1**. Tie a knot in the dialysis tubing as close as possible to one end, so that the end is sealed.

step 3 The whole length of the dialysis tubing needs to be separated to allow the tubing to be filled with solution. To do this, rub the whole length of the dialysis tubing gently between your finger and thumb.

step 4 Put 10 cm^3 of 20.0% glucose solution, **R**, into the open end of the dialysis tubing.

step 5 Rinse the outside of the dialysis tubing by dipping it in the water in beaker **D1**.

step 6 Put the dialysis tubing containing **R** into the large test-tube and keep it in position using an elastic band as shown in Fig. 1.2.

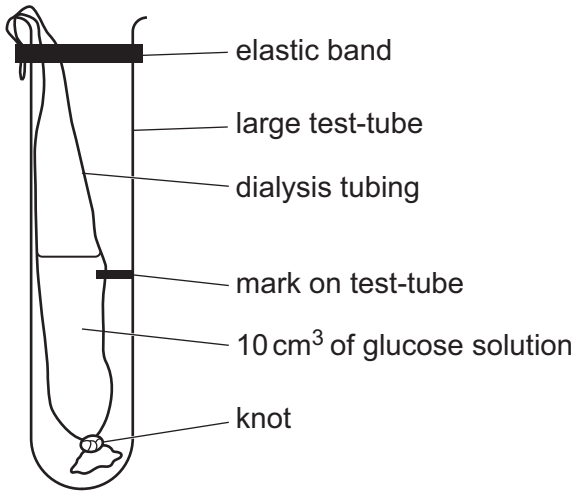

Fig. 1.2

step 7 Put distilled water into the large test-tube so that the top of the water is above the level of the glucose solution in the dialysis tubing.

step 8 Start timing and leave the dialysis tubing in the distilled water for 15 minutes.

step 9 Repeat step 1 to step 7 using the dialysis tubing in the container labelled **D2** and the 10.0% glucose solution, **S**, instead of **R**.

step 10 Start timing and leave the dialysis tubing in the distilled water for 15 minutes.

While you are waiting, continue with preparing the glucose standards.

Preparing glucose standards

You will need to carry out a **serial** dilution of the 1.0% glucose solution, **G**, to reduce the concentration by **half** between each successive dilution.

You will need to prepare **four** concentrations of glucose solution in addition to the 1.0% glucose solution, **G**.

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

(a) (i) Complete Fig. 1.3 to show how you will prepare your serial dilution.

Each beaker should have:

- a labelled arrow to show the volume of glucose solution transferred
- a labelled arrow to show the volume of distilled water, **W**, added
- a label under the beaker to show the concentration of glucose solution.

