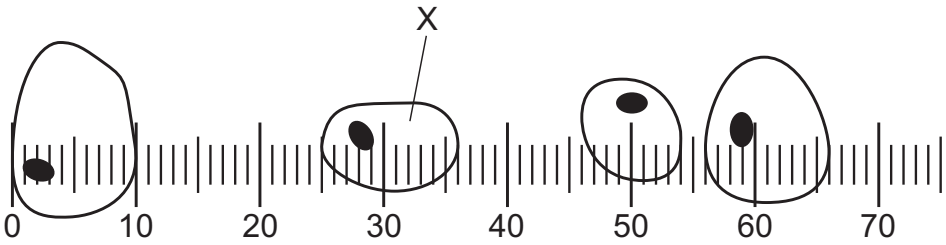
1 In a photomicrograph of magnification ×5000, a chloroplast measures 25 mm in diameter.

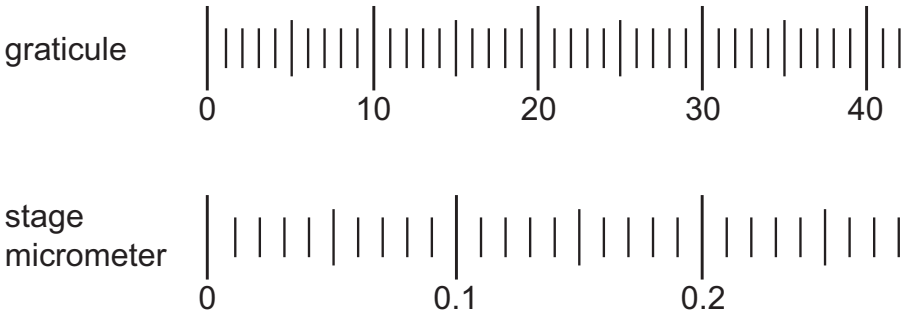
What is the actual diameter of the chloroplast?

A 0.2 μm **B** 0.5 μm **C** 2 μm **D** 5 μm

1 A student observed some cells using a microscope with an eyepiece graticule.



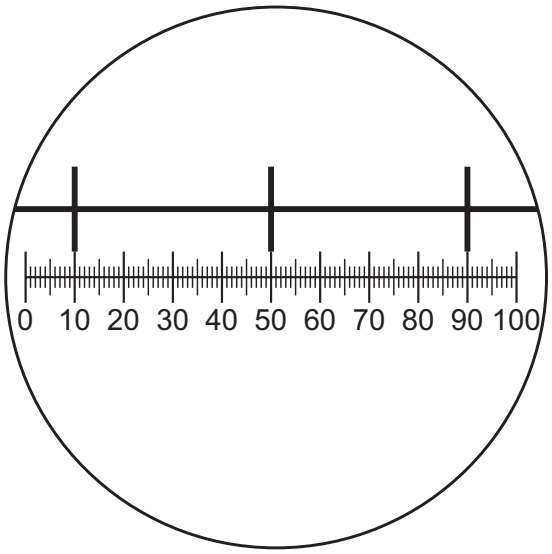
They then replaced the slide containing the cells with a stage micrometer with a millimetre scale, and lined up the eyepiece graticule as shown.



What is the maximum diameter of the cell labelled X?

A 0.0066 μm **B** 66 μm **C** 73 μm **D** 733 μm

1 The diagram shows a stage micrometer, with divisions 0.1 mm apart, viewed through an eyepiece containing a graticule.



The same eyepiece is now used to examine a blood smear.

How many graticule divisions will cover the diameter of a lymphocyte of 10 μm?

A 1 **B** 4 **C** 10 **D** 20

1 Which structures are visible in an appropriately stained plant cell using a high power (×400) light microscope?

	centrioles	mitochondria	starch grains
A	✓	✗	✓
B	✓	✗	✗
C	✗	✓	✗
D	✗	✓	✓

key

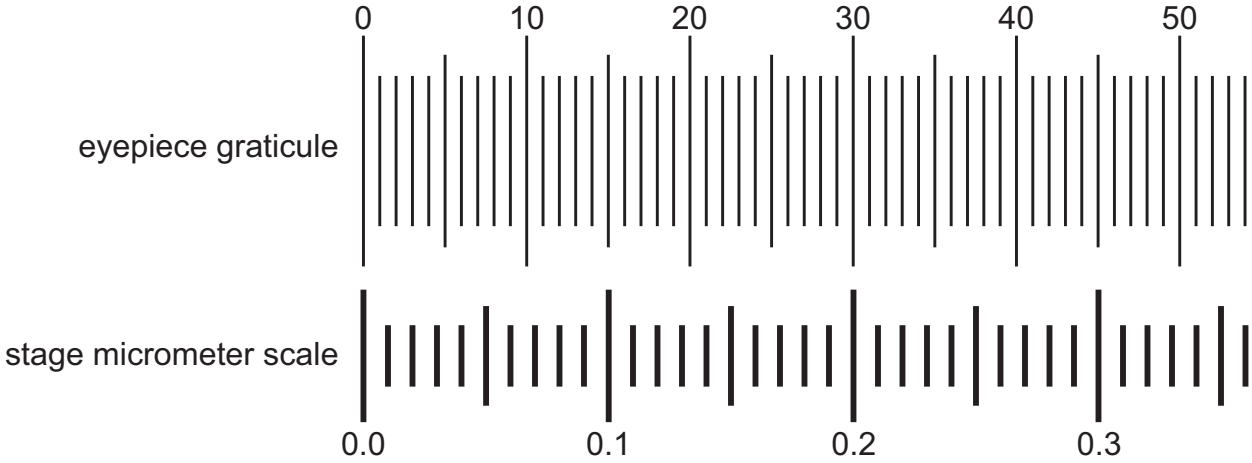
✓ = visible

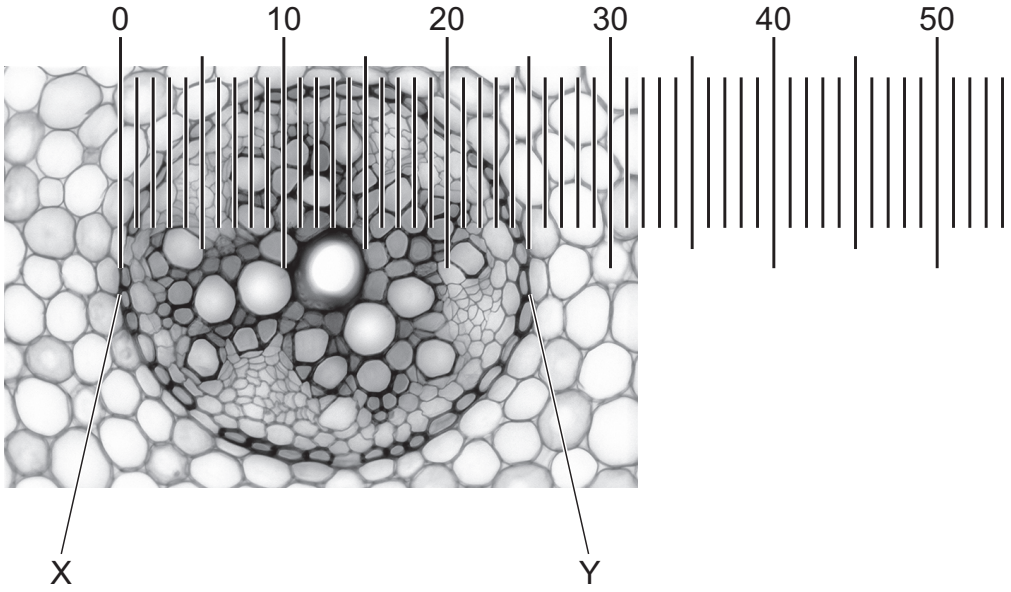
✗ = **not** visible

2 The images show an eyepiece graticule and a stage micrometer scale viewed through a microscope.

The smallest divisions of the stage micrometer scale are 0.01 mm.

The images also show a photomicrograph of a transverse section through a plant root using the same eyepiece graticule and the same magnification.





What is the actual width of the vascular tissue in the plant root between X and Y?

A 17 μm **B** 25 μm **C** 170 μm **D** 250 μm

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.

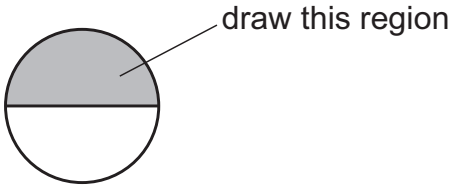


Fig. 2.1

[5]

(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]

(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.

