

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.

If you have enough time, think about how you can improve the confidence in your results, for example by recording one or more additional measurements.

You will **gain marks** for recording your results according to the instructions.

1 Fusicoccin is a chemical that increases the sucrose concentration in phloem at the source.

In this investigation you will be provided with a sample, **U**, which has been taken from the phloem of a plant.

You will need to:

- prepare proportional dilutions of a 10% sucrose solution
- carry out the test for non-reducing sugars on each concentration of sucrose solution
- carry out the test for non-reducing sugars on the unknown concentration of sucrose, **U**
- estimate the concentration of sucrose in **U**.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume/cm ³
S	10% sucrose solution	none	50
Benedict's	Benedict's solution	harmful	30
W	distilled water	none	50
H	dilute hydrochloric acid	irritant	20
A	10g sodium hydrogencarbonate powder	none	–
U	solution of unknown sucrose concentration	none	10

If any of the materials come into contact with your skin, wash off immediately under cold water.

It is recommended that you wear suitable eye protection.

11. Continue to put a small amount of **A** into each test-tube until there is no more fizzing and there is a small amount of **A** in the bottom of the test-tube.
 12. Put 4 cm³ of Benedict's solution into the test-tube containing the highest concentration of sucrose solution.
 13. Shake the test-tube gently to mix.
 14. Put this test-tube in the boiling water-bath. Start timing.
 15. Measure the time taken for the first appearance of a colour change in the test-tube. If there is no colour change after 120 seconds, **stop timing** and record as 'more than 120'.
 16. Record the result from step 15 in **(a)(ii)**.
 17. Remove the test-tube from the water-bath. Put the test-tube in the test-tube rack.
 18. Repeat step 12 to step 17 with the remaining concentrations of sucrose solution.
- (ii)** Record your results in an appropriate table for the known concentrations of sucrose solution.

[5]

19. Repeat step 12 to step 15 with **U** and record the result from step 15 in **(a)(iii)**.

(iii) State the result for **U**.

..... [1]

A plant that has been treated with fusicoccin has a phloem sucrose concentration of between 5.5% and 7.5%.

(iv) State whether **U** is taken from the phloem of a plant treated with fusicoccin.
Give a reason for your answer.

answer.....

reason.....

..... [1]

(v) Suggest how you could change the independent variable to have more confidence in your answer to **(iv)**.

.....

.....

.....

..... [2]

An investigation was carried out to show the effect of fusicoccin on two plants, **F** and **G**.

- Plant **F** was treated with 10 cm³ of fusicoccin solution.
- Plant **G** was treated with 10 cm³ of water instead of fusicoccin solution.
- Plant **F** and plant **G** were grown in moist soil and in identical conditions.

(vi) State why plant **G** was treated with 10 cm³ of water.

.....

.....

..... [1]

- (b) A scientist investigated the effect of treating a plant with fusicoccin. Samples were taken from the phloem every 35 minutes for a total of 175 minutes.

The concentration of sucrose in each sample was measured. These raw results were then used to calculate the rate of mass flow.

The results are shown in Table 1.3.

Table 1.3

time/min	rate of mass flow /cm³min⁻¹
35	6.00
70	10.25
105	15.00
140	19.50
175	23.75

- (i) Plot a graph of the data in Table 1.3 on the grid in Fig. 1.1.

Use a sharp pencil for drawing graphs.