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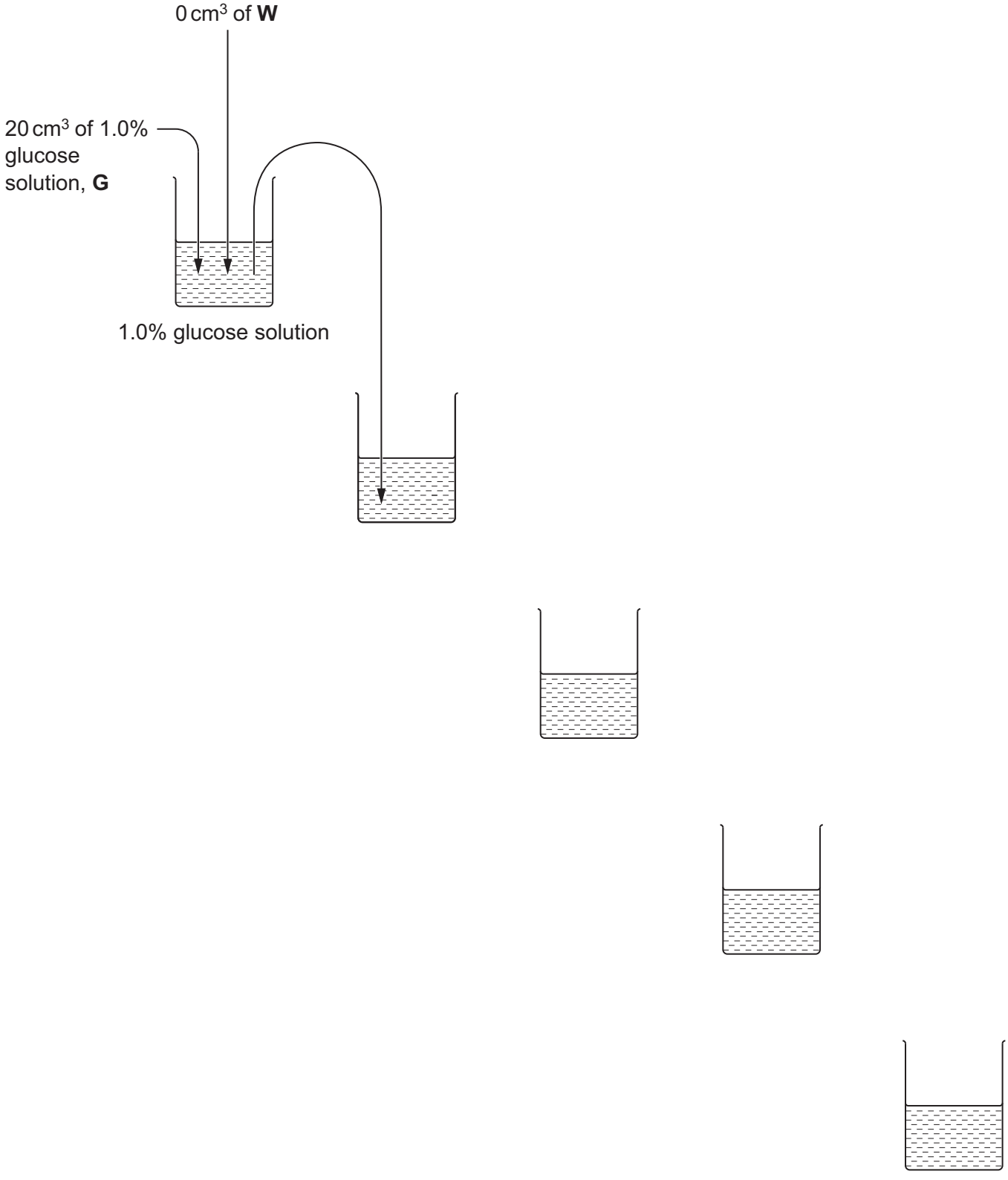

Fig. 1.3

[3]

Carry out step 11 to step 19.

step 11 Set up a boiling water-bath ready for step 16.

step 12 Prepare the concentrations of glucose solutions as shown in Fig. 1.3.

step 13 Label 5 test-tubes with the concentrations prepared in step 12.

step 14 Put 1 cm^3 of each glucose concentration into the appropriately labelled test-tube.

step 15 Put 1 cm^3 of **Benedict's** into each of the test-tubes. Shake gently to mix.

step 16 Put the test-tube containing 1.0% glucose solution into the boiling water-bath. Start timing.

step 17 Record in **(a)(ii)** the time to the first colour change.

If there is no colour change after 120 seconds, stop timing and record the time as 'more than 120'.

step 18 Remove the test-tube from the boiling water-bath.

step 19 Repeat step 16 to step 18 with the other glucose concentrations.

You will need the boiling water-bath again in step 25.

(ii) Record your results in an appropriate table.

[5]

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Carry out step 20 to step 23.

step 20 Label a small test-tube **R1**.

step 21 After 15 minutes (step 8), put a 1 cm^3 syringe into the water surrounding the dialysis tubing containing **R**, so that the end of the syringe is level with the mark on the test-tube. Remove 1 cm^3 from the water surrounding the dialysis tubing and put this into the test-tube labelled **R1**.

step 22 Label a small test-tube **S1**.

step 23 After 15 minutes (step 10), put a 1 cm^3 syringe into the water surrounding the dialysis tubing containing **S**, so that the end of the syringe is level with the mark on the test-tube. Remove 1 cm^3 from the water surrounding the dialysis tubing and put this into the test-tube labelled **S1**.

You will determine the concentrations of glucose in **R1** and **S1** by:

- carrying out the Benedict's test on **R1** and **S1**
- using your results to estimate the concentration of glucose in **R1** and **S1**.

Estimating the concentration of glucose in samples R1 and S1

Carry out step 24 to step 28.

step 24 Put 1 cm^3 of **Benedict's** into the test-tube labelled **R1**. Shake gently to mix.

step 25 Put the test-tube into the boiling water-bath. Start timing.

step 26 Record in **(a)(iii)** the time to the first colour change.

If there is no colour change after 120 seconds, stop timing and record the time as 'more than 120'.

step 27 Remove the test-tube from the boiling water-bath.

step 28 Repeat step 24 to step 27 with the test-tube labelled **S1**.

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(iii) Record your results for **R1** and **S1**.

result for **R1** ..... s

result for **S1** ..... s
[1]

(iv) Use your results in **(a)(ii)** and **(a)(iii)** to estimate the percentage concentration of glucose in **R1** and **S1**.

percentage concentration of glucose in **R1** = ...%

percentage concentration of glucose in **S1** = ...%
[1]

(v) Suggest a reason for the percentage concentrations of glucose estimated in **R1** and **S1** in **(a)(iv)**.

.....

.....

.....

..... [2]

(vi) Calculate the average **rate** at which the percentage concentration of glucose is increasing in the water surrounding the dialysis tubing containing **R**.

Show your working and give your answer to **two** significant figures.

average rate of increase of percentage concentration of glucose ..... per minute
[1]

(vii) Suggest how you could modify this investigation to obtain a more accurate estimate for the concentration of glucose in sample **R1**.

.....

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..... [2]

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(viii) A possible source of error when carrying out step 21 is shown in Table 1.2.

Complete Table 1.2 by stating the type of error as systematic **or** random, **and** the effect the error may have on the results.

Table 1.2

source of error	systematic error or random error	effect on the results
the line at 1.0 cm^3 on the syringe used in step 21 actually measures a volume of 0.95 cm^3 and not 1.0 cm^3		

[1]

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(b) Fruits contain a range of naturally occurring sugars that make them taste sweet. These sugars include glucose, fructose and sucrose. Scientists measured the mass of these sugars in apple and pineapple.

The results are shown in Table 1.3.

Table 1.3

type of sugar	mass of sugar / g per 100 g fruit	
	apple	pineapple
glucose	2.3	1.3
fructose	6.9	2.3
sucrose	1.9	5.2

(i) Draw a bar chart of the data in Table 1.3 on the grid in Fig. 1.4.

Use a sharp pencil.

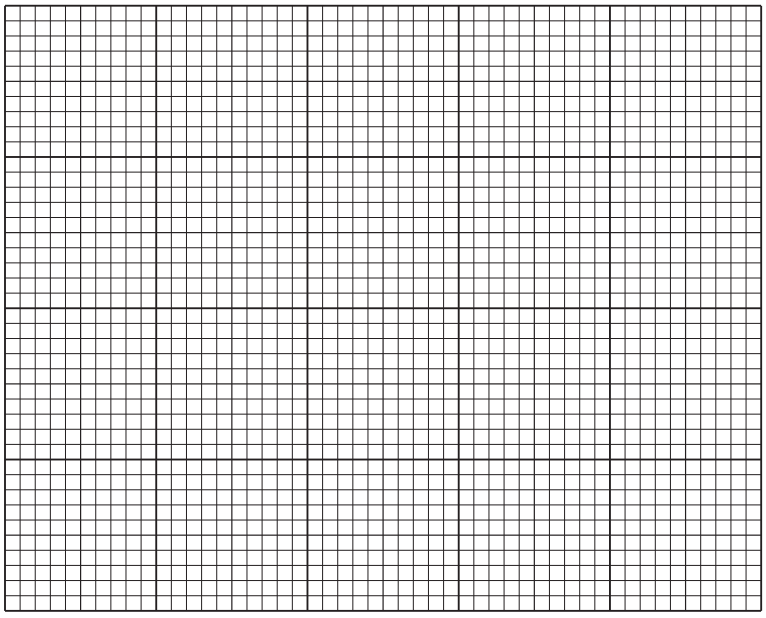

Fig. 1.4

[4]

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(ii) Calculate the percentage difference in the mass of sucrose per 100 g of pineapple compared to the mass of sucrose per 100 g of apple.

Show your working.

percentage difference in the mass of sucrose = ...
[1]

[Total: 21]

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2 **M1** is a slide of a stained transverse section through a plant stem.

(a) **(i)** Draw a large plan diagram of the region on **M1** indicated by the shaded area in Fig. 2.1. Use a sharp pencil.