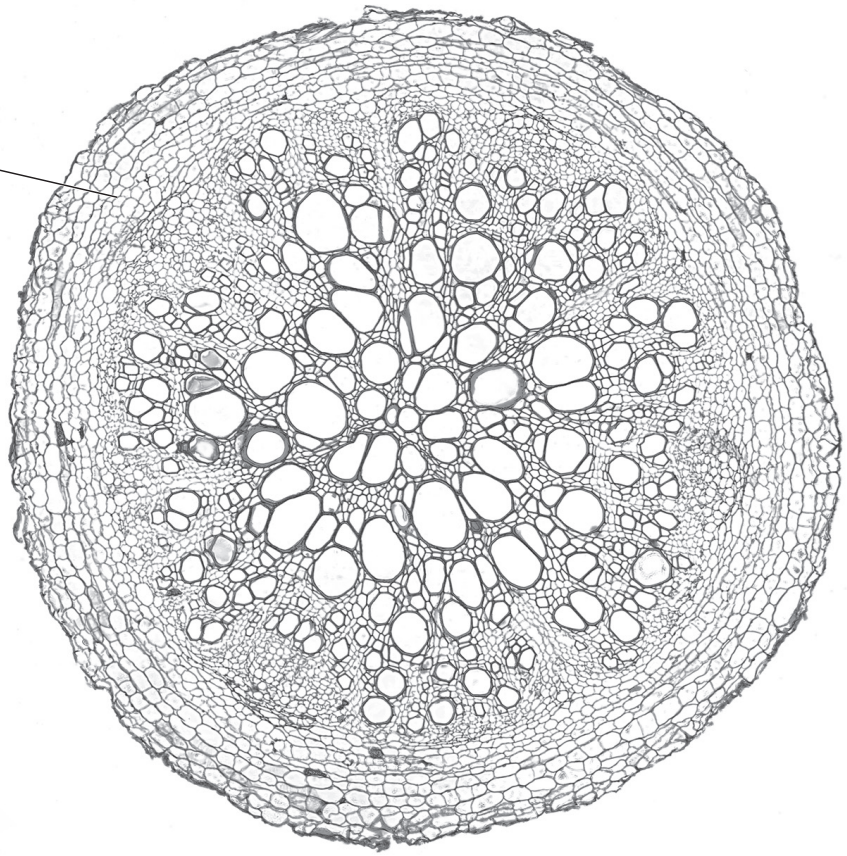
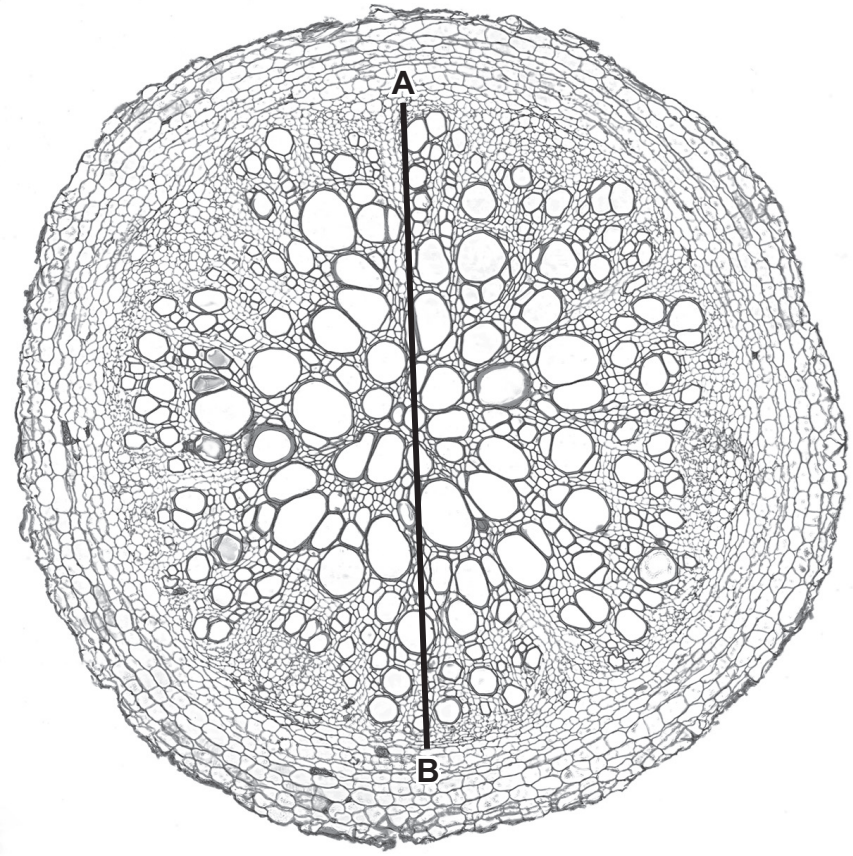