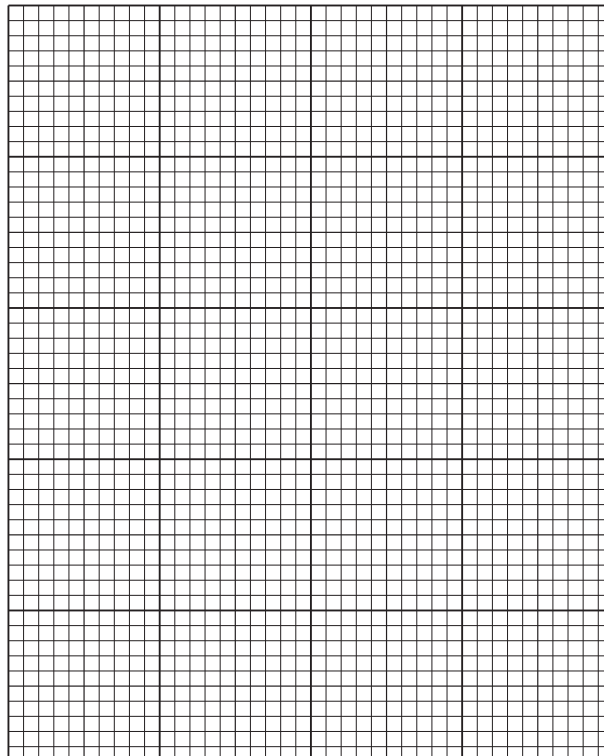


Fig. 1.1

- (ii) Use your graph to find the time when the rate of mass flow was $20\text{ cm}^3\text{ min}^{-1}$.
Show on the graph how you determined your answer.

time = [2]

- (iii) Before treating the plant with fusicoccin, the scientist had obtained a rate of mass flow of $1.5\text{ cm}^3\text{ min}^{-1}$.

Describe the effect of fusicoccin on the rate of mass flow shown in Fig. 1.1.

..... [1]

- (iv) Suggest how fusicoccin increases the loading of sucrose into phloem sieve tubes.

.....
.....
.....
.....
..... [2]

[Total: 21]

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

You are not expected to be familiar with this specimen.

(a) Select a field of view so that you can observe:

- the epidermis
- at least three vascular bundles.

Use a sharp pencil for drawings.

You are expected to draw the correct shape and proportions of the different tissues.

(i) Draw a large plan diagram from the selected field of view which has:

- part of the epidermis
- only **three** vascular bundles
- any other observable tissues.

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

[5]

(ii) Observe the epidermis of the organ on **M1**.

Select two epidermal cells **and** two adjacent, touching cells on the layer below the epidermis.

Each cell must touch at least two other cells.

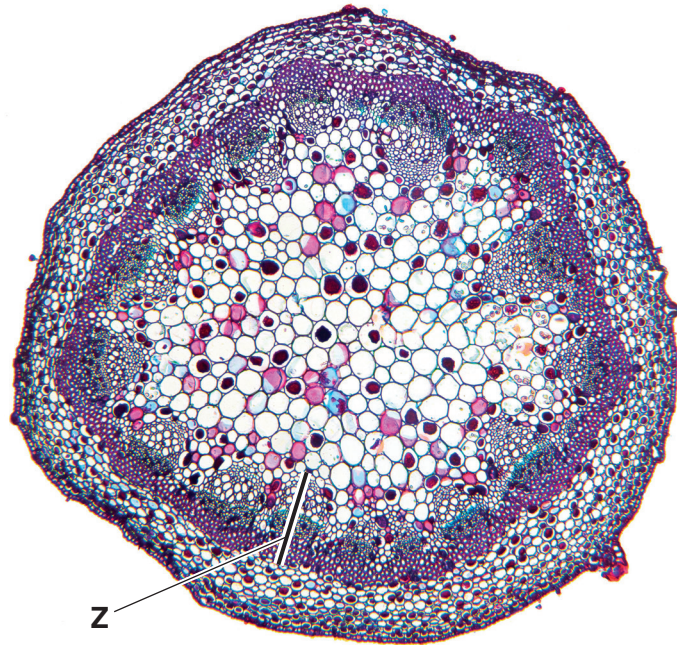
Make a large drawing of this group of **four** cells.

Use **one** ruled label line and label to identify the cell wall of **one** cell.

[5]

- (b) Fig. 2.1 is a photomicrograph of a stained transverse section through an organ from a different species.

You are not expected to be familiar with this specimen.



magnification $\times 20$

Fig. 2.1

- (i) Identify the organ shown in Fig. 2.1.
Describe **one** observable feature that supports your identification.
- name of organ*
- feature*
- [1]
- (ii) Use the magnification and the line Z on Fig. 2.1 to calculate the actual length of the vascular bundle.

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

actual length of the vascular bundle = [5]

- (iii) State the apparatus that you would use with a microscope to measure the actual length of a vascular bundle in the organ on **M1**.

..... [1]

- (c) Identify the observable differences between the organ on **M1** and the organ shown in Fig. 2.1.

Record the observable differences in Table 2.1.

Table 2.1

feature	M1	Fig. 2.1

[2]

[Total: 19]

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