CAMBRIDGE INTERNATIONAL AS & A LEVEL BIOLOGY · 9700

BIOLOGY



EXAM QUESTION PACK

7 TRANSPORT IN PLANTS

SCORE	PERCENTAGE
/	%

STEMUP

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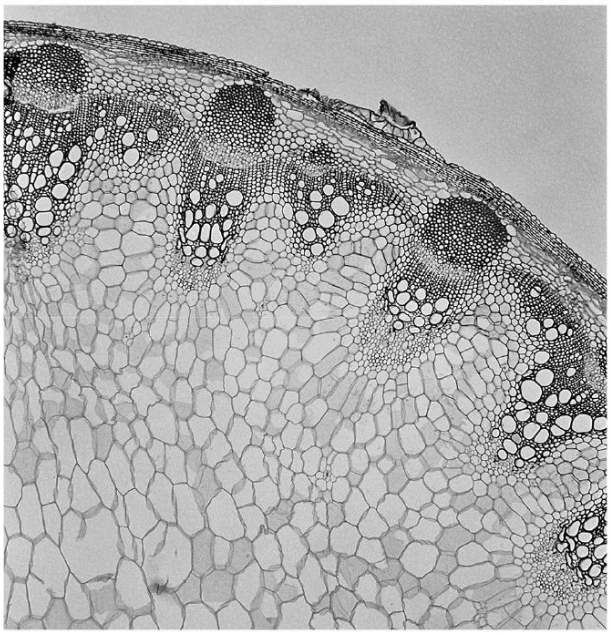
Chapter 7

Transport in plants

7.1 Structure of transport tissues

934. 9700_m20_qp_12 Q: 25

The photomicrograph shows a section of a plant organ.



Students were asked to study the photomicrograph and identify the organ, giving a reason to support their answer.

Which statement written by the students correctly identifies the organ and provides a correct reason to support this identification?

A It is a leaf because the xylem is located on the inner side of each vascular bundle.

B It is a stem because there is a ring of endodermis visible around the edge of the vascular tissue.

C It is a stem because the vascular bundles are arranged in a ring near the epidermis.

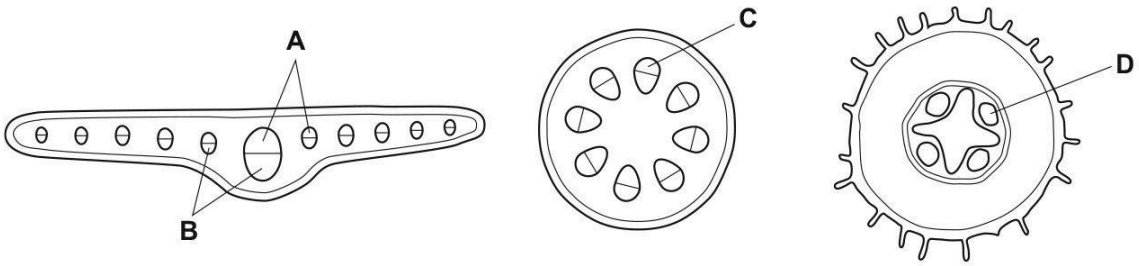
D It is a xerophytic leaf because there is a thick epidermis made up of many layers of cells.

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935. 9700_s20_qp_13 Q: 24

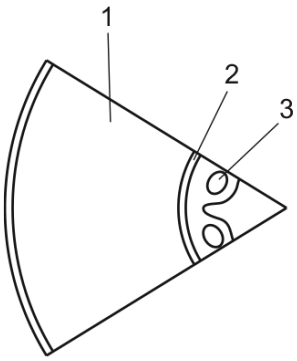
The diagrams show transverse sections through parts of plants.

Which of the labelled regions contains cells which are dead?



936. 9700_s20_qp_13 Q: 25

The diagram shows the distribution of tissues in part of a transverse section through a plant organ.



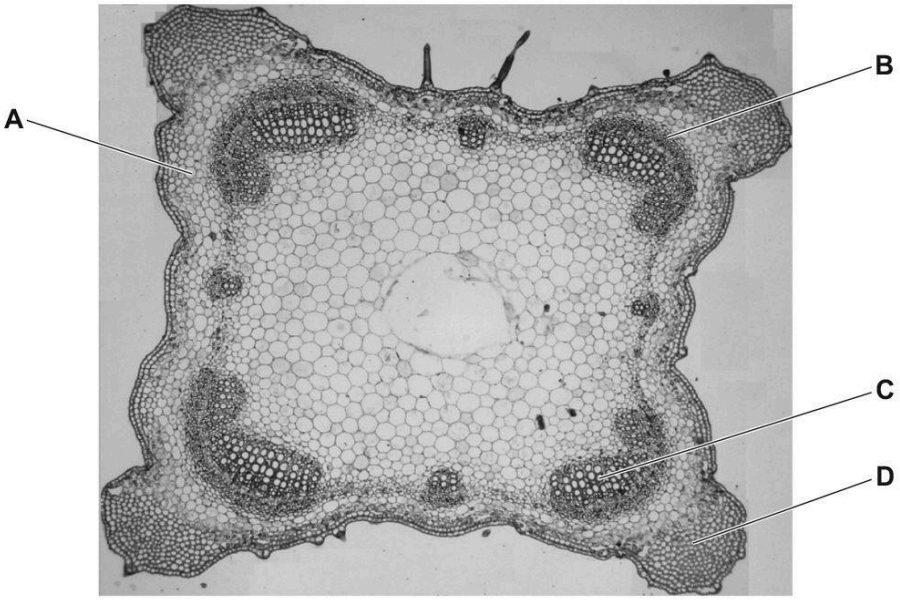
Which row correctly identifies tissues 1, 2 and 3?

	1	2	3
A	cortex	endodermis	phloem
B	cortex	epidermis	xylem
C	endodermis	epidermis	pith
D	pith	endodermis	phloem

937. 9700_w20_qp_11 Q: 23

The photograph shows a section of a stem.

Which labelled part is the xylem?



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938. 9700_w20_qp_11 Q: 24

Some fungi cause wilting in crop plants by growing within the xylem vessel elements.

Which process will be directly affected by these fungi?

A cohesion between water molecules

B development of root pressure

C mass flow during movement of assimilates

D uptake of water by root hair cells

---

939. 9700_w20_qp_12 Q: 23

Which combination of features is correct for a phloem sieve tube element as it unloads into a sink?

	water potential	lignified cell wall
A	higher than sink	absent
B	higher than sink	present
C	lower than sink	absent
D	lower than sink	present

---

940. 9700_w20_qp_13 Q: 25

Some of the features present in transport tissues in plants are listed.

1 lignified walls
2 cytoplasm
3 many mitochondria
4 pits
5 plasmodesmata
6 sieve plates

Which of these features are present in xylem vessel elements?

A 1, 2, 4 and 5 **B** 1 and 4 only **C** 2, 3, 5 and 6 **D** 2, 3 and 5 only

---

941. 9700_m19_qp_12 Q: 23

Which terms describe the method by which water is transported within xylem vessel elements?

1 mass flow
2 cohesion-tension
3 osmosis

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

---

942. 9700_m19_qp_12 Q: 24

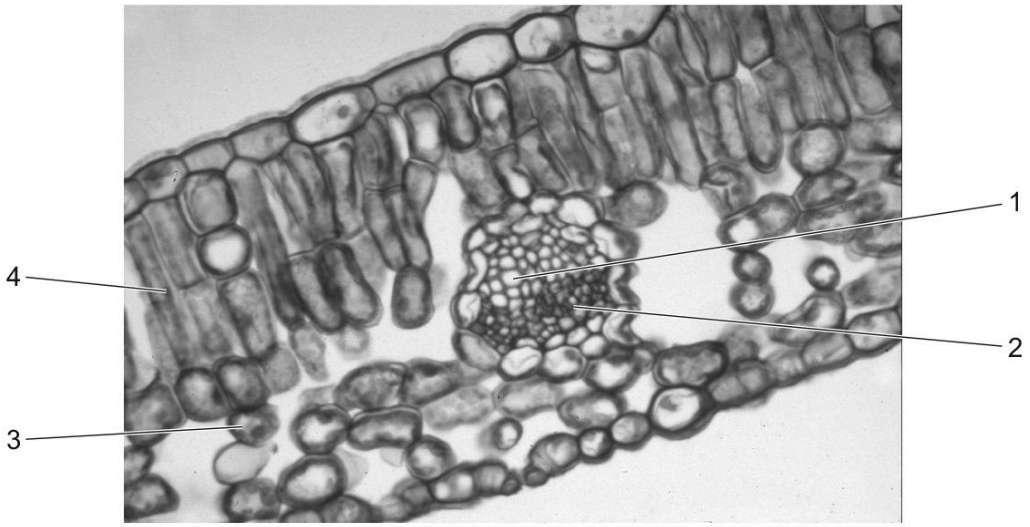
Which combination of features is characteristic of a phloem sieve tube element as it is loaded from a source?

	water potential of the phloem sieve tube element	lignification of the cell wall
A	less negative than source	absent
B	less negative than source	present
C	more negative than source	absent
D	more negative than source	present

---

943. 9700_s19_qp_11 Q: 26

The photomicrograph shows a transverse section of part of a dicotyledonous leaf.



What are the correct labels for 1, 2, 3 and 4?

	1	2	3	4
A	phloem	xylem	palisade mesophyll	spongy mesophyll
B	phloem	xylem	spongy mesophyll	palisade mesophyll
C	xylem	phloem	palisade mesophyll	spongy mesophyll
D	xylem	phloem	spongy mesophyll	palisade mesophyll

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944. 9700_s19_qp_11 Q: 27

Some of the features present in transport tissues in plants are listed.

1 lignified walls
2 cytoplasm
3 mitochondria
4 pits
5 plasmodesmata

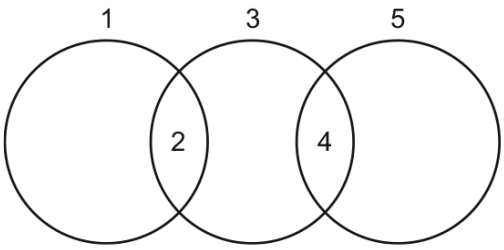
Which of these features are present in phloem sieve tube elements?

A 1, 2 and 5 **B** 1, 3 and 4 **C** 2, 3 and 5 **D** 2, 4 and 5

---

945. 9700_s19_qp_11 Q: 28

The diagram shows the relationship between phloem sieve tube elements, xylem vessel elements and companion cells.



Which row is correct?

	1	2	3	4	5
A	companion cells	endoplasmic reticulum	phloem sieve tube elements	no nucleus	xylem vessel elements
B	companion cells	nucleus	phloem sieve tube elements	cytoplasm	xylem vessel elements
C	phloem sieve tube elements	mitochondria	companion cells	nucleus	xylem vessel elements
D	xylem vessel elements	no cytoplasm	phloem sieve tube elements	vacuole	companion cells

---

946. 9700_s19_qp_12 Q: 22

What is correct for phloem sieve tube elements?

A Companion cells provide structural support to the phloem sieve tube elements.

B Lignified walls of phloem sieve tube elements prevent transport of mineral salts by mass flow.

C Phloem sieve tube elements become narrower as movement of sucrose occurs.

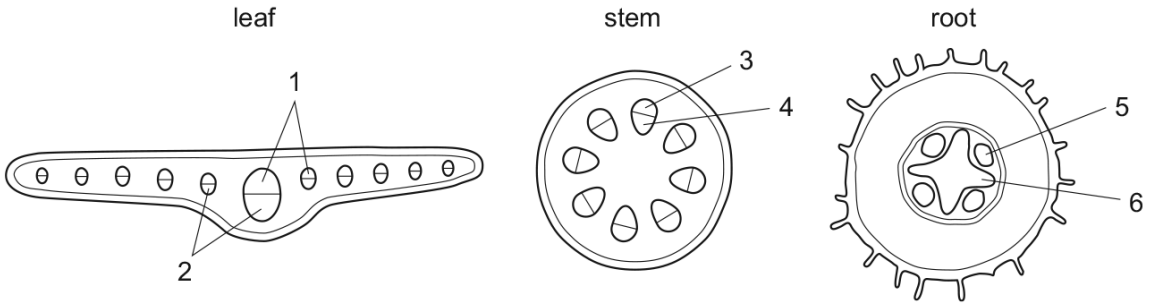
D Plasmodesmata allow movement of water and solutes across cell walls of phloem sieve tube elements.

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947. 9700_s19_qp_12 Q: 23

The diagrams show transverse sections of parts of a plant.

Transport tissues are labelled 1 to 6.



Which combination shows the tissues that have a main function of transporting water?

	1	2	3	4	5	6
A	✓	✓	✗	✗	✓	✓
B	✓	✗	✗	✓	✗	✓
C	✗	✓	✓	✗	✓	✗
D	✗	✓	✗	✓	✓	✗

key

✓ = transporting water is a main function

✗ = transporting water is **not** a main function

---

948. 9700_s19_qp_12 Q: 24

The statements are descriptions of how water moves across the root to the xylem vessel elements.

1 Water enters cell walls.

2 Water enters cytoplasm by osmosis.

3 Water moves from cell to cell through plasmodesmata.

4 Water moves through cell walls.

Which statements describe the apoplast pathway?

A 1, 2, 3 and 4

B 1, 2 and 3 only

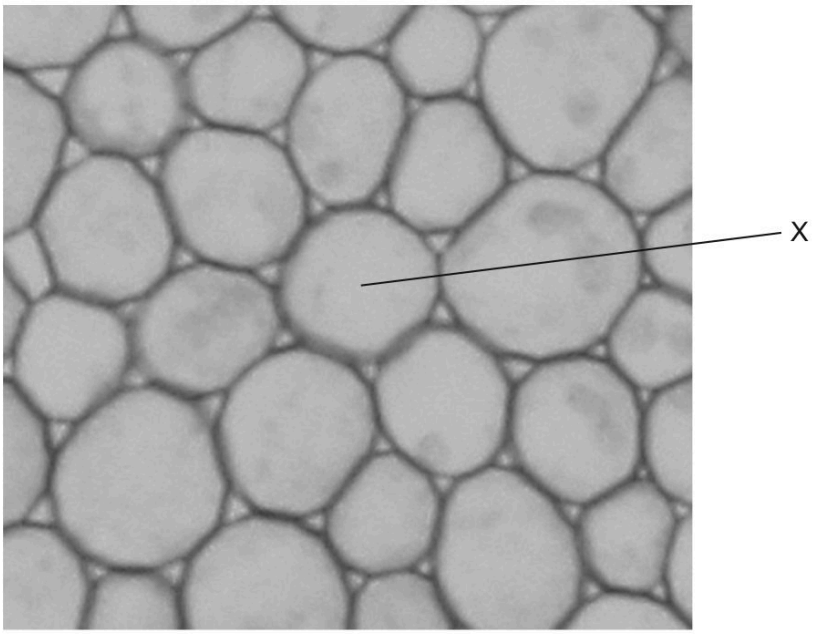
C 1 and 4 only

D 4 only

---

949. 9700_s19_qp_13 Q: 29

A group of students were asked to look at the photomicrograph of a cross-section of unfamiliar material and make observations.



The students described X as:

1 circular

2 a hollow tube

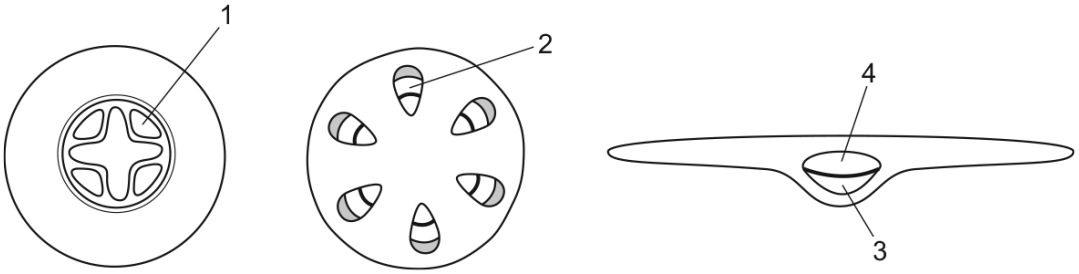
3 a spherical structure.

Which descriptions are correct?

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

950. 9700_w19_qp_11 Q: 24

The diagrams show some tissue types in plant organs.



Which row identifies the tissue types?

	1	2	3	4
A	phloem	phloem	phloem	xylem
B	phloem	xylem	phloem	xylem
C	xylem	phloem	xylem	phloem
D	xylem	xylem	phloem	xylem

---

951. 9700_w19_qp_11 Q: 25

Which row correctly describes the adaptations of companion cells, phloem sieve tube elements and xylem vessel elements for their roles?

	companion cell	phloem sieve tube element	xylem vessel element
A	a thin layer of cytoplasm to reduce resistance to flow	strong, lignified cell walls for supporting the plant	many plasmodesmata for communication between cells
B	empty cells allowing water to flow freely	many plasmodesmata for communication between cells	strong, lignified cell walls for supporting the plant
C	many plasmodesmata for communication between cells	a thin layer of cytoplasm to reduce resistance to flow	empty cells allowing water to flow freely
D	strong, lignified cell walls for supporting the plant	empty cells allowing water to flow freely	a thin layer of cytoplasm to reduce resistance to flow

---

952. 9700_w19_qp_12 Q: 25

Which features have a role in the transport of water in xylem vessel elements?

1 capillary action

2 cohesion

3 hydrogen bonding

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

---

953. 9700_w19_qp_13 Q: 24

Which row explains why xylem vessels have no cytoplasm?

	to contain a larger volume of water	to transport water faster	to increase the cellulose content of the vessel walls
A	✓	✓	✓
B	✗	✗	✓
C	✓	✓	✗
D	✓	✗	✓

key

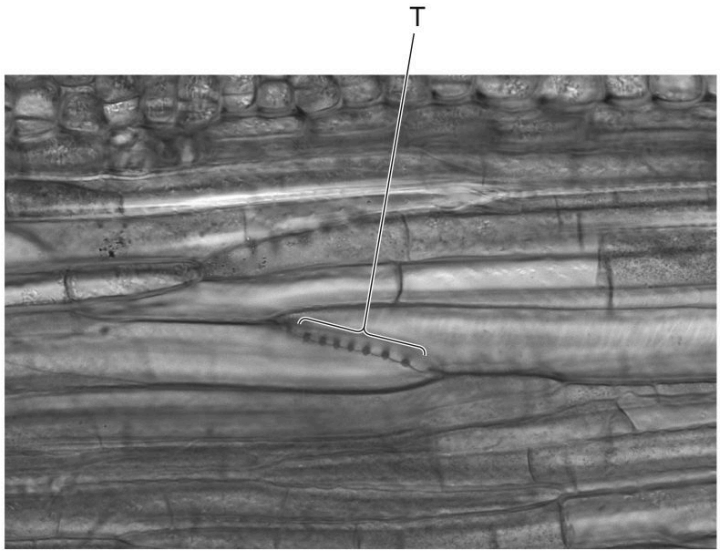
✓ = explains

✗ = does not explain

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954. 9700_m18_qp_12 Q: 26

The photomicrograph shows a transport tissue in the stem of a grape vine.



What is the structure labelled T?

A companion cell

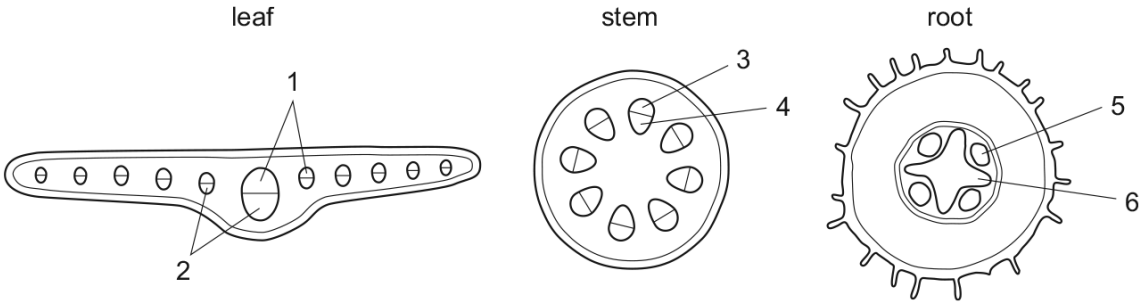
B sieve plate

C sieve tube element

D xylem vessel element

955. 9700_m18_qp_12 Q: 27

The diagrams show transverse sections of parts of a plant. Transport tissues are labelled 1 to 6.

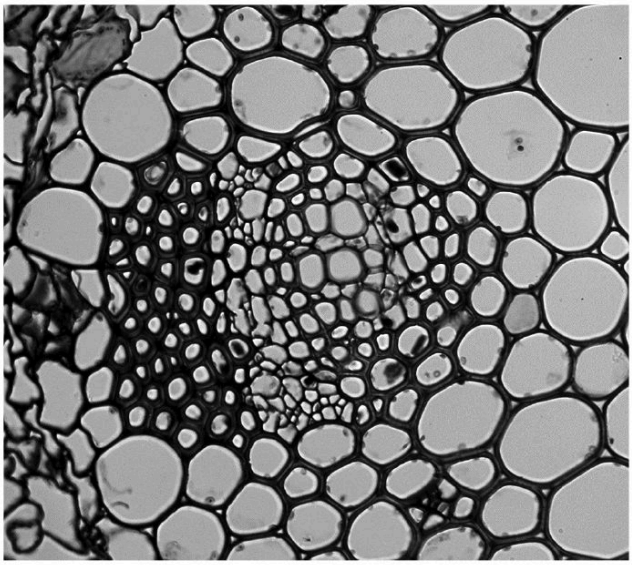


Which row shows tissues that mainly transport water and tissues that mainly transport sucrose?

	mainly transport water	mainly transport sucrose
A	1 and 3	4 and 6
B	2 and 3	4 and 5
C	3 and 5	2 and 6
D	4 and 6	2 and 3

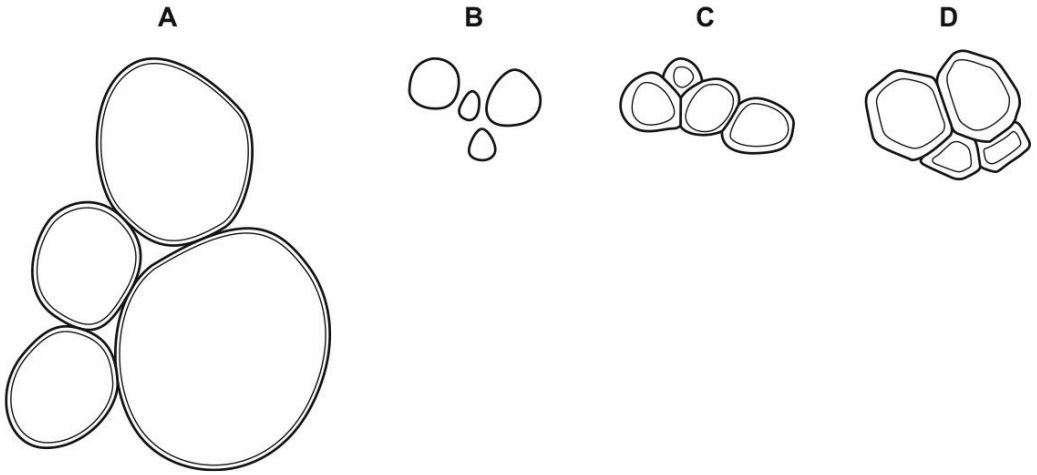
956. 9700_s18_qp_11 Q: 24

The photomicrograph shows tissues in a stained transverse section of a plant stem.



Students are asked to draw four adjacent xylem vessel elements.

Which drawing, all drawn to the same scale, is correct?



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957. 9700_s18_qp_12 Q: 26

What is the role of ATP in a companion cell when sucrose is loaded into a sieve tube element?

A moving sucrose into the sieve tube element

B removing protons from the sieve tube element

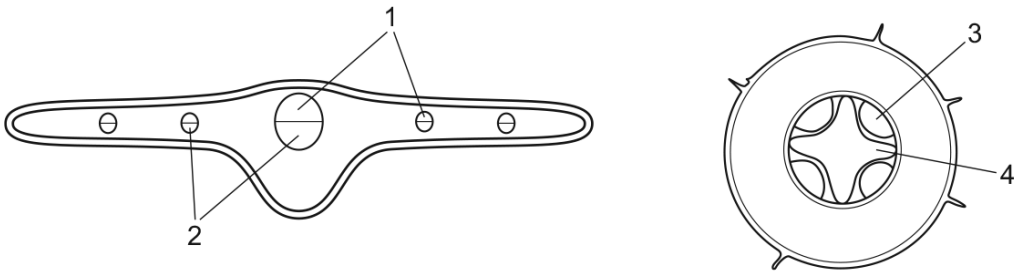
C removing protons out of the cytoplasm of the companion cell

D taking up sucrose into the cytoplasm of the companion cell

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958. 9700_s18_qp_12 Q: 29

The diagrams show transverse sections of parts of a plant.



Which structures, labelled 1 to 4, transport water **and** sucrose?

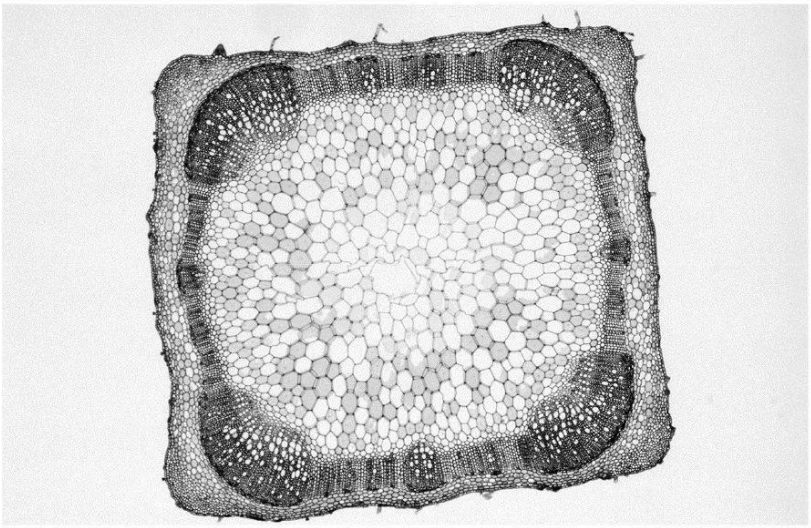
	1	2	3	4
A	✓	✗	✓	✗
B	✓	✗	✗	✓
C	✗	✓	✓	✗
D	✗	✓	✗	✓

key
✓ = correct
✗ = incorrect

---

959. 9700_s18_qp_13 Q: 26

The photomicrograph shows a section through a plant organ.



Which statement could be used to describe this organ?

A The central region of this organ has supporting tissue.

B The endodermis tissue is a thick layer around the edge of the organ.

C The epidermis tissue in this organ has unicellular extensions (trichomes).

D The xylem tissue is found in greatest density in the centre of the organ.

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960. 9700_s18_qp_13 Q: 28

Which of the processes involved in water movement through xylem vessels depends on hydrogen bonding between water molecules?

A adhesion

B cohesion

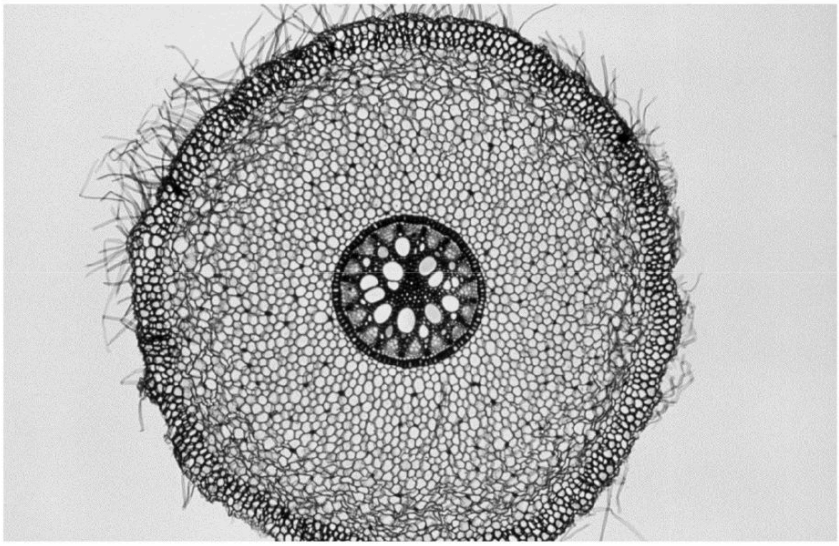
C evaporation

D hydrostatic pressure

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961. 9700_w18_qp_11 Q: 25

The photomicrograph shows a transverse section through a root.



What is the simplest ratio of the diameter of the root (excluding root hairs) to the diameter of the vascular tissue and endodermis?

A 40 mm : 11 mm

B 40 : 11

C 8 cm : 2.2 cm

D 80 : 22

---

962. 9700_w18_qp_11 Q: 26

Which properties of water molecules are important in the upward flow of water through xylem?

1 Water molecules are attracted to each other by hydrogen bonding.

2 Water molecules are attracted to cellulose by adhesion.

3 Water molecules have high cohesion in water columns.

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

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963. 9700_w18_qp_11 Q: 27

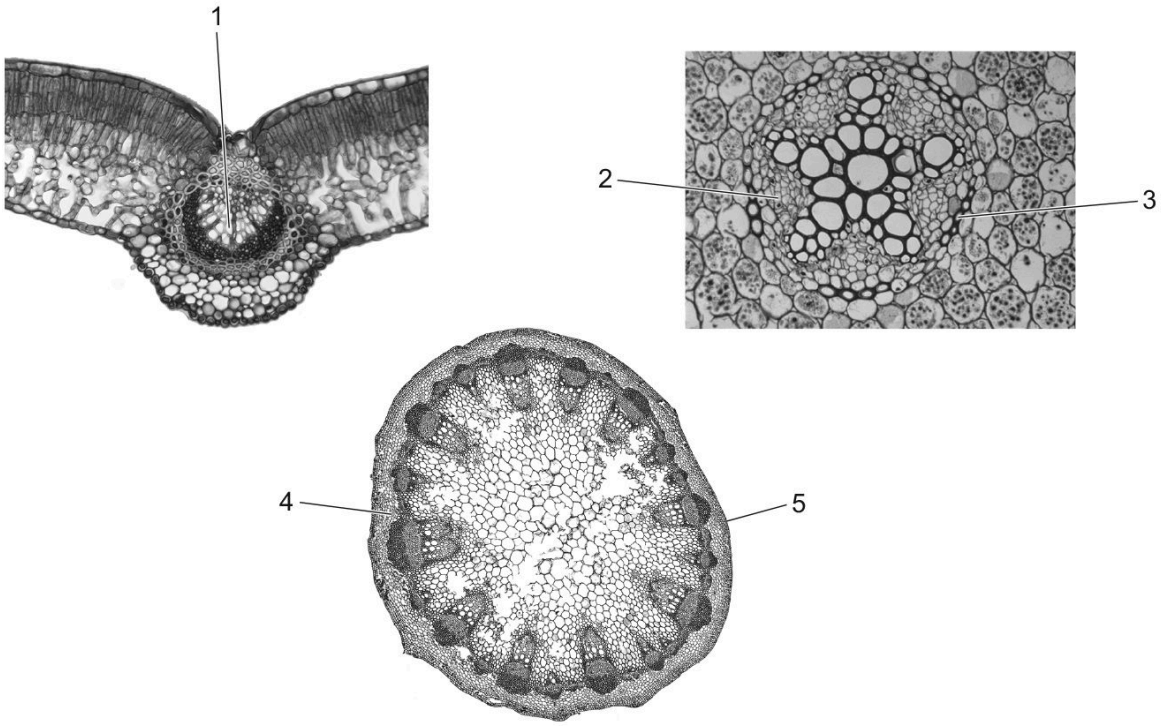
What is correct for a phloem sieve tube element that is unloading to a sink?

	water potential of the phloem sieve tube element becomes	lignification of the cell wall
A	less negative than sink	absent
B	less negative than sink	present
C	more negative than sink	absent
D	more negative than sink	present

---

964. 9700_w18_qp_12 Q: 25

Photomicrographs of a dicotyledonous plant root, stem and leaf are shown.



Which row is correct for the labels 1 to 5 on the photomicrographs?

	1	2	3	4	5
A	cortex	phloem	epidermis	parenchyma	endodermis
B	phloem	parenchyma	xylem	epidermis	cortex
C	phloem	xylem	endodermis	cortex	epidermis
D	xylem	phloem	endodermis	cortex	epidermis

---

965. 9700_w18_qp_12 Q: 26

Which features apply to phloem sieve tube elements and to xylem vessel elements?

1 no cytoplasm

2 no end walls

3 no nucleus

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

---

966. 9700_w18_qp_12 Q: 27

Which statement correctly describes an event in the process of mass flow in phloem sieve tube elements?

A Any part of a plant where sucrose is loaded into a sieve tube element is called a sink.

B Loading sucrose into a sieve tube element increases the water potential inside it.

C Mass flow in the phloem is a passive process occurring at the same rate as diffusion.

D Sucrose moves down a hydrostatic pressure gradient in the phloem from source to sink.

---

967. 9700_w18_qp_13 Q: 24

Four students were asked to suggest a set of four labels to add to a plan diagram of a transverse section of a dicotyledonous leaf.

Which student suggested a correct set of labels?

	label 1	label 2	label 3	label 4
A	lower epidermis	phloem	spongy mesophyll	palisade mesophyll
B	phloem sieve tubes	upper epidermis	spongy mesophyll	xylem vessel elements
C	spongy mesophyll	endodermis	xylem vessel elements	palisade mesophyll
D	waxy cuticle	xylem	companion cells	spongy mesophyll

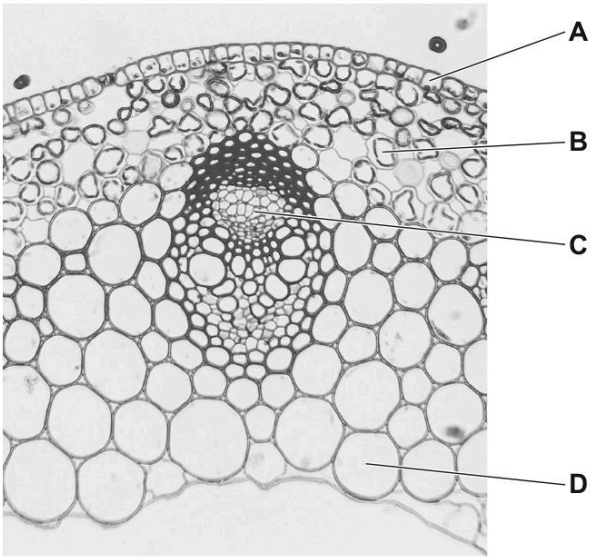
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968. 9700_w18_qp_13 Q: 25

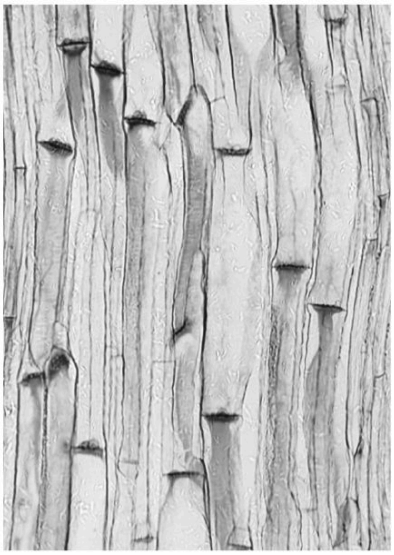
Photomicrograph X shows a transverse section through a typical stem. Photomicrograph Y shows a longitudinal section through one type of cell shown in photomicrograph X.

Which letter represents the cells from photomicrograph Y?

photomicrograph X



photomicrograph Y



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969. 9700_m17_qp_12 Q: 28

Which combination of features is characteristic of a phloem sieve tube element as it unloads into a sink?

	water potential	lignification of the cell wall
A	higher than sink	absent
B	higher than sink	present
C	lower than sink	absent
D	lower than sink	present

---

970. 9700_m17_qp_12 Q: 29

Which statements correctly describe transport pathways in dicotyledonous plants?

1 In the symplast pathway, water may move through intercellular spaces.

2 The symplast pathway may be blocked by the tonoplast.

3 In the apoplast pathway, water does not move through plasmodesmata.

4 The apoplast pathway may be blocked by the Casparian strip.

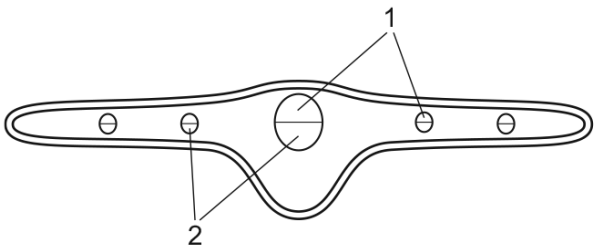
A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

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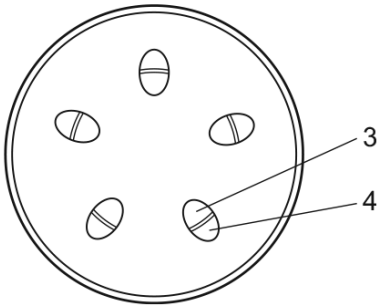
971. 9700_m17_qp_12 Q: 30

The diagrams show transverse sections of parts of a plant.

leaf



stem



Which labelled structures transport mineral ions?

	1	2	3	4
A	✓	✗	✓	✗
B	✓	✗	✗	✓
C	✗	✓	✓	✗
D	✗	✓	✗	✓

key
✓ = yes
✗ = no

---

972. 9700_m17_qp_12 Q: 31

Which feature of transport in plants is correct for **both** xylem and phloem?

A It is passive.

B It occurs by mass flow.

C It occurs from source to sink.

D It occurs only in one direction.

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973. 9700_m17_qp_12 Q: 32

What is the main function of a companion cell in phloem tissue?

A providing cytoplasmic contact with the sieve tube element for loading

B providing structural support for the sieve tube element

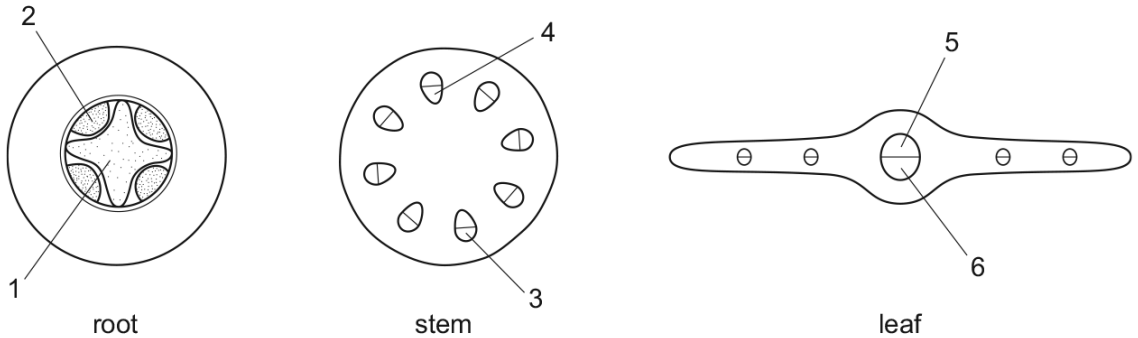
C providing the nucleus for cell division in the phloem

D providing the source of assimilates for storage

---

974. 9700_s17_qp_11 Q: 28

The diagrams represent transverse sections of three plant organs.



Which row is correct for phloem?

	root	stem	leaf
A	1	3	5
B	1	4	6
C	2	3	6
D	2	4	5

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975. 9700_s17_qp_11 Q: 29

Sucrose moves from a phloem sieve tube element into a root cell.

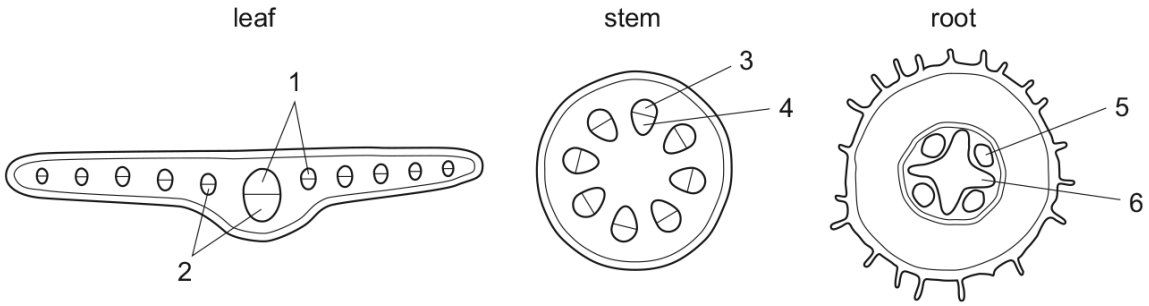
Which changes to the water potential and the volume of liquid in the phloem sieve tube element are correct?

	water potential	volume of liquid
A	becomes higher	decreases
B	becomes higher	increases
C	becomes lower	decreases
D	becomes lower	increases

---

976. 9700_s17_qp_13 Q: 22

The diagrams show transverse sections of parts of a plant.



In the transverse sections, which tissues transport most amino acids?

	1	2	3	4	5	6
A	✓	✗	✓	✗	✗	✓
B	✓	✗	✗	✓	✗	✓
C	✗	✓	✓	✗	✓	✗
D	✗	✓	✗	✓	✓	✗

key

✓ = transports most amino acids

✗ = does not transport most amino acids

---

977. 9700_s17_qp_13 Q: 23

The statements are descriptions of how water moves across the root to the xylem vessel elements in plants.

1 Water enters the intercellular spaces.

2 Water enters the cytoplasm by osmosis.

3 Water moves from cell to cell through plasmodesmata.

4 Water moves through the cell wall.

Which statements are correct for **both** the apoplast pathway **and** the symplast pathway?

A 1, 2, 3 and 4

B 1, 2 and 3 only

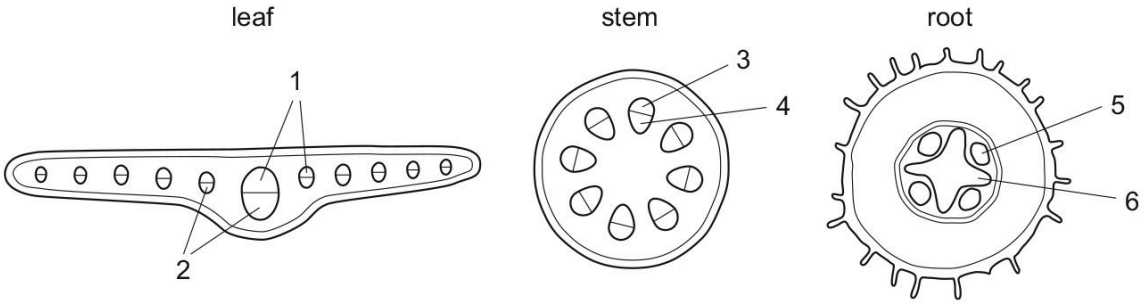
C 2 and 4 only

D 4 only

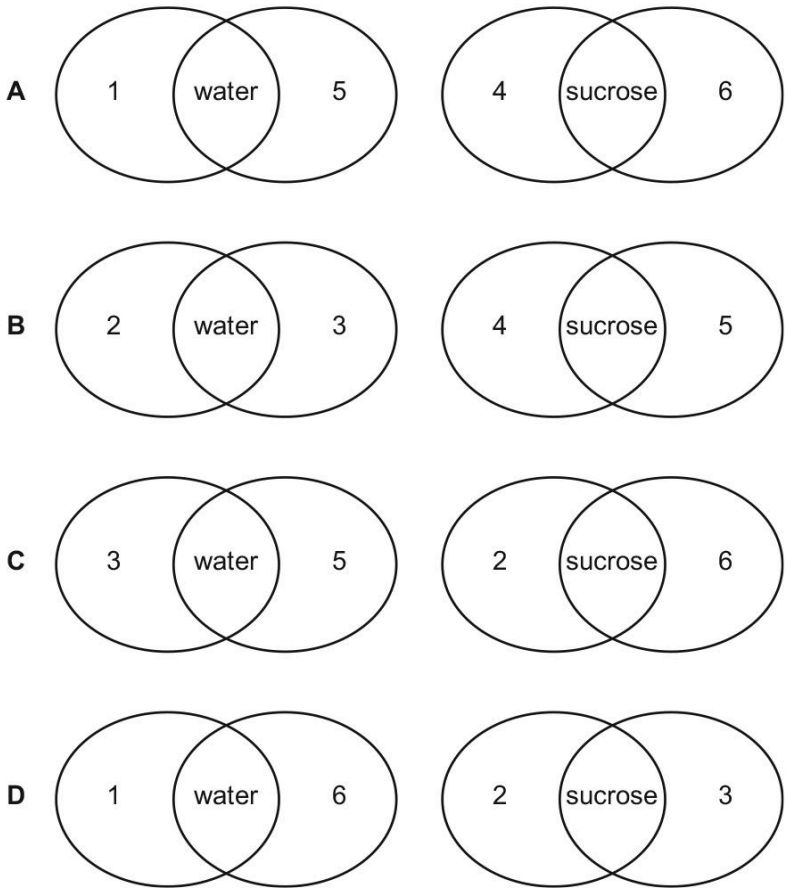
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978. 9700_w17_qp_11 Q: 22

The diagrams show transverse sections of parts of a plant with some transport tissues labelled 1–6.



Which tissues mainly transport water and which tissues mainly transport sucrose?



979. 9700_w17_qp_11 Q: 24

Mass flow is the bulk movement of materials from one place to another.

How many of the vessels listed carry fluids by mass flow?

- artery
- phloem sieve tube
- vein
- xylem vessel

A 1 **B** 2 **C** 3 **D** 4

---

980. 9700_w17_qp_12 Q: 26

What contributes to the movement of water through the xylem vessel elements?

A cohesion of water molecules through hydrogen bonding

B ion movement followed by passive osmosis

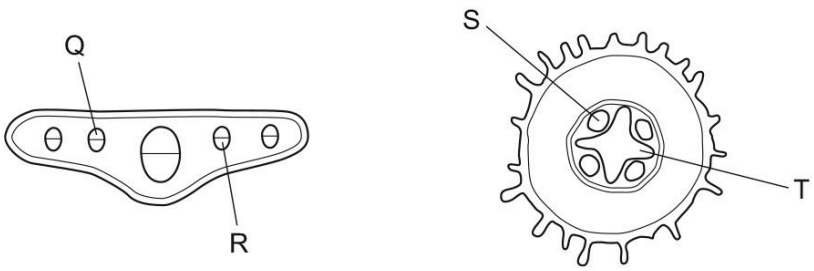
C negative water potential in the xylem

D surface tension at the top of the plant

---

981. 9700_w17_qp_12 Q: 29

The transverse sections of two plant organs are shown.



Which pair of tissues contains proton pumps?

A Q and S **B** Q and T **C** R and S **D** R and T

---

982. 9700_w17_qp_12 Q: 30

Measurements of the stem of a young tree showed that the diameter varied slightly. It decreased during the day and increased during the night.

Which statement explains these observations?

A During the day, cohesion between water molecules and lignin in the walls of the xylem vessels pulls the walls of the vessels inwards.

B During the day, the tension developed in a moving column of water molecules reduces the pressure inside the xylem vessels, so that their walls move inwards.

C During the night, the adhesion of water molecules to the lignin in the walls of the xylem vessels pushes the walls of the vessels outwards.

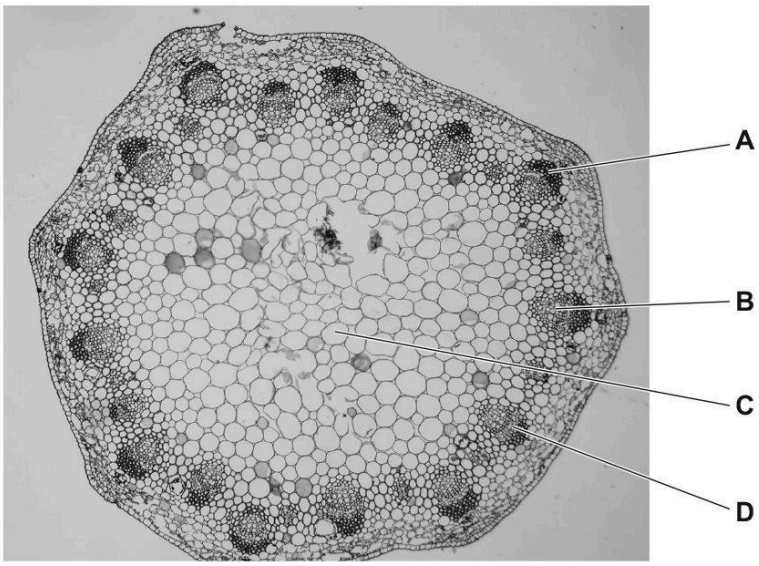
D During the night, the pressure of the column of water molecules adhering to one another increases and pushes the walls of the xylem vessels outwards.

---

983. 9700_w17_qp_13 Q: 27

The photomicrograph is a section through a plant organ.

Which label identifies the xylem vessels?



---

984. 9700_w17_qp_13 Q: 28

Which of these statements correctly describe transport pathways in dicotyledonous plants?

1 In the apoplast pathway, water may move through plasmodesmata.

2 In the symplast pathway, water may move through intercellular spaces.

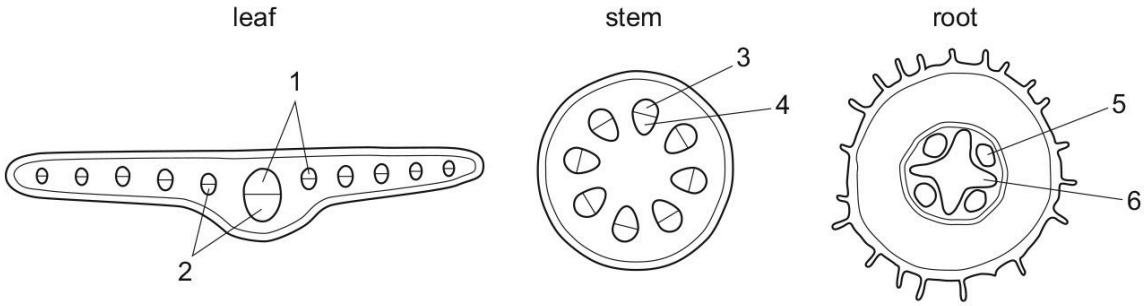
3 The apoplast pathway may be blocked by the Casparian strip.

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

---

985. 9700_m16_qp_12 Q: 23

The diagrams show transverse sections of parts of a plant.



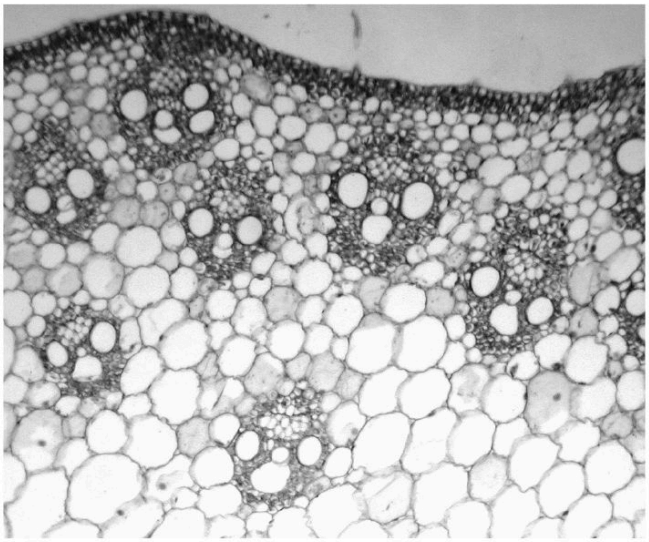
In the transverse sections, which tissues transport sucrose?

	1	2	3	4	5	6
A	✓	✗	✓	✗	✗	✓
B	✓	✗	✗	✓	✗	✓
C	✗	✓	✓	✗	✓	✗
D	✗	✓	✗	✓	✓	✗

key
✓ = yes
✗ = no

986. 9700_s16_qp_11 Q: 23

A student was asked to draw a plan diagram of the plant tissue shown in the photomicrograph and to annotate two observable features.



What are correct annotations?

A epidermis darkly stained layer of cells, xylem hollow vessels

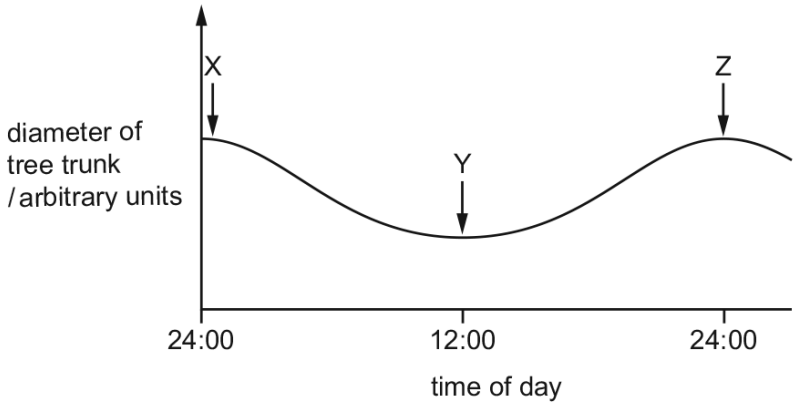
B epidermis formed of a single layer of cells, xylem strengthened by lignin

C phloem small cells, xylem empty cells to transport water

D vascular bundles arranged in a regular pattern, xylem large dead cells

987. 9700_s16_qp_12 Q: 23

The graph shows the diameter of a tree trunk at different times.



Which statement is correct?

A X shows the expansion of the trunk as water fills the xylem during transpiration.

B Y shows a reduction in diameter of trunk as water is lost from the xylem due to transpiration.

C Y shows a reduction in diameter of trunk due to water held in tension in the xylem.

D Z shows the expansion of the trunk as the phloem tissue acts as a sink at night.

---

988. 9700_s16_qp_12 Q: 24

Some plant species can take up toxic heavy metal ions that are dissolved in water in the soil. These ions accumulate in the aerial parts of the plant, which can be harvested and disposed of safely.

An investigation was carried out into the ability of a plant species to remove a heavy metal ion from soil. This produced the following observations:

- some heavy metal ions accumulated in the cells of the root cortex
- within these cells, most of these ions were in the vacuole
- in the roots and leaves, the ions were transported dissolved in water.

Which suggestions about the transport and accumulation of heavy metals are valid?

1 After initial entry into the root, some of the ions can pass through the tonoplast.

2 In the roots and leaves, the ions pass through a symplastic or apoplastic pathway but at the endodermis they must take a symplastic pathway.

3 In xylem vessels, the ions pass through an apoplastic pathway only.

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

---

989. 9700_w16_qp_11 Q: 23

Which changes to the water potential and the volume of liquid in the phloem occur when carbohydrate is taken out of a sink into a phloem sieve tube element?

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

---

990. 9700_w16_qp_12 Q: 24

Which processes are involved in the mass movement of water through xylem vessels?

1 hydrogen bonding between water molecules

2 cohesion between water molecules

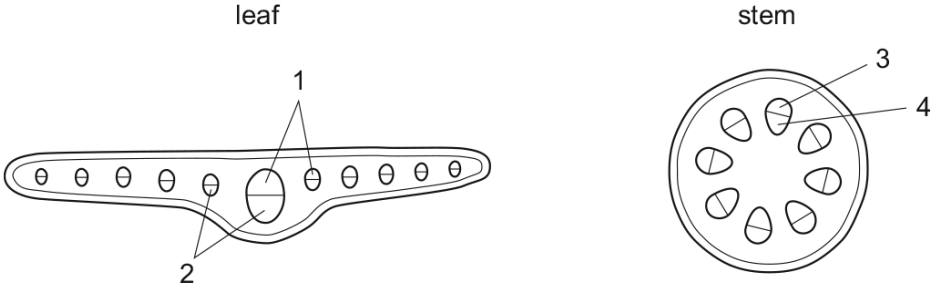
3 adhesion between water molecules and lignin

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

---

991. 9700_w16_qp_12 Q: 25

The diagrams show transverse sections of parts of a plant.



In the transverse sections, which tissues transport most mineral ions?

	1	2	3	4
A	✓	✗	✓	✗
B	✓	✗	✗	✓
C	✗	✓	✓	✗
D	✗	✓	✗	✓

key

✓ = yes

✗ = no

---

992. 9700_w16_qp_12 Q: 26

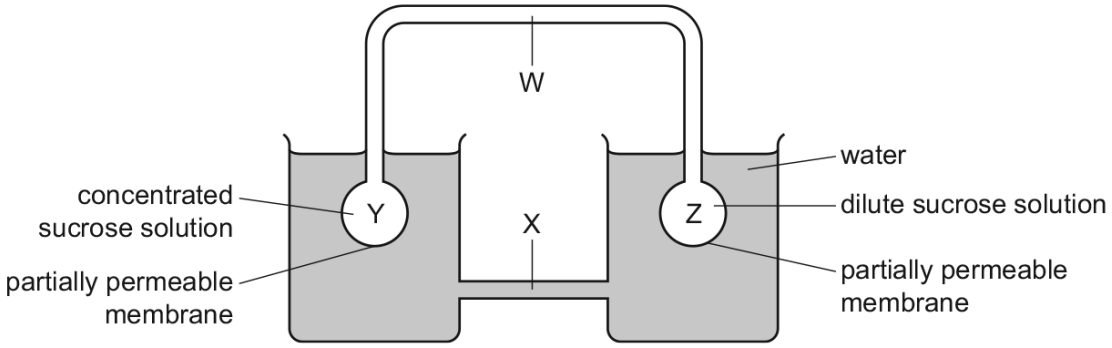
Which changes to the water potential and the volume of liquid in the phloem occur when amino acids are transferred from leaves to be transported to a sink in the phloem sieve tube element?

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

---

993. 9700_w16_qp_12 Q: 28

The diagram shows a model to demonstrate mass flow.



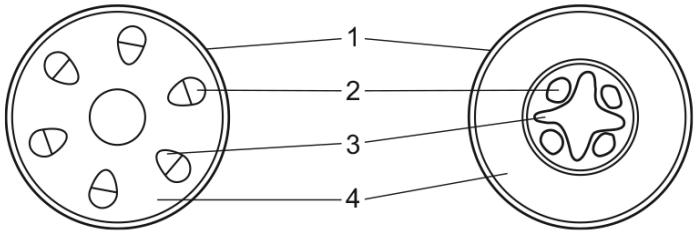
In a plant, what are the structures W, X, Y and Z and what is the direction of flow of solution along W?

	phloem	xylem	roots	leaves	direction of flow along W
A	W	X	Y	Z	from Z to Y
B	W	X	Z	Y	from Y to Z
C	X	W	Y	Z	from Y to Z
D	X	W	Z	Y	from Z to Y

---

994. 9700_s15_qp_11 Q: 23

The diagram shows transverse sections of two plant structures.

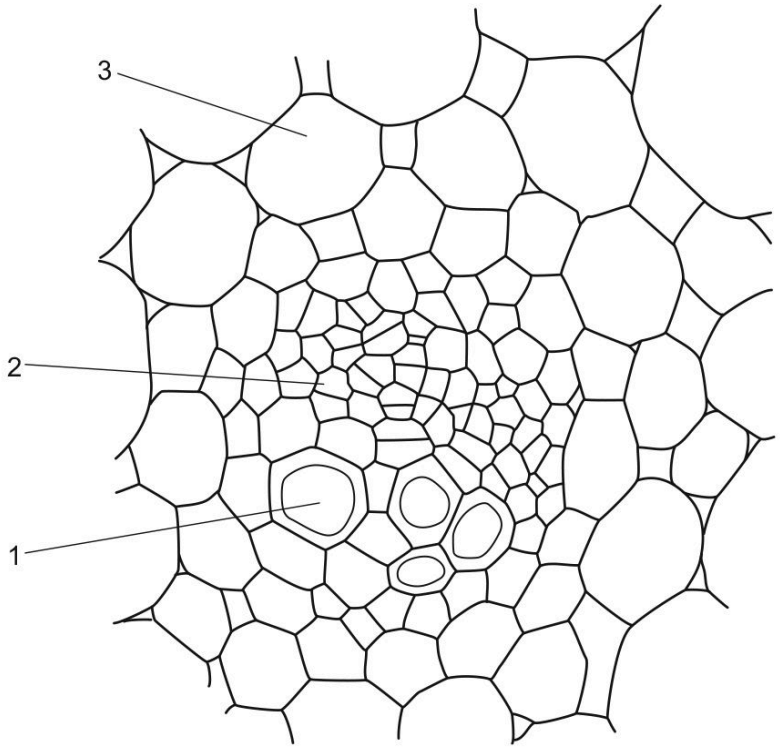


Which row shows the correct labels?

	1	2	3	4
A	cuticle	phloem	xylem	pith
B	cuticle	xylem	phloem	cortex
C	epidermis	phloem	xylem	cortex
D	epidermis	xylem	phloem	pith

995. 9700_s15_qp_11 Q: 25

The diagram shows a vascular bundle from the stem of a plant.



Which row describes the functions of the labelled cells?

	transports sucrose	transports ions	stores starch
A	1	2	3
B	2	1	3
C	2	3	1
D	3	1	2

996. 9700_s15_qp_12 Q: 23

Which features of these cells make them suitable for their function?

	companion cells	xylem vessel elements
A	circulating contents allow transport in both directions	lignified walls provide support
B	cellulose walls provide support	nuclei allow cell division
C	nuclei allow cell division	gaps between cells allow rapid transport
D	numerous mitochondria supply energy	absence of cytoplasm allows mass flow

---

997. 9700_w15_qp_11 Q: 5

Which features of microvilli and root hairs are correct?

	increase cell surface area	cannot be resolved with the light microscope	contain vacuoles	more than one present on a cell
A	microvilli	microvilli	root hairs	microvilli
B	microvilli	root hairs	microvilli	microvilli
C	root hairs	microvilli	root hairs	root hairs
D	root hairs	root hairs	microvilli	root hairs

---

998. 9700_w15_qp_11 Q: 23

By which process does sucrose move through phloem sieve tube elements?

A active transport

B diffusion

C facilitated diffusion

D mass flow

---

999. 9700_w15_qp_11 Q: 26

Which changes to the water potential and the volume of liquid in the phloem occur when carbohydrate is taken out of a root into phloem sieve tubes?

	water potential in a phloem sieve tube becomes	volume of liquid in phloem sieve tubes
A	less negative	decreased
B	less negative	increased
C	more negative	decreased
D	more negative	increased

1000. 9700_w15_qp_12 Q: 23

What is the role of the Casparian strip?

A to act as a site for active transport of ions into the xylem

B to increase root pressure, increasing transpiration

C to lower the water potential in the xylem

D to prevent water moving back into the cortex from the xylem

---

1001. 9700_w15_qp_12 Q: 24

Sucrose is loaded into companion cells and phloem sieve tube elements by active transport and diffusion using transport proteins and plasmodesmata.

Which row shows how sucrose is loaded?

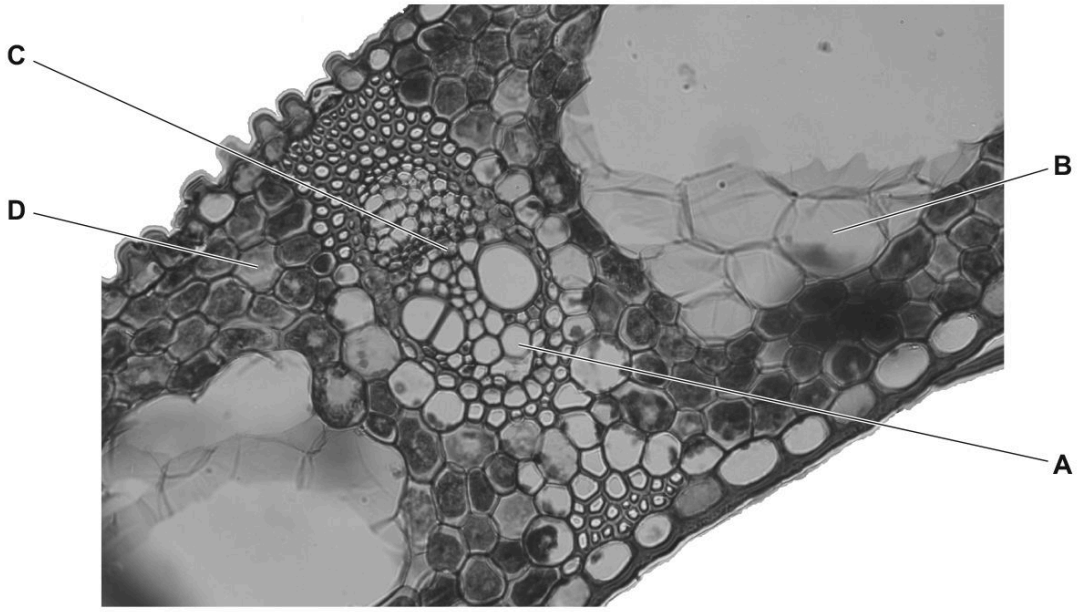
	active transport	diffusion	transport proteins	plasmodesmata
A	into companion cell	into phloem sieve tube element	into companion cell	into phloem sieve tube element
B	into companion cell	into phloem sieve tube element	into phloem sieve tube element	into companion cell
C	into phloem sieve tube element	into companion cell	into companion cell	into phloem sieve tube element
D	into phloem sieve tube element	into companion cell	into phloem sieve tube element	into companion cell

---

1002. 9700_w15_qp_13 Q: 23

The photomicrograph shows a transverse section of a leaf.

Which cell has the least negative water potential?



7.2 Transport mechanisms

1003. 9700_m20_qp_12 Q: 26

What is correct about the apoplastic pathway and symplastic pathway in a root?

	apoplastic pathway	symplastic pathway
A	Casparian strip blocks the movement of water	water moves across the root through cell walls
B	water moves across the root through cell walls	water moves from cell to cell via the plasmodesmata
C	water moves from cell to cell via the plasmodesmata	water passes through the cytoplasm
D	water passes through the cytoplasm	Casparian strip blocks the movement of water

1004. 9700_m20_qp_12 Q: 27

Sucrose moves into a phloem sieve tube element from a leaf mesophyll cell.

Which changes to the water potential and the volume of solution in the phloem sieve tube element are correct?

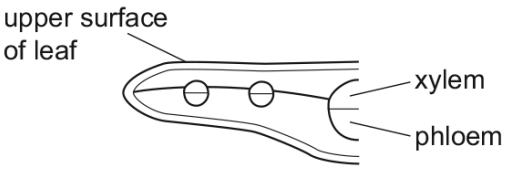
	water potential becomes	volume of solution
A	higher	decreases
B	higher	increases
C	lower	decreases
D	lower	increases

1005. 9700_s20_qp_11 Q: 24

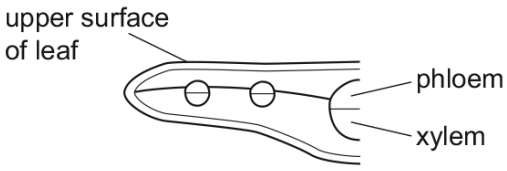
A dicotyledonous leaf has a palisade mesophyll layer that is approximately twice as thick as the spongy mesophyll layer.

Which plan diagram is correct?

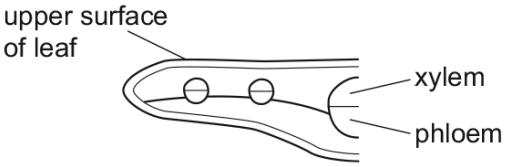
A



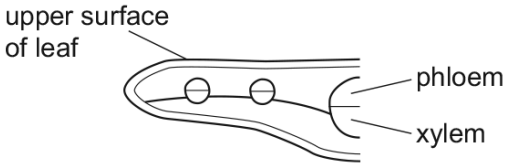
B



C



D



1006. 9700_s20_qp_11 Q: 25

A number of processes contribute to maintaining a water potential gradient in plants allowing water to reach the highest parts of a plant.

Which processes are responsible for maintaining this water potential gradient?

1 capillarity

2 osmosis

3 transpiration

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

---

1007. 9700_s20_qp_11 Q: 26

What is a correct statement about the movement of substances absorbed by roots?

A Ions have to pass through cell walls to cross the endodermis.

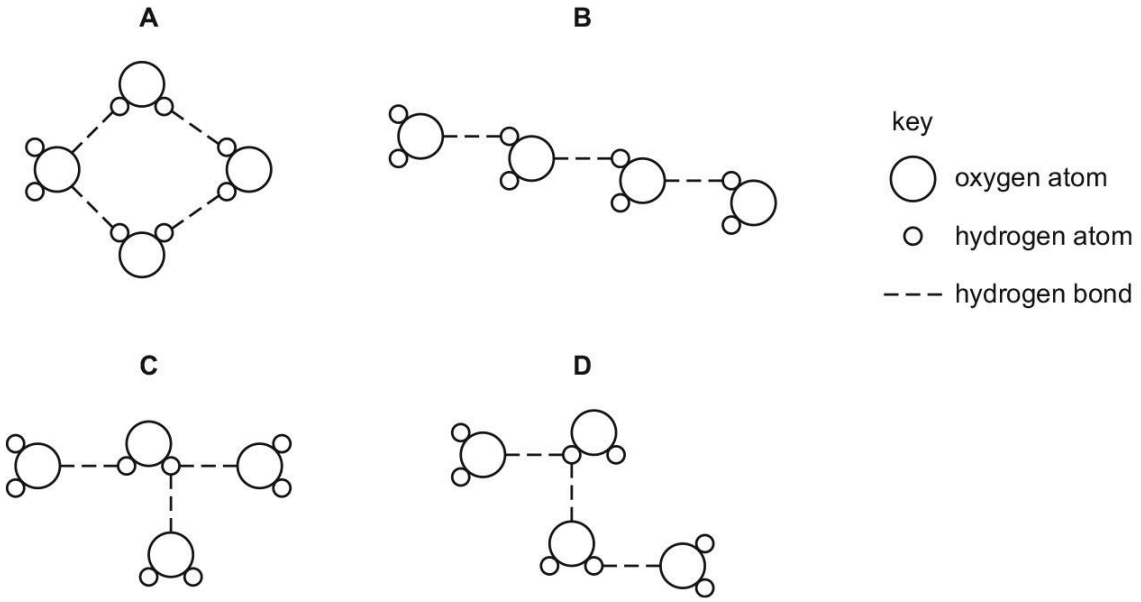
B Ions move through the symplastic pathway only until they reach the Casparian strip.

C Soil water has a more negative water potential than the xylem sap.

D Water passes through the symplastic pathway along a water potential gradient.

1008. 9700_s20_qp_11 Q: 27

Which arrangement of four molecules of water shows how water may cohere when moving up a xylem vessel?



1009. 9700_s20_qp_11 Q: 28

Which statement about sucrose loading into companion cells and then into the phloem sieve tube element is **not** correct?

A Hydrogen ions and sucrose molecules move into the companion cells using a carrier protein.

B Hydrogen ions are pumped out of the companion cells by active transport.

C Sucrose molecules are carried into the companion cells down the concentration gradient for sucrose.

D Sucrose molecules move from a companion cell into the sieve tubes of the phloem through plasmodesmata.

1010. 9700_s20_qp_12 Q: 25

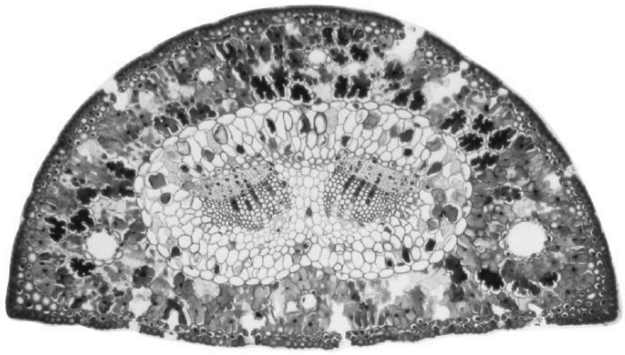
External factors change the rate of transpiration, which also affects the water potential gradient of cells in the leaf.

Which combination is correct?

	external factor changing the rate of transpiration	water potential gradient in the leaf
A	decreasing temperature	increases
B	decreasing wind speed	increases
C	increasing relative humidity	decreases
D	increasing sunlight	decreases

1011. 9700_s20_qp_12 Q: 26

The photomicrograph shows a transverse section through a leaf.



×50

Which features of a xerophytic leaf are visible in this section?

1 sunken stomata

2 two layers of epithelium

3 thick cuticle

4 small surface area to volume

A 1, 2, 3 and 4 **B** 1 and 2 only **C** 1 and 3 only **D** 3 and 4 only

---

1012. 9700_s20_qp_12 Q: 27

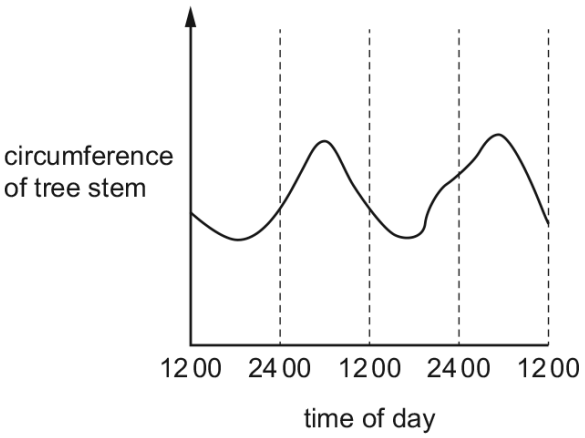
Which changes occur as carbohydrates move out of a root cell into a phloem sieve tube?

	water potential in a phloem sieve tube becomes	volume of liquid in phloem sieve tube
A	less negative	decreases
B	less negative	increases
C	more negative	decreases
D	more negative	increases

1013. 9700_s20_qp_13 Q: 26

The circumference of a tree stem was measured continually for 48 hours.

The results are shown on the chart recording.



What explains the changes in circumference recorded during the 48 hours?

A Adhesion forces decrease during the night.

B Cohesive tension forces increase during the day.

C Mass flow of sucrose increases during the night.

D Root pressure decreases during the day.

1014. 9700_s20_qp_13 Q: 27

Which description of movement in phloem is correct?

A Adding sucrose to a sieve tube element increases its water potential so that water enters and increases the hydrostatic pressure.

B At a sink, such as a storage organ, sucrose is removed from a sieve tube element and polymerised into starch.

C At a source, such as a photosynthesising leaf, sucrose enters a sieve tube element by facilitated diffusion.

D At a source, sucrose is loaded into a companion cell using a protein that carries both hydrogen ions and sucrose molecules.

1015. 9700_w20_qp_11 Q: 25

Which features have a role in the transport of water in xylem vessel elements?

1 capillary action

2 adhesion

3 hydrogen bonding

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

---

1016. 9700_w20_qp_11 Q: 26

The loading of sucrose into companion cells involves a number of processes.

Which process is active?

A the movement of hydrogen ions into the cytoplasm of companion cells

B the movement of hydrogen ions out of the cytoplasm of companion cells

C the movement of sucrose into companion cells

D the movement of sucrose out of companion cells

1017. 9700_w20_qp_11 Q: 27

The statements describe events that occur during the movement of sucrose.

1 Hydrostatic pressure is decreased.

2 Hydrostatic pressure is increased.

3 Sucrose is loaded into the phloem vessel.

4 Sucrose is unloaded from the phloem vessel.

5 Water moves by osmosis into the phloem.

6 Water moves by osmosis out of the phloem.

7 Water potential decreases in the phloem.

8 Water potential increases in the phloem.

Which sequence correctly describes what happens in a plant at a source during the movement of sucrose?

A $3 \rightarrow 7 \rightarrow 5 \rightarrow 2$

B $3 \rightarrow 8 \rightarrow 6 \rightarrow 1$

C $4 \rightarrow 7 \rightarrow 5 \rightarrow 2$

D $4 \rightarrow 8 \rightarrow 6 \rightarrow 1$

1018. 9700_w20_qp_12 Q: 24

Mass flow is the bulk movement of materials from one place to another.

Which vessels carry fluids by mass flow?

1 artery

2 phloem sieve tube

3 vein

4 xylem vessel

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1 and 3 only

D 2 and 4 only

1019. 9700_w20_qp_12 Q: 25

Which two rows are correct for the movement of water from the soil into a root?

	soil	root
1	lower solute concentration	higher solute concentration
2	higher water potential	lower water potential
3	higher solute concentration	lower solute concentration
4	lower water potential	higher water potential

A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

1020. 9700_w20_qp_12 Q: 26

ATP is used in companion cells to provide the energy for loading a sieve tube element with sucrose.

How does the co-transporter mechanism use this energy?

A to pump hydrogen ions into the sieve tube element

B to pump hydrogen ions out of the companion cell

C to pump sucrose into the sieve tube element

D to pump sucrose out of the companion cell

1021. 9700_w20_qp_13 Q: 26

The diameter of a tree trunk usually decreases slightly during the day and increases slightly at night.

Which three environmental factors, if increased, could cause the largest decrease in diameter?

A humidity, temperature, wind speed

B humidity, light intensity, temperature

C humidity, light intensity, wind speed

D light intensity, temperature, wind speed

1022. 9700_w20_qp_13 Q: 27

Sucrose moves within a phloem sieve tube from a source to a sink by mass flow.

Which type of gradient within the phloem sieve tube between the source and sink causes the movement of sucrose?

A diffusion gradient

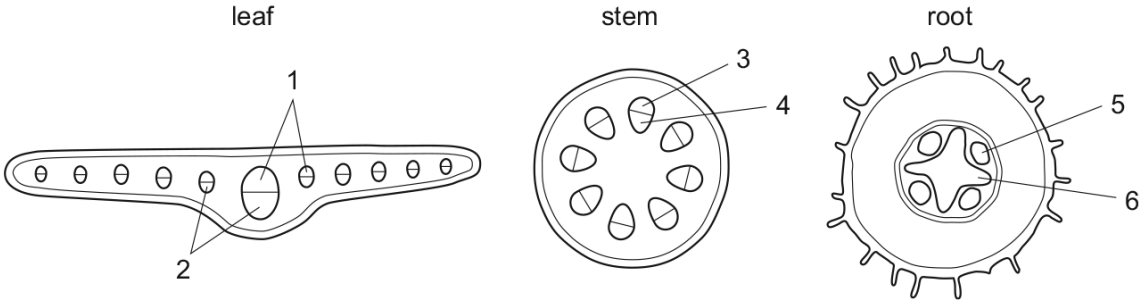
B hydrostatic gradient

C concentration gradient

D water potential gradient

1023. 9700_m19_qp_12 Q: 25

The diagrams show transverse sections of parts of a plant with some transport tissues labelled from 1 to 6.



Which row shows tissues that mainly transport water and tissues that mainly transport sucrose?

	mainly transport water	mainly transport sucrose
A	1 and 3	4 and 6
B	1 and 6	3 and 5
C	2 and 3	4 and 5
D	3 and 5	2 and 6

1024. 9700_m19_qp_12 Q: 26

Which properties of lignin are important for the function of xylem vessels in the stem of a tall plant, such as a tree?

1 It is inflexible so does not bend easily.

2 It is not permeable to water.

3 It is strong to resist collapse under pressure.

4 It has weaker adhesion to water molecules than cellulose.

A 1, 2 and 3 **B** 1, 2 and 4 **C** 1, 3 and 4 **D** 2, 3 and 4

1025. 9700_m19_qp_12 Q: 27

A heating sleeve was placed around the trunk of a small tree at a height of 1 m above the ground. This allowed a narrow region of the tree trunk to be heated to 60 °C.

How will heating this region to 60 °C affect the transport of phloem sap and xylem sap between the roots and leaves?

	movement of phloem sap	movement of xylem sap
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = transport continues

✗ = transport stops

1026. 9700_s19_qp_11 Q: 29

Which statement correctly describes a transport pathway in plants?

A In the apoplast pathway, water may move through plasmodesmata.

B In the symplast pathway, water may move through intercellular spaces.

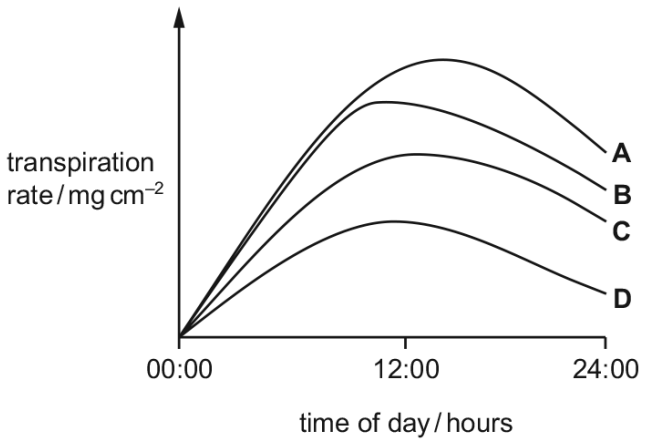
C The apoplast pathway may be blocked by the Casparian strip.

D The symplast pathway may be blocked by the tonoplast.

1027. 9700_s19_qp_12 Q: 25

Four plants, **A**, **B**, **C** and **D**, were grown in the same conditions and their transpiration rates measured.

Which plant is most likely to be a xerophyte?



1028. 9700_s19_qp_12 Q: 26

Sucrose moves from a mesophyll cell in a leaf into a phloem sieve tube element.

Which changes to the water potential and the volume of liquid in the phloem sieve tube element are correct?

	water potential becomes	volume of liquid
A	less negative	decreases
B	less negative	increases
C	more negative	decreases
D	more negative	increases

1029. 9700_s19_qp_13 Q: 30

Irrigating crop plants with water containing low concentrations of salt causes an increase in the concentration of salt in the soil.

What explains why the increase in salt concentration eventually kills the crop?

	water potential in roots	water potential in soil	direction of water movement
A	↓		into the roots
B	↑		into the soil solution
C		↓	out of the roots
D		↑	into the roots

key

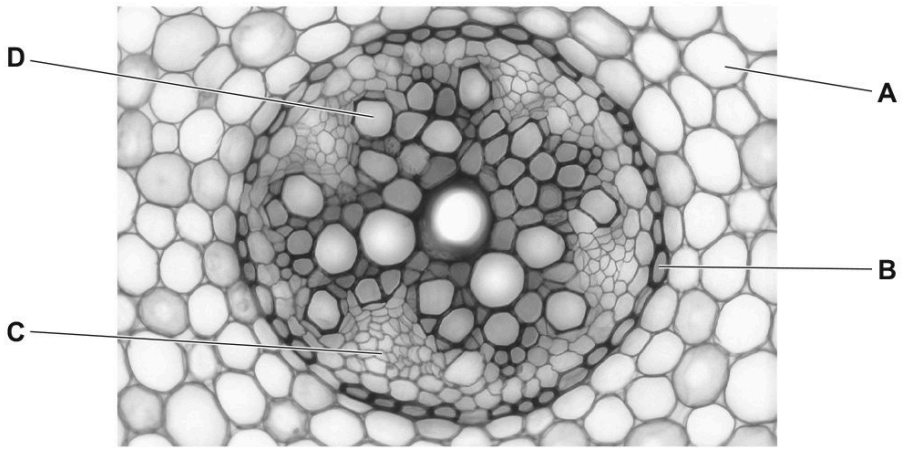
↑ = water potential increases

↓ = water potential decreases

1030. 9700_s19_qp_13 Q: 31

The photomicrograph shows a transverse section through part of a plant root.

Which tissue inhibits the path of water through the apoplastic pathway?



1031. 9700_w19_qp_11 Q: 26

Irrigating crop plants with water containing low concentrations of salt causes an increase in the concentration of salt in the soil.

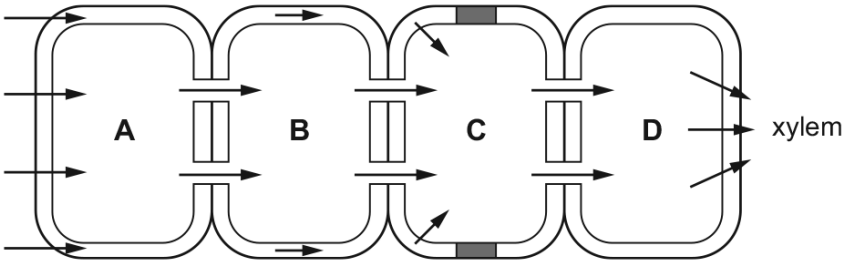
What explains why the increase in salt concentration could eventually kill the crop?

	water potential in roots	water potential in soil	direction of water movement
A	decreases		out of the roots
B	increases		into the roots
C		decreases	out of the roots
D		increases	into the roots

1032. 9700_w19_qp_11 Q: 27

The diagram shows the pathway of water across root cells to the xylem.

Which cell is in the endodermis?



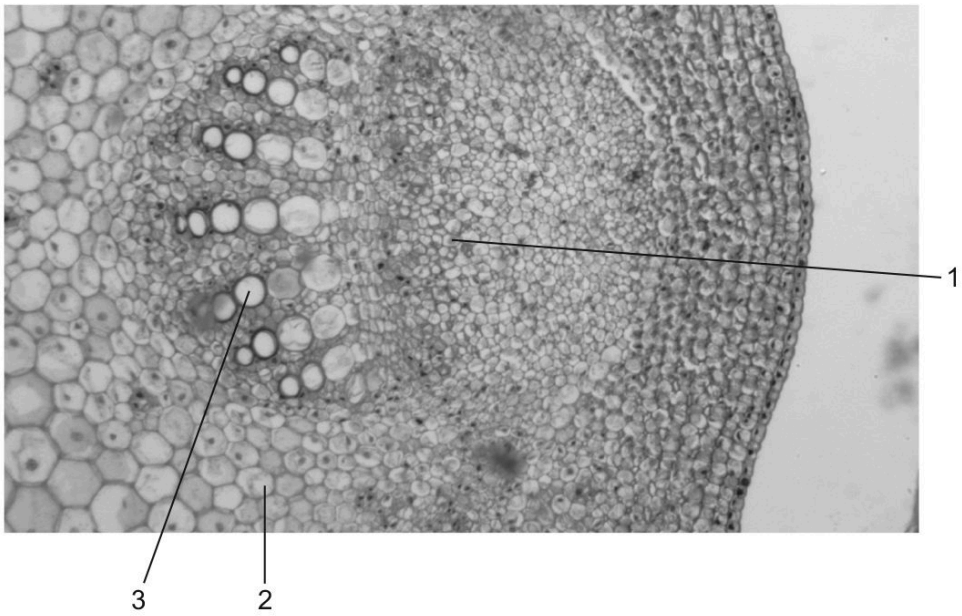
1033. 9700_w19_qp_11 Q: 28

Which row shows the cause of mass flow in the phloem and the direction of movement of phloem sap by mass flow?

	cause of mass flow in the phloem	direction of movement of phloem sap by mass flow
A	hydrostatic pressure gradient	sink to source
B	hydrostatic pressure gradient	source to sink
C	water potential gradient	sink to source
D	water potential gradient	source to sink

1034. 9700_w19_qp_12 Q: 24

The photomicrograph shows a vascular bundle.



Which describes the relationship of water potential in the labelled cells?

A Cell 3 is less negative than cell 1.

B Cell 2 is less negative than cell 3.

C Cell 3 is more negative than cells 1 and 2.

D Cells 1, 2 and 3 have the same water potential.

1035. 9700_w19_qp_12 Q: 26

What is a definition of transpiration?

A the evaporation of water vapour from a leaf due to the diffusion of water from an area of low water potential to high water potential

B the loss of water vapour from a plant to its environment by diffusion down a water potential gradient

C the movement of water from root to leaf due to the adhesion of water molecules to one another

D the uptake of water by plant roots by movement of water down a continuous water potential gradient from air to soil

---

1036. 9700_w19_qp_13 Q: 25

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

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

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

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

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

---

1037. 9700_w19_qp_13 Q: 26

What is true about a Casparian strip?

	location	formed from	effect
A	cell wall of cortical cell	lignin	closes symplastic pathway
B	cell wall of endodermis cell	suberin	closes apoplastic pathway
C	cytoplasm of cortical cell	lignin	closes apoplastic pathway
D	cytoplasm of endodermis cell	suberin	closes symplastic pathway

---

1038. 9700_w19_qp_13 Q: 27

Which xerophytic adaptations reduce the water potential gradient between leaf surface and atmosphere?

1 rolled leaves

2 hairy leaves

3 sunken stomata

4 fewer stomata

5 fleshy leaves

A 1, 2, 3, 4 and 5

B 1, 2 and 3 only

C 1, 3 and 4 only

D 2 and 5 only

1039. 9700_w19_qp_13 Q: 28

When sucrose is loaded into the phloem it has to travel from mesophyll cells to a companion cell and then into the phloem.

In many plants, proton pumps and co-transporter molecules are involved in this process.

Which row shows the relative concentrations of sucrose in each type of cell?

	relative concentration of sucrose / arbitrary units		
	mesophyll cell	companion cell	phloem sieve tube element
A	5	10	15
B	5	15	10
C	15	10	5
D	15	5	10

1040. 9700_m18_qp_12 Q: 28

What will increase the rate of transpiration?

1 increasing the humidity

2 increasing the light intensity

3 decreasing the temperature

4 decreasing the wind speed

A 1, 2 and 3 **B** 1, 3 and 4 **C** 2 only **D** 4 only

1041. 9700_m18_qp_12 Q: 29

Which properties of water are important for transport in xylem?

1 cohesion

2 adhesion

3 high energy requirement for evaporation

4 good solvent properties

A 1, 2 and 4 **B** 1 and 4 only **C** 2, 3 and 4 **D** 2 and 3 only

---

1042. 9700_s18_qp_11 Q: 25

What is a function of the hairs (trichomes) on xerophytic leaves?

A adding a waterproof layer

B protecting the stomata

C reducing the surface area

D trapping a layer of moist air

1043. 9700_s18_qp_11 Q: 26

Which features of companion cells are essential to their function?

1 They are connected by plasmadesmata to the sieve tube elements.

2 They have a thinner cell wall than a sieve tube element.

3 They contain a nucleus and mitochondria.

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

---

1044. 9700_s18_qp_12 Q: 27

A potometer was used to measure the transpiration rate of a leafy shoot.

What could be the correct units?

A cm min **B** $cm^2 min^{-1}$ **C** $cm^3 g^{-1} min$ **D** $cm^3 min^{-1}$

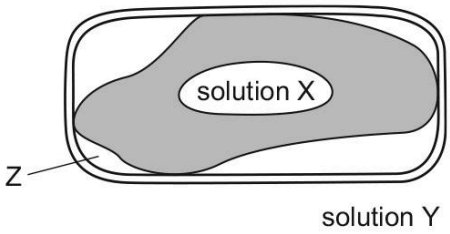
1045. 9700_s18_qp_12 Q: 28

Which combination of features is characteristic of a phloem sieve tube element as it is loaded from a source?

	water potential of the phloem sieve tube element	lignification of the cell wall
A	higher than source	absent
B	higher than source	present
C	lower than source	absent
D	lower than source	present

1046. 9700_s18_qp_13 Q: 18

The diagram shows a partially plasmolysed plant cell.



What is found at Z?

A air

B solution X

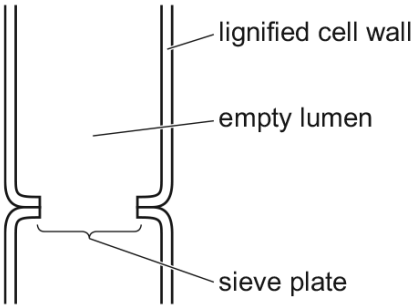
C solution Y

D water

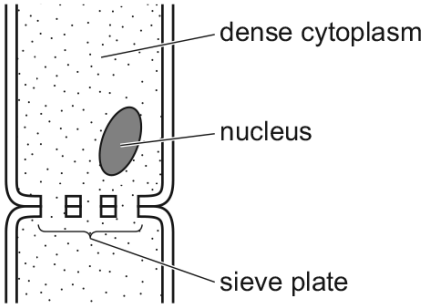
1047. 9700_s18_qp_13 Q: 27

Which diagram correctly represents part of a sieve tube element?

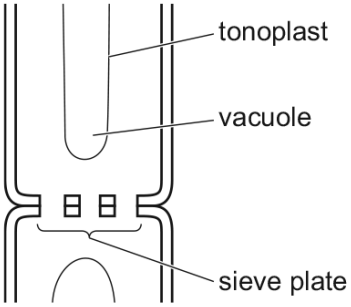
A



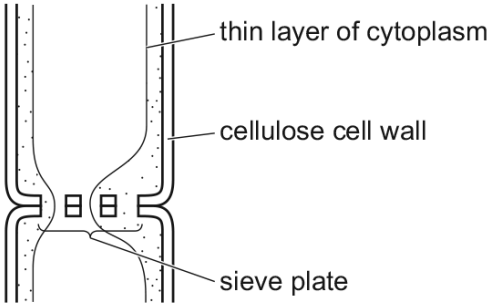
B



C



D



1048. 9700_s18_qp_13 Q: 29

Which statements about water movement in plants are correct?

1 Water can pass through cellulose.

2 Water cannot pass through lignin.

3 Water can pass through suberin.

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

---

1049. 9700_w18_qp_11 Q: 24

Which statements correctly describe transport pathways in dicotyledonous plants?

1 In the apoplast pathway, water does not move through plasmodesmata.

2 In the symplast pathway, water does not move through intercellular spaces.

3 The apoplast pathway may be blocked by the Casparian strip.

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

---

1050. 9700_w18_qp_11 Q: 28

Which statement concerning transpiration is correct?

A On a humid day, the water potential gradient between the intercellular air space and the external atmosphere increases to stimulate water loss by evaporation.

B Water arriving at the spongy mesophyll cells via the symplast pathway must move by osmosis through the cell surface membrane before evaporation from the surface of the cells.

C Water diffuses down the water potential gradient from the saturated air space through the guard cells before evaporating from the surface of the cells into the atmosphere.

D Water moves up the xylem in the apoplast pathway and can continue on this pathway by osmosis to reach the spongy mesophyll cells before evaporating into the intercellular air space.

1051. 9700_w18_qp_12 Q: 28

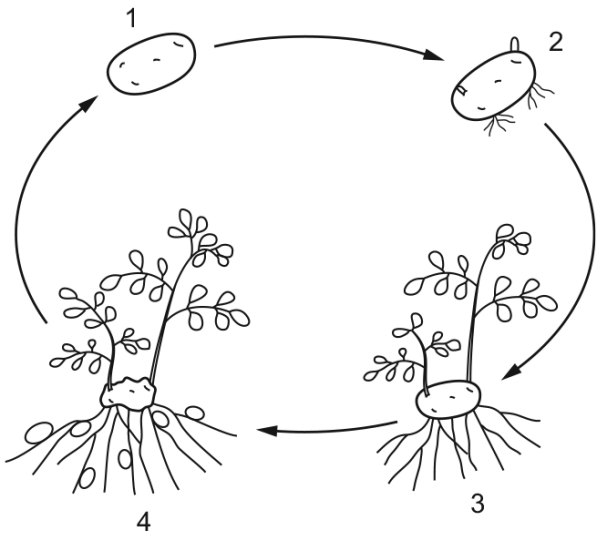
The diagram shows a potato tuber at different stages.

1 dormant tuber (not growing)

2 sprouting roots and shoots

3 growing roots and shoots

4 making new potato tubers



Which row identifies a stage where a potato tuber acts as a source and a stage where it acts as a sink?

	source	sink
A	1	3
B	2	4
C	3	2
D	4	1

1052. 9700_w18_qp_13 Q: 26

By which process would water rise up through xylem vessels in a plant root when the shoot has been removed?

A capillarity, root pressure and transpiration pull

B capillarity and root pressure only

C capillarity and transpiration pull only

D root pressure only

1053. 9700_w18_qp_13 Q: 27

Which changes occur to the water potential and the volume of liquid in the phloem sieve tube element when carbohydrate is moved into a sink?

	water potential of the sieve tube element	volume of liquid of the sieve tube element
A	lowers	decreases
B	lowers	increases
C	raises	decreases
D	raises	increases

1054. 9700_s17_qp_11 Q: 30

Which statements about water movement in plants are correct?

1 Water can pass through cellulose cell walls.

2 Water can pass through lignified cell walls.

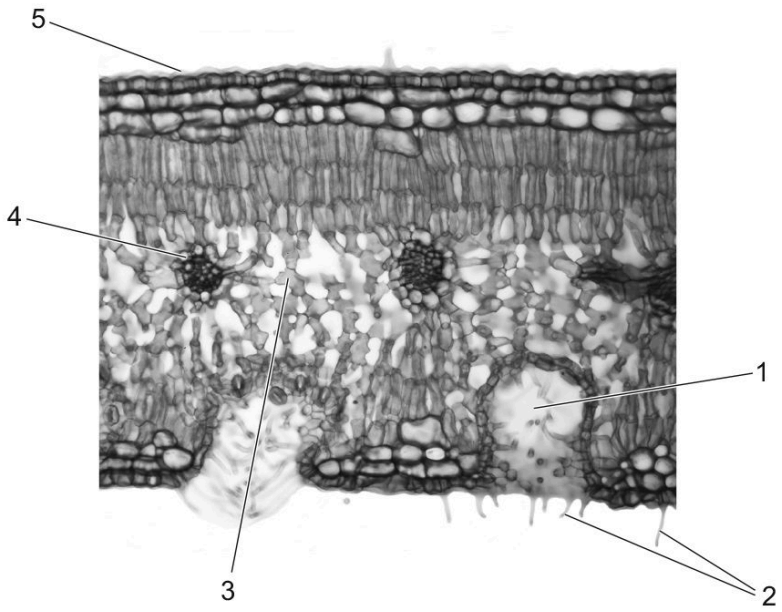
3 Water cannot pass through suberin in cell walls.

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

---

1055. 9700_s17_qp_11 Q: 31

The photomicrograph is a transverse section of a leaf.



Which features are characteristic of xerophytes?

A 1, 3, 4 and 5 **B** 1, 2 and 3 **C** 1, 2 and 5 **D** 2, 3, 4 and 5

1056. 9700_s17_qp_11 Q: 32

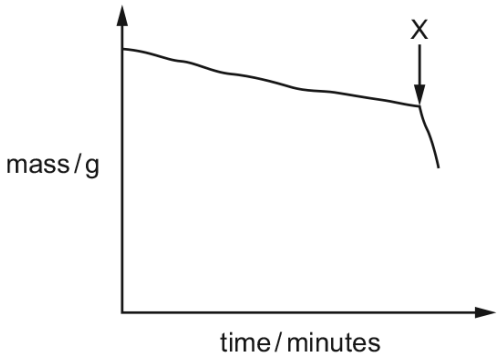
A maize crop is successfully growing in a field in which the water potential of the soil is –40 KPa.

What is the most likely water potential of the cell sap in the root hair cell?

A –60 KPa **B** –40 KPa **C** –20 KPa **D** 0 KPa

1057. 9700_s17_qp_12 Q: 22

The graph shows the loss of mass in a potted plant due to transpiration.



What could have occurred at point X on the graph?

A A plastic bag was placed around the plant.

B The lower epidermis was sealed with petroleum jelly.

C The plant was placed into a dark cupboard.

D Warm moving air was blown over the plant.

1058. 9700_s17_qp_12 Q: 23

Which row is correct for a phloem sieve tube element?

	cell surface membrane	cytoplasm	nucleus	80S ribosomes
A	✓	✓	✓	✓
B	✓	✓	✓	✗
C	✓	✓	✗	✗
D	✗	✗	✗	✗

key
✓ = present
✗ = absent

1059. 9700_s17_qp_12 Q: 24

An aphid, such as a greenfly, uses a tubular mouthpart called a stylet to feed on nutrients in the plant.

It inserts the stylet through the surface of a stem or leaf.

When a stylet is cut near the aphid's head, leaving the stylet in the plant, a liquid with a low water potential continues to flow out of the plant.

Which statement explains this?

A The stylet is in a phloem sieve tube element in which there is a high concentration of solutes.

B The stylet is in a phloem sieve tube element in which there is a low concentration of solutes.

C The stylet is in a xylem vessel element in which there is a high concentration of solutes.

D The stylet is in a xylem vessel element in which there is a low concentration of solutes.

1060. 9700_s17_qp_12 Q: 25

Which statement correctly describes transport pathways in dicotