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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME										
CENTRE NUMBER							CANDIDATE NUMBER			

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BIOLOGY **9700/33**

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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1 Dialysis tubing is a partially permeable membrane. Glucose molecules can diffuse through the dialysis tubing.

You are required to investigate the diffusion of glucose across dialysis tubing.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
G	20.0% glucose solution	low	50
W	distilled water	low	200
Benedict's	Benedict's solution	harmful irritant	40
D	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 glucose solution into dialysis tubing surrounded by water
- take samples of the water surrounding the dialysis tubing
- test for the presence of glucose in each sample of water.

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Carry out step 1 to step 11.

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

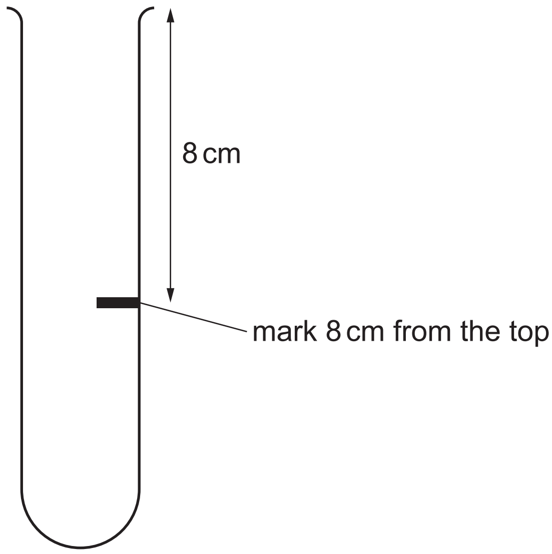

Fig. 1.1

step 2 Remove the dialysis tubing from beaker **D**. 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 gently between your finger and thumb.

step 4 Put 10 cm^3 of 20.0% glucose solution, **G**, 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 **D**.

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

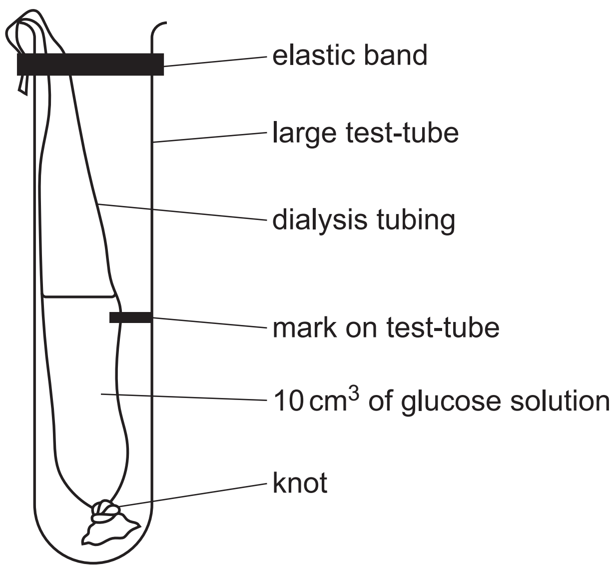

Fig. 1.2

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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.

You are required to take samples of the water surrounding the dialysis tubing every 5 minutes for 15 minutes. You will collect three samples.

step 9 Label three test-tubes with the times the samples of water will be taken (**5**, **10** and **15**).

step 10 After 5 minutes (step 8), put a 1 cm^3 syringe into the water surrounding the dialysis tubing 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 **5**. Repeat this action to remove another 1 cm^3 from the water surrounding the dialysis tubing and put this into the test-tube labelled **5**. The test-tube labelled **5** will now contain a 2 cm^3 sample. Do **not** stop timing.

step 11 Repeat step 10 at 10 minutes and at 15 minutes using the appropriately labelled test-tubes.

You need to carry out a dilution of the 20.0% glucose solution, **G**, to make a 1.0% glucose solution. You will need 20 cm^3 of this 1.0% glucose solution.

(a) (i) Complete Table 1.2 to show the volume of distilled water, **W**, you will use to make 20 cm^3 of a 1.0% glucose solution.

Table 1.2

volume of 20.0% glucose solution, G / cm^3	volume of distilled water, W / cm^3
1	....

[1]

step 12 Prepare the 1.0% glucose solution as shown in Table 1.2.

You will need to carry out a **serial** dilution of the 1.0% glucose solution you have prepared in step 12 as shown in Fig. 1.3. You must 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 from step 12.

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

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(ii) 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.