Fig. 2.2

[4]

(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.



magnification ×35

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]

(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.

.....

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 20]

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

(a) **(i)** Draw a large plan diagram of the region on **L1** indicated by the shaded area in Fig. 2.1. Use a sharp pencil.

Use **one** ruled label line and label to identify **one** vascular bundle.

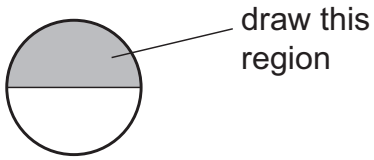


Fig. 2.1

[5]

(ii) Observe the xylem vessel elements in the organ on **L1**.

Select a line 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 line of **four** xylem vessel elements.
- Use **one** ruled label line and label to identify the wall of **one** xylem vessel element.

[5]

(iii) Identify the plant organ on **L1** and give a reason for your answer.

.....

..... [1]

(b) Fig. 2.2 is a photomicrograph of a stained transverse section of the same organ from a different plant to **L1**.

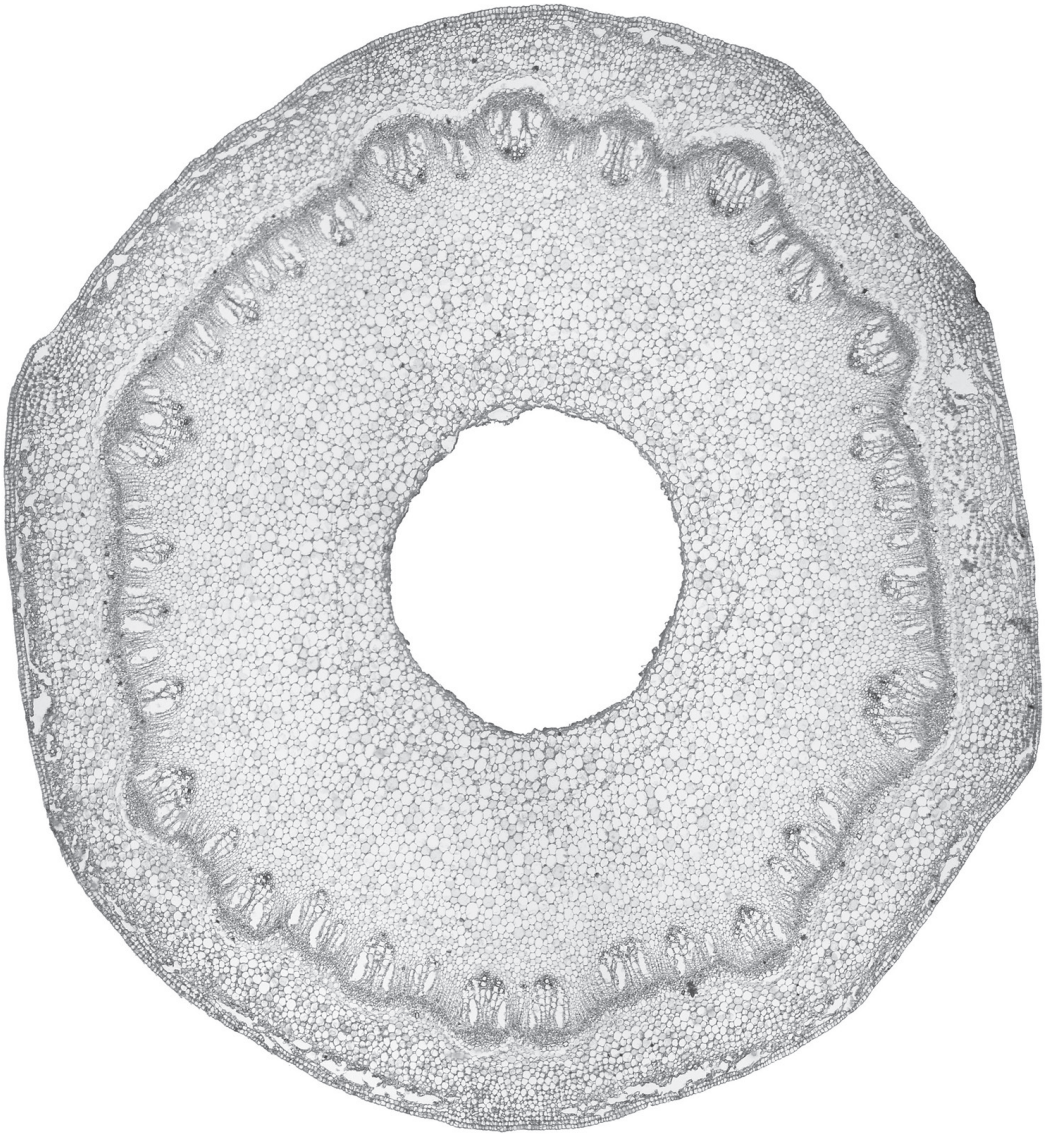


Fig. 2.2

Identify **two** observable differences, other than colour, between the section on **L1** and the section in Fig. 2.2.

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

Table 2.1

feature	L1	Fig. 2.2
1		
2		

[2]

(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.

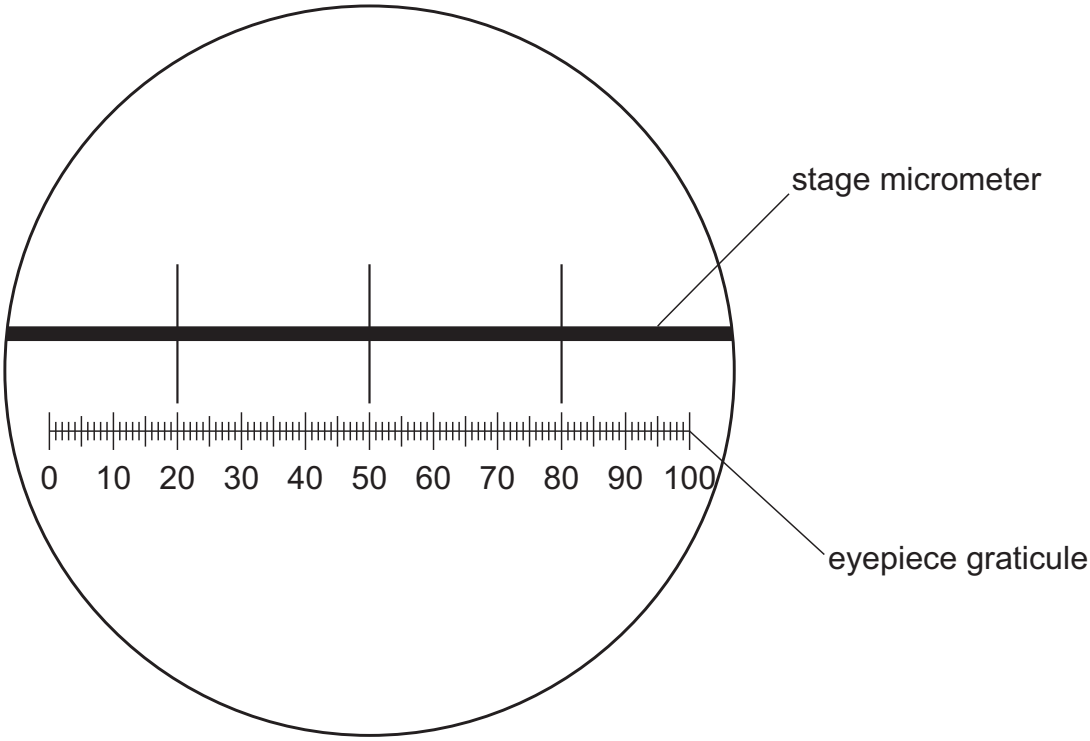


Fig. 2.3

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

Give your answer in micrometres (μm).

Show your working.

actual length = ... μm
[2]

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 width of the tissue.