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

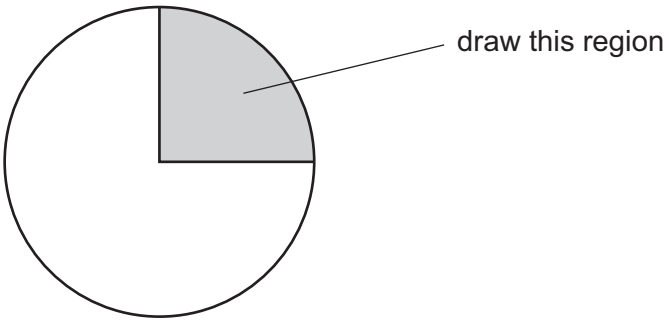

Fig. 2.1

[5]

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(ii) Observe the xylem vessel elements in the stem on **M1**.

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

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

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

[5]

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(b) Fig. 2.2 is a photomicrograph of a stained transverse section of a stem from a different plant to **M1**.

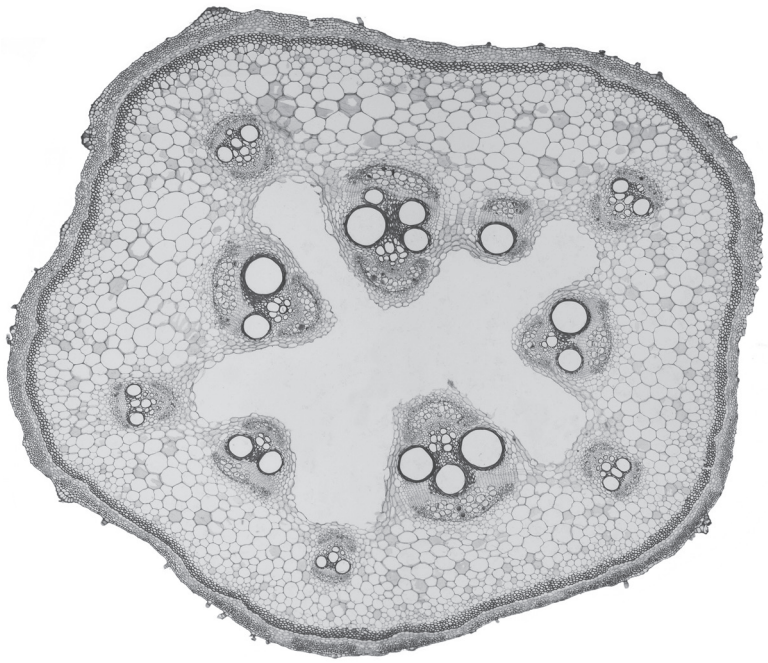

Fig. 2.2

Identify **three** observable differences, other than colour, between the stem section on **M1** and the stem section in Fig. 2.2.

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

[4]

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(c) Fig. 2.3 shows a photomicrograph 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 the stage micrometer in Fig. 2.3 is 1.0 mm.

