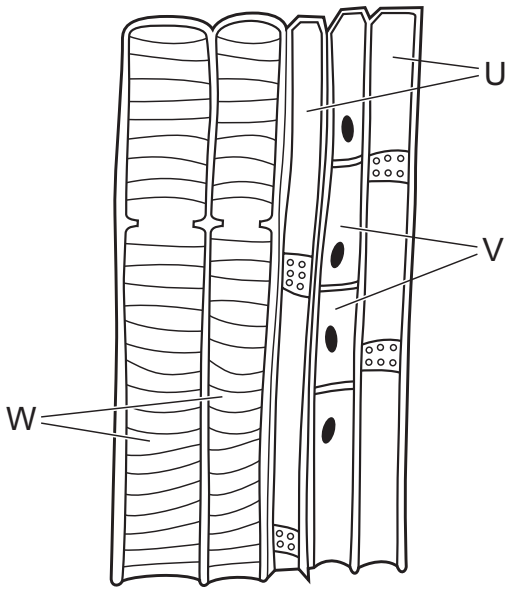
26 The diagram shows a vertical section through part of the stem of a dicotyledonous plant. Three types of structures are labelled.



What are the structures U, V and W?

	companion cells	phloem sieve tube elements	xylem vessel elements
A	U	W	V
B	V	U	W
C	U	V	W
D	W	V	U

27 Which features of xylem vessels help to reduce the resistance to water flow?

1 Lignin forms an incomplete secondary wall.

2 There are **no** cross walls between the vessel elements.

3 The xylem vessels form narrow tubes.

A 1, 2 and 3 **B** 1 and 2 only **C** 2 only **D** 3 only

28 What causes water to move from the root hair cells to the endodermis?

A diffusion through cell walls and osmosis down a water potential gradient in the cytoplasm

B diffusion through the symplast and osmosis and root pressure through the apoplast

C osmosis from cell vacuole to cell vacuole and active transport into the endodermis

D osmosis through the intercellular spaces and diffusion in cell walls and cytoplasm

29 Which changes occur as carbohydrate is moved into a sink?

	water potential of the sieve tube element becomes	volume of liquid of the sieve tube element
A	lower	decreases
B	lower	increases
C	higher	decreases
D	higher	increases

29 What is the correct name for the attraction due to the hydrogen bonding between water molecules during mass flow in plants?

A transpiration

B cohesion

C tension

D adhesion

5 **(a)** Fig. 5.1 is a photomicrograph of a longitudinal section through part of the stem of a plant.

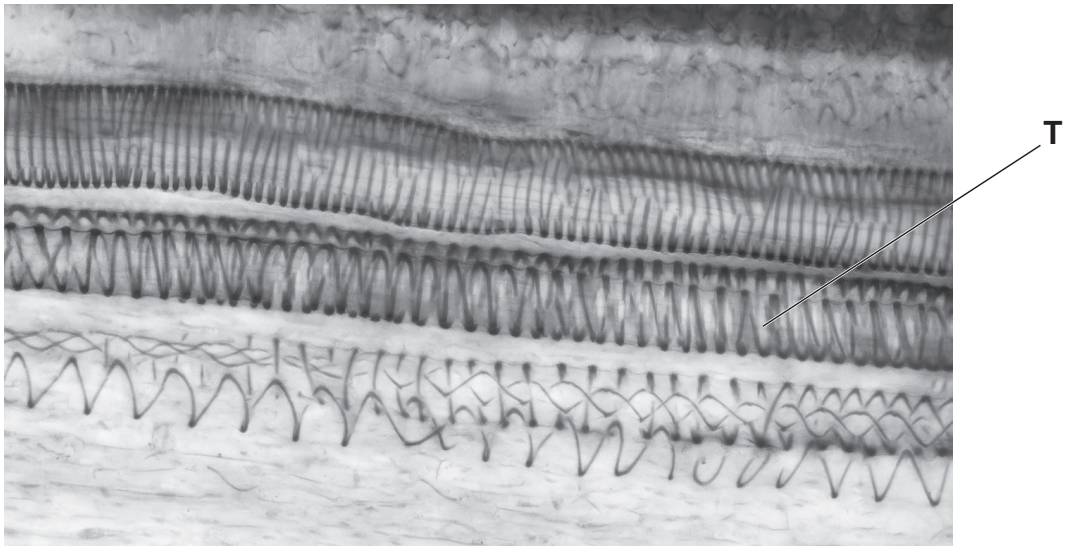


Fig. 5.1

(i) Name **one** substance transported in **T** in Fig. 5.1.

..... [1]

(ii) State the name of the substance that forms the spiral thickening around the structure labelled **T** in Fig. 5.1.

..... [1]

(b) A scientist studied the effect of leaf temperature on the rate of transpiration from the leaves of the wheat plant, *Triticum aestivum*.

The scientist repeated the investigation using the cotton plant, *Gossypium hirsutum*.

The results of the investigation are shown in Table 5.1.

Table 5.1

leaf temperature / °C	rate of transpiration of *T. aestivum* / mmol m^{-2} s^{-1}	rate of transpiration of *G. hirsutum* / mmol m^{-2} s^{-1}
25	7	9
30	12	10
35	15	11
40	22	12
45	31	14

(i) Suggest explanations for the relationship between leaf temperature and the rate of transpiration of *T. aestivum* as shown in Table 5.1.

.....

.....

.....

.....

.....

.....

..... [3]

(ii) Suggest **one** difference between the structure of the leaves of *T. aestivum* and the leaves of *G. hirsutum* that could explain the results shown in Table 5.1.

.....

.....

..... [1]

(c) Nematodes are microscopic animals that infect a wide range of economically important plant crops including cotton plants. Nematodes feed on the roots of plants, limiting their growth.

When root cells become infected, the nematodes disrupt the plant mitotic cell cycle. This causes the formation of a special type of feeding cell (cell **G**) in the plant, from which the nematodes absorb nutrients. Cell **G** is formed as a result of multiple cell cycles without any cytokinesis.

(i) Suggest how cell **G** differs from cells produced during a mitotic cell cycle that has **not** been disrupted by a nematode.

.....

.....

.....

..... [1]

(ii) Nematodes can also stimulate a process called endoreplication. This process causes a plant cell to go through multiple S phases during one cell cycle without entering mitosis or undergoing cytokinesis.

State how the nucleus of a cell that has been through endoreplication may differ from the nucleus of a cell in the same plant that has **not** been affected by the nematode.

.....

.....

.....

..... [1]

[Total: 8]

1 Many substances can move through cell surface membranes between the cytoplasm of animal cells and the extracellular environment.

(a) A student made a drawing to summarise the movement of substances across the cell surface membranes of mammalian red blood cells.

Fig. 1.1 shows the drawing made by the student:

- Each arrow indicates the movement of a substance through the membrane.
- The number of each of the 4 shapes represents the relative concentrations of each substance in the cytoplasm and in the blood plasma.

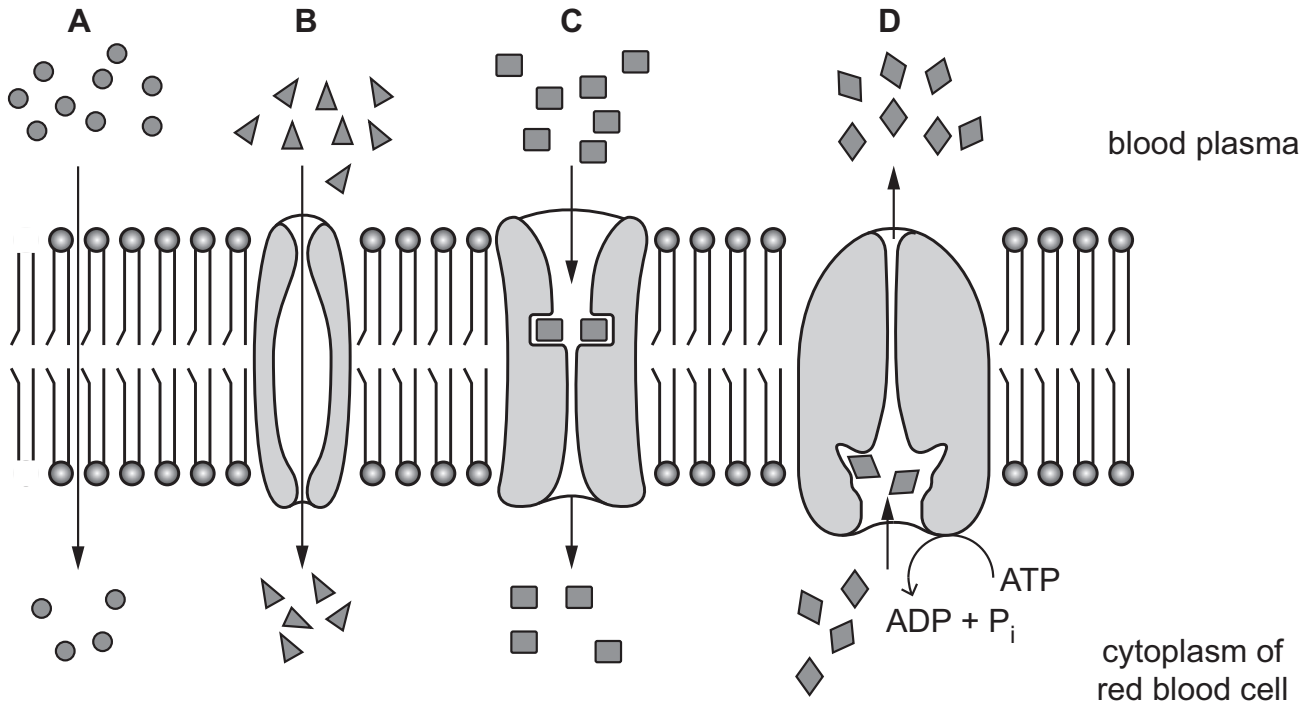


Fig. 1.1

The student carried out research and made a list of some of the substances found in red blood cells as shown in Fig. 1.2.

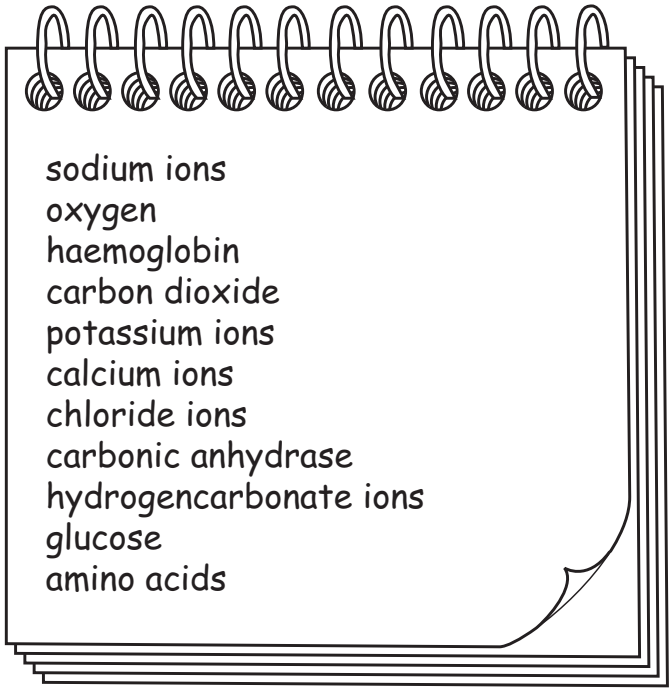


Fig. 1.2

Table 1.1 shows information about the 4 types of movement of substances across the cell surface membranes of red blood cells as shown in Fig. 1.1.

Complete Table 1.1 using the information in Fig. 1.1 and Fig. 1.2.

Table 1.1

letter from Fig. 1.1	type of movement	name of part of membrane involved	example of a substance that moves across the membrane (from Fig. 1.2)
A	simple diffusion	phospholipids	
B	facilitated diffusion		calcium ions
C	facilitated diffusion		
D			

[5]

(b) Some viruses infect plants through the surfaces of damaged leaves. These plant viruses can travel from one leaf cell to another without having to pass through any cell surface membranes.

Explain how some plant viruses can travel from one cell to another without passing through cell surface membranes.

.....

.....

.....

.....

..... [2]

[Total: 7]

2 **J1** is a slide of a stained transverse section through a plant stem.

(a) **(i)** Draw a large plan diagram of the whole section on **J1**. Use a sharp pencil.

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

[5]

(ii) Observe the epidermis of the stem on **J1**.

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

Each cell must touch at least **one** other cell.

- Make a large drawing of this group of **four** epidermal cells and waxy cuticle.
- Use **one** ruled label line and label to identify the waxy cuticle.

[5]

(iii) Fig. 2.1 is a photomicrograph of a stained transverse section of a stem from a different type of plant from **J1**.

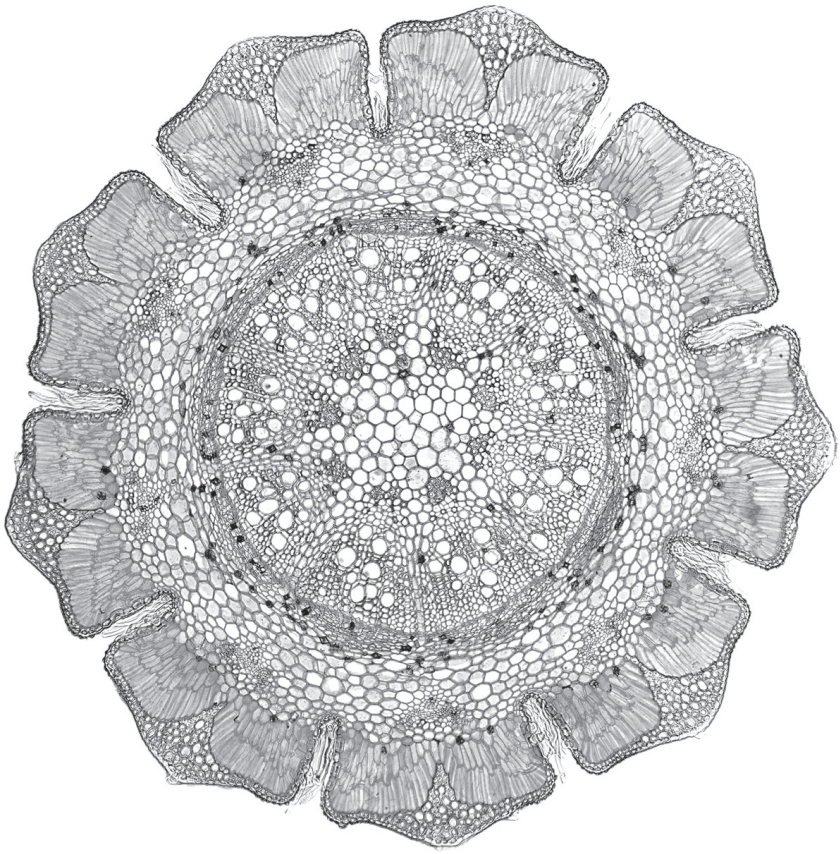


Fig. 2.1

Identify **three** observable differences, other than colour, between the stem section on **J1** and the stem section in Fig. 2.1.

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

Table 2.1

feature	J1	Fig. 2.1
1		
2		
3		

[3]

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

You will calculate the density of vascular bundles in the stem section. The circle represents the area of the stem.

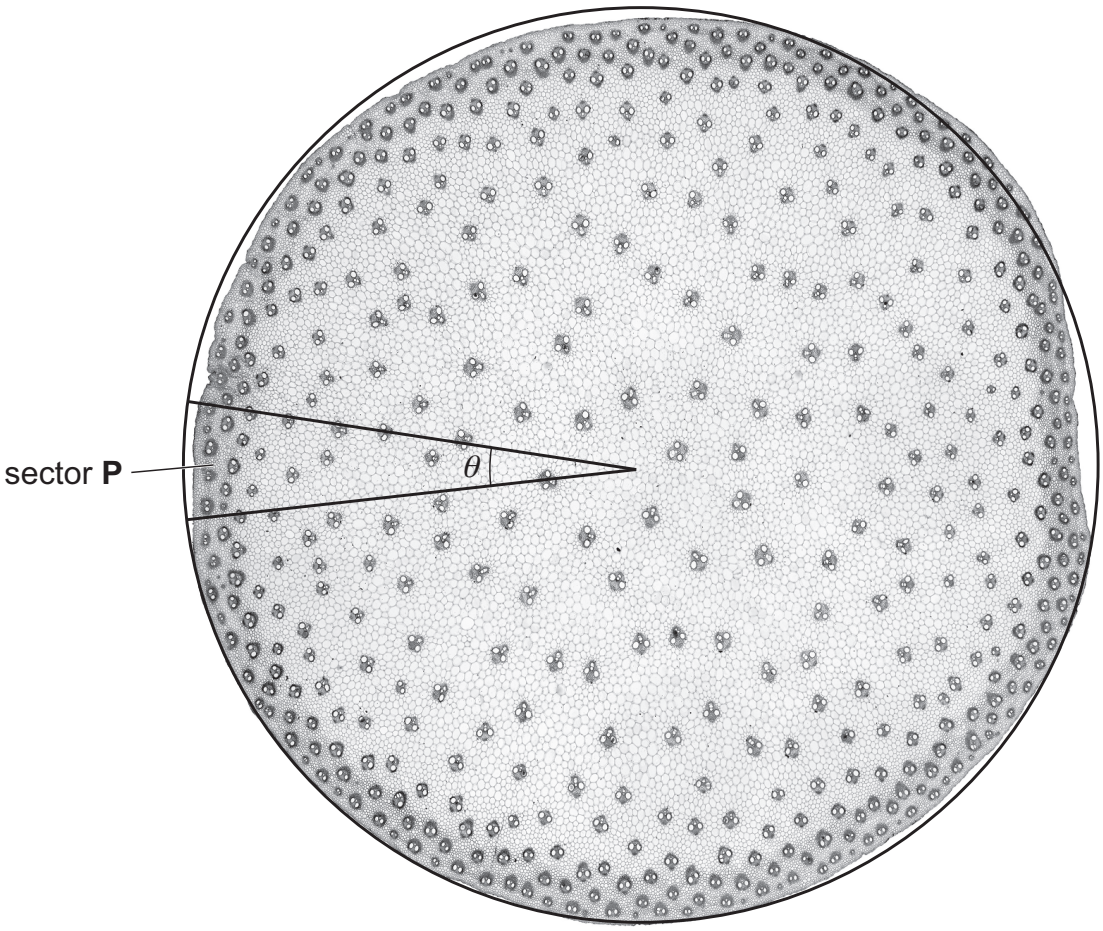


Fig. 2.2

(i) To calculate the density of vascular bundles you will first need to count the number of whole vascular bundles in sector **P**.

number of whole vascular bundles in sector **P** = ... [1]

(ii) Use your answer to **(b)(i)** to estimate the total number of vascular bundles in the stem section shown in Fig. 2.2.

angle θ = 15°

Show your working.

total number of vascular bundles = ...
[2]

(iii) The stem section shown in Fig. 2.2 has an actual area of 44 mm^2.

Use your answer in **(b)(ii)** to calculate the density of vascular bundles in the stem section.

Give your answer to **two** significant figures.

Show your working.

vascular bundle density = ... mm^{-2}
[2]

[Total: 18]