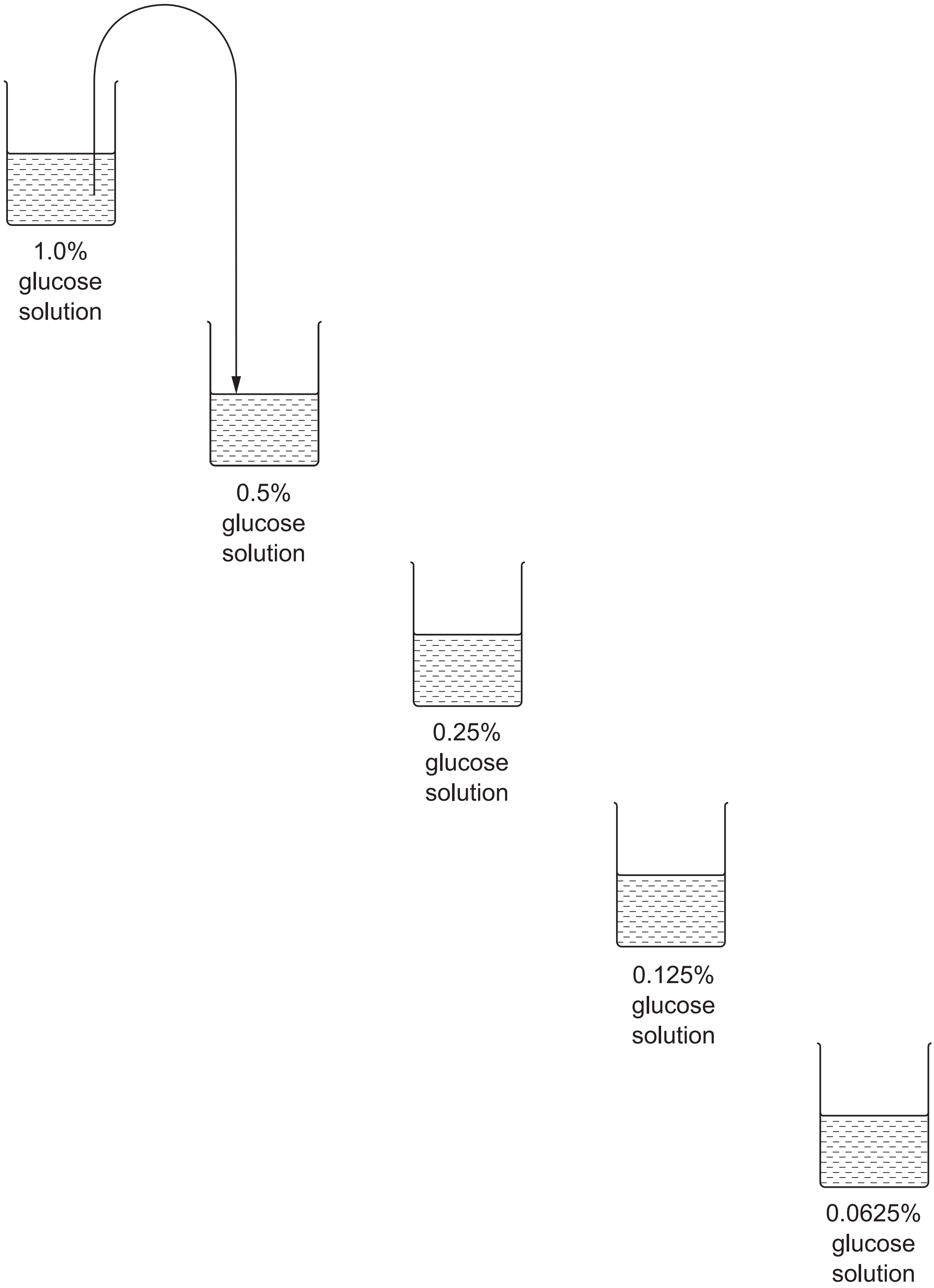

Fig. 1.3

[2]

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step 13 Set up a boiling water-bath ready for step 18 and step 22.

step 14 Prepare the concentrations of glucose solution as shown in Fig. 1.3.

step 15 Label 5 test-tubes with the concentrations of glucose solution shown in Fig. 1.3.

step 16 Put 2 cm^3 of the 1.0% glucose solution into the appropriately labelled test-tube.

(iii) You are required to carry out the Benedict's test on the glucose solutions that you have prepared in step 14.

State the volume of Benedict's solution you will use for each reducing sugar test. Explain why you have selected this volume.

volume of Benedict's solution .... cm^3

explanation ....

....
[1]

step 17 Put the volume of Benedict's solution stated in **(a)(iii)** into the test-tube labelled 1.0%. Shake gently to mix.

step 18 Put this test-tube into the boiling water-bath and record in Table 1.3 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 19 Remove the test-tube from the boiling water-bath.

step 20 Repeat step 16 to step 19 using 2 cm^3 of each of the other concentrations of glucose solution.