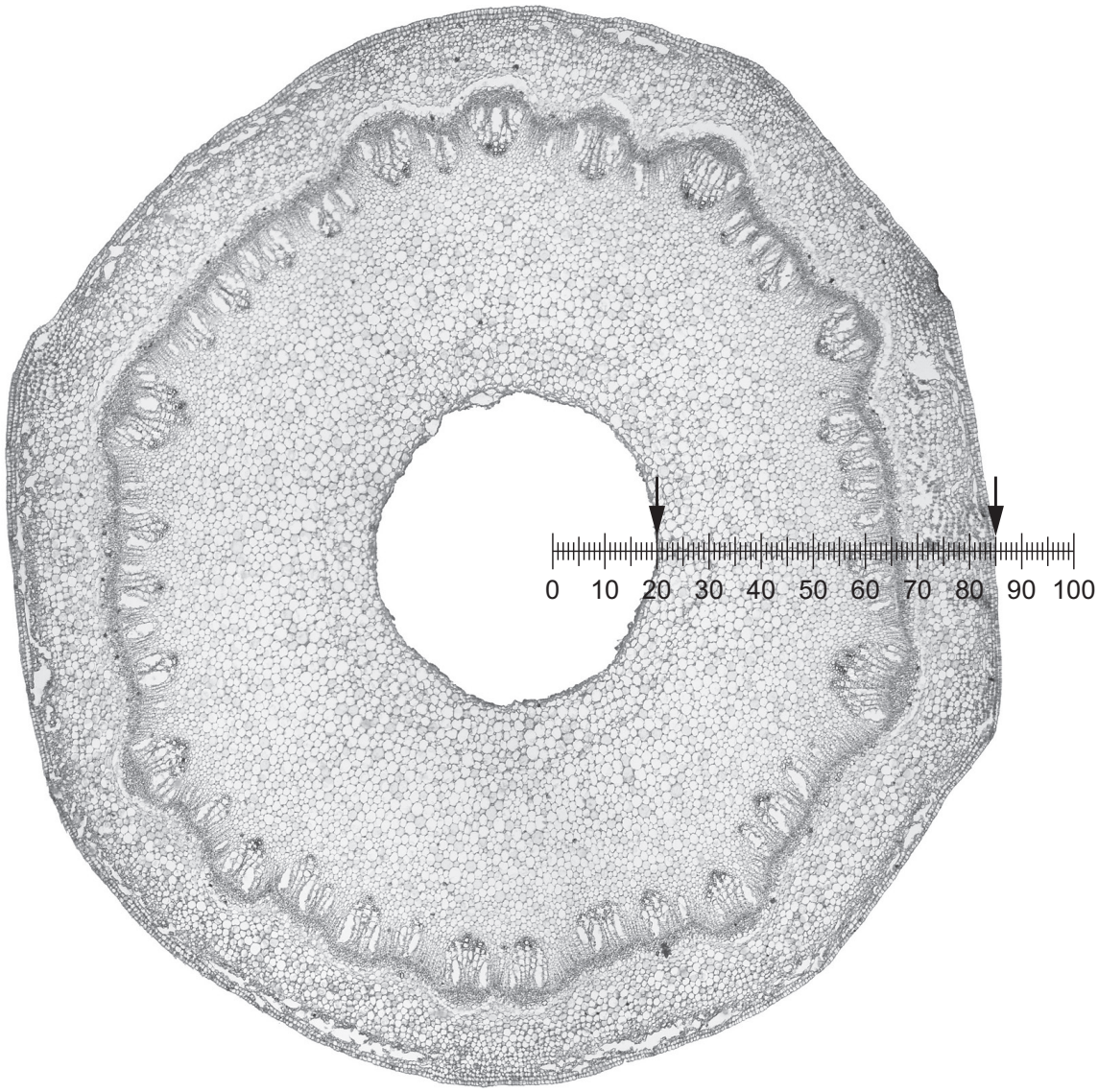


Fig. 2.4

(ii) Use your calibration of one eyepiece graticule unit from **(c)(i)** to calculate the actual width of the tissue between the arrows on Fig. 2.4.

Show your working and use appropriate units.

actual width of the tissue between the arrows .....

[2]

(iii) The width of the tissue in Fig. 2.4 varies. Suggest how you could more accurately calculate the width of the tissue.

.....

..... [1]

[Total: 19]