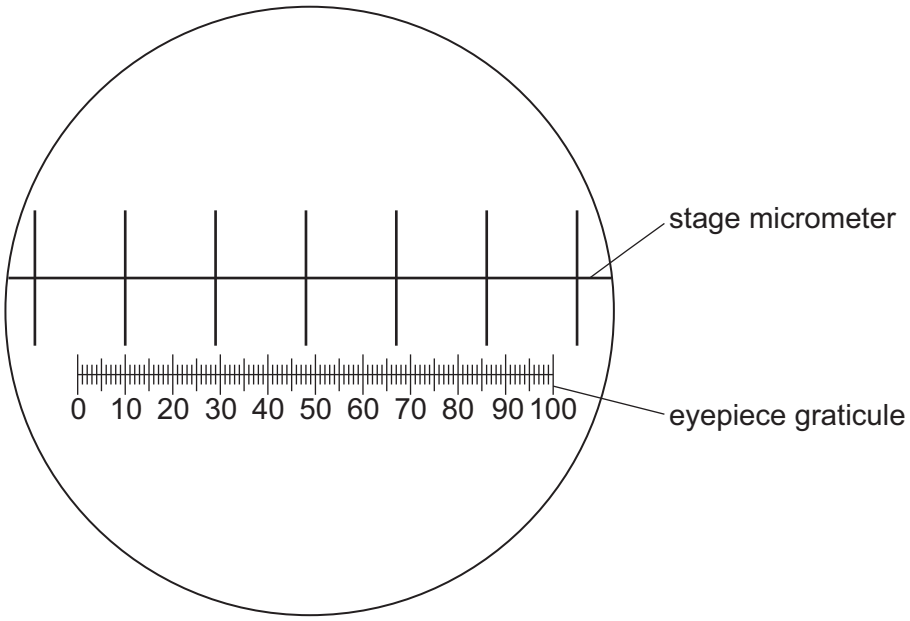

Fig. 2.3

(i) Calculate the actual length of one eyepiece graticule unit shown in Fig. 2.3.

Give your answer in micrometres (μm).

Show your working and give your answer to **three** significant figures.

actual length of one eyepiece graticule unit = ... μm
[3]

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(ii) Fig. 2.4 is the same photomicrograph as that shown in Fig. 2.2. This was taken with the same microscope and the same lenses used to take the photomicrograph in Fig. 2.3.

The eyepiece graticule has been placed across the length of a vascular bundle.

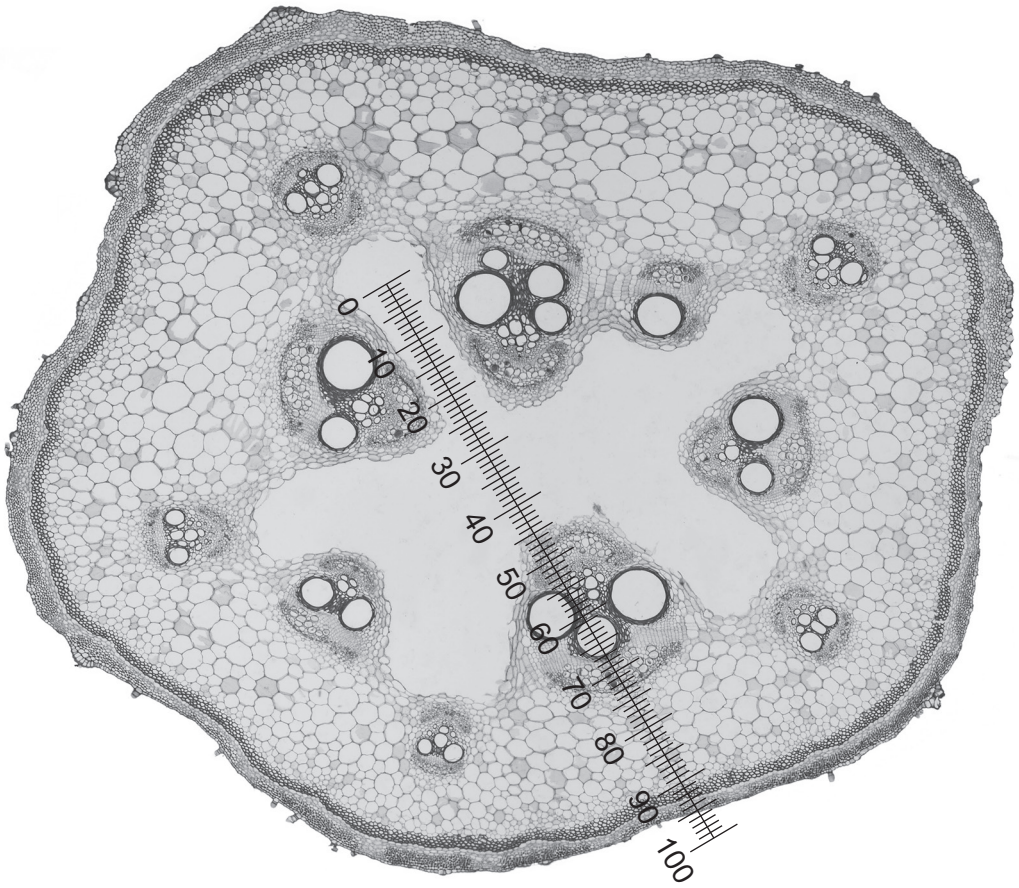

Fig. 2.4

Use the calibration of the eyepiece graticule unit from **(c)(i)** to calculate the actual length of the vascular bundle in Fig. 2.4.

Show your working and use appropriate units.

actual length of the vascular bundle = ...
[2]

[Total: 19]

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