(iv) Complete Table 1.3 to record your results.

Table 1.3

percentage concentration of glucose	
1.0	
0.5	
0.25	
0.125	
0.0625	

[1]

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You are required to carry out the Benedict's test on the three samples collected from the water surrounding the dialysis tubing (**5**, **10** and **15**).

step 21 Put the volume of Benedict's solution stated in **(a)(iii)** into the test-tube labelled **5**. Shake gently to mix.

step 22 Put this test-tube into the boiling water-bath and record in **(a)(v)** 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 23 Remove the test-tube from the boiling water-bath.

step 24 Repeat step 21 to step 23 for the other samples (**10** and **15**).

(v) Record your results in an appropriate table.

[4]

(vi) State **one** source of error when carrying out the Benedict's test.

....

.... [1]

(vii) Use your results in **(a)(iv)** and **(a)(v)** to estimate the percentage concentration of glucose in the samples taken at **5**, **10** and **15** minutes.

percentage concentration of glucose in sample **5** = ...

percentage concentration of glucose in sample **10** = ...

percentage concentration of glucose in sample **15** = ...

[1]

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(viii) Suggest a reason for the percentage concentrations of glucose estimated in **(a)(vii)**.

....

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....

.... [1]

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Question 1 continues on page 10.

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(b) A dialysis membrane, similar to dialysis tubing, is used in the treatment of kidney disease.

During this treatment, the blood of a person with kidney disease is passed through a dialysis machine to remove unwanted waste products from the blood.

The machine contains dialysate which is a solution of glucose and ions. Blood flows through the dialysis machine and is separated from the dialysate by a membrane. Some molecules diffuse from the blood into the dialysate. This is shown in Fig. 1.4.

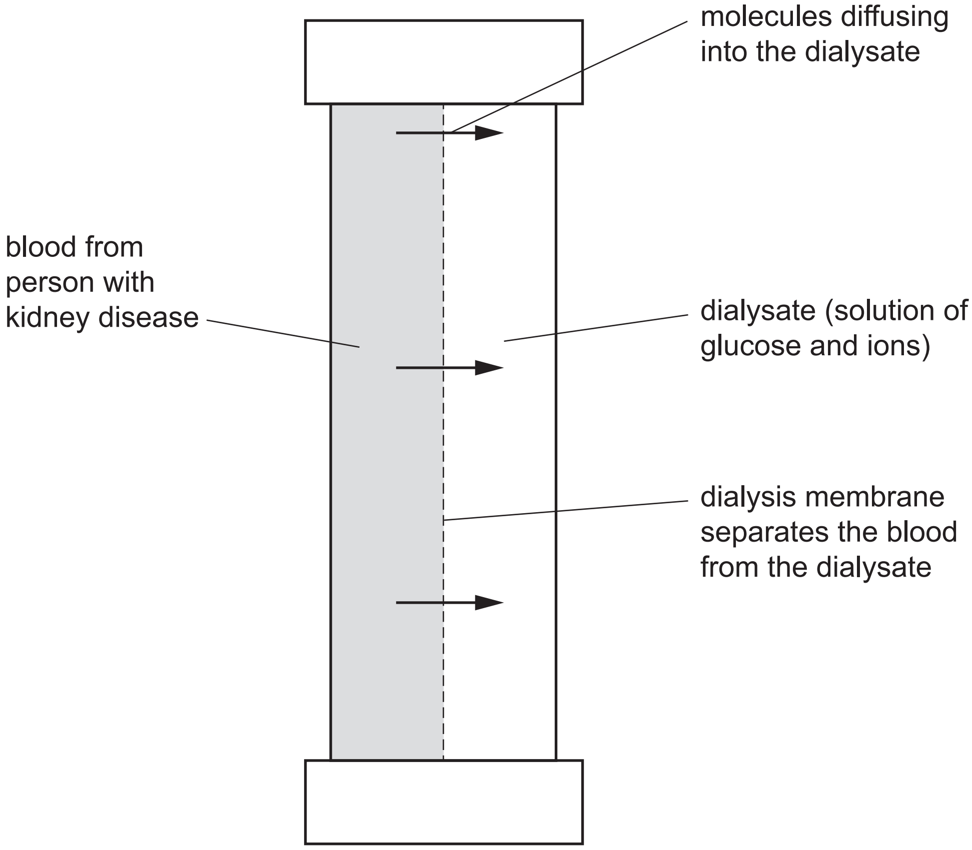

Fig. 1.4

Scientists studied the movement of two molecules, **P** and **Q**, found in the blood of a person with kidney disease. They wanted to see if these two molecules would remain in the blood or move out of the blood across the dialysis membrane into the dialysate.

The scientists took samples of blood from a person using a dialysis machine every 5 minutes for 20 minutes and recorded the concentration of **P** and **Q** in these samples. The results are shown in Table 1.4.

Table 1.4

time sample was taken from the blood / min	concentration of P in the blood / arbitrary units	concentration of Q in the blood / arbitrary units
0	200	400
5	205	280
10	200	150
15	195	90
20	200	75

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(i) Plot a line graph of the data in Table 1.4 on the grid in Fig. 1.5.

Use a sharp pencil.

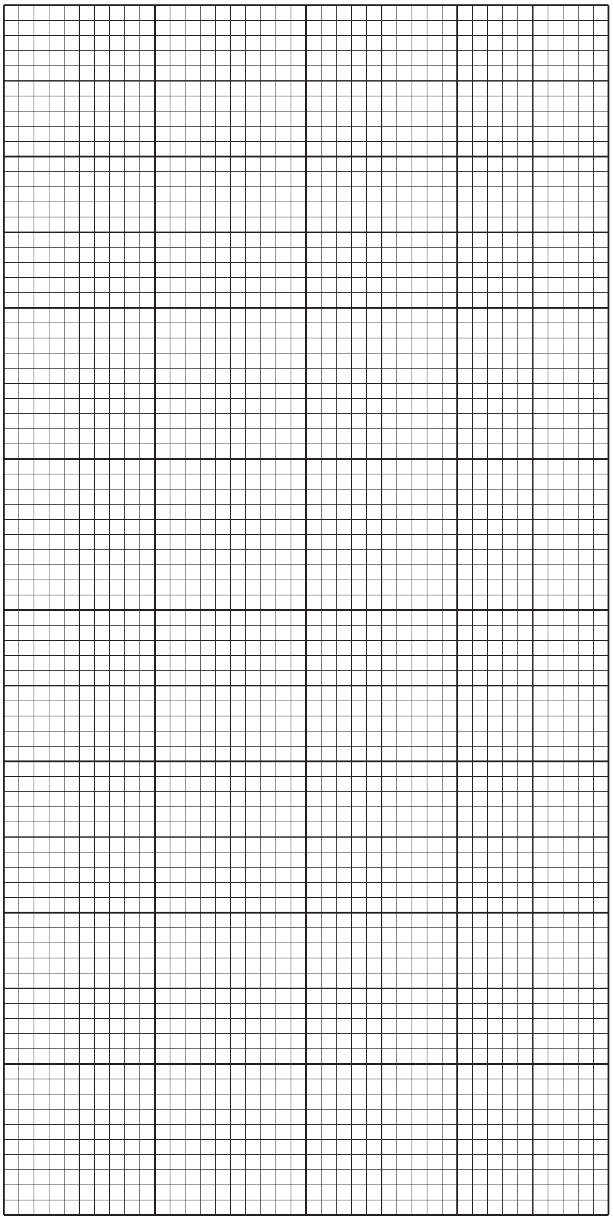

Fig. 1.5

[4]

(ii) Calculate the percentage decrease in concentration of **Q** between 5 minutes and 20 minutes.

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

.... %
[2]

(iii) Suggest a reason for the rate of decrease in the concentration of **Q** from 0 to 10 minutes and from 10 to 20 minutes.

0 to 10 minutes ....

....

....

10 to 20 minutes ....

....

....
[2]

[Total: 20]

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Question 2 starts on page 14.

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

(a) (i) Draw a large plan diagram of the region on **K1** indicated by the shaded area in Fig. 2.1. Use a sharp pencil.

Use **one** ruled label line and the label **T** to identify a tissue involved in transport of substances throughout the plant.

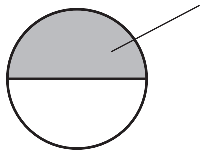

Fig. 2.1

[5]

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(ii) Observe the cells in the centre of the root on **K1**.

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

Each cell must touch at least **one** of the other cells.

Make a large drawing of this group of **four** cells.

[4]

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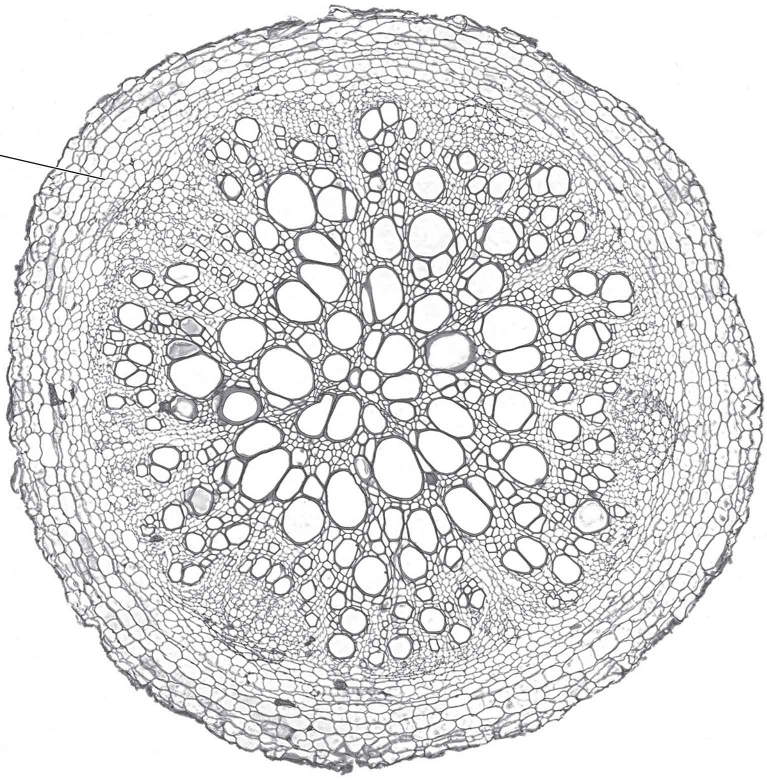
(b) Fig. 2.2 is a photomicrograph of a stained transverse section through the root of a different plant to **K1**.

One difference between the section in Fig. 2.2 and the section on **K1** has been labelled.

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

Draw **three** label lines on Fig. 2.2 to label the **three** differences you have identified. You should complete the labels to describe the differences you observe.



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magnification ×35

Fig. 2.2

[4]

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(c) A student was asked to find the area of the vascular tissue in a transverse section of root.

The student grew one plant for three weeks and took a section from one of the roots. This section is shown in Fig. 2.3.

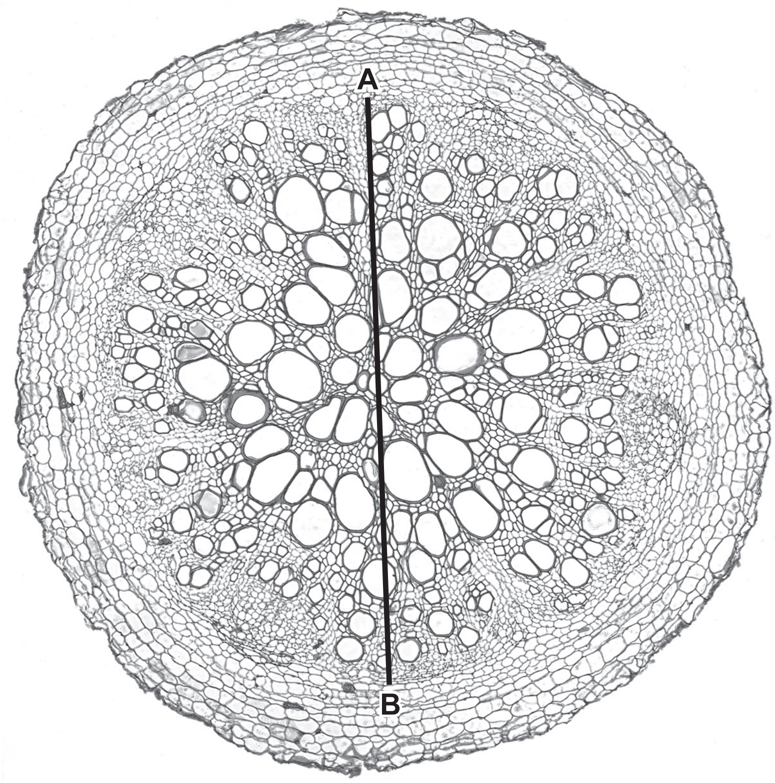

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Fig. 2.3

The vascular tissue is the central region of the section.

Assume that the vascular tissue is a circle. The line **A–B** is the diameter of the vascular tissue.

(i) Calculate the actual area of the vascular tissue.

Use the formula: area = πr^2, where π = 3.14.

actual area of the vascular tissue = ... mm^2 [4]

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(ii) The student wrote a hypothesis which stated that:

The area of vascular tissue in a root section changes as the plant grows.

Suggest modifications to the method used in **(c)** to investigate this hypothesis.

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.... [3]

[Total: 20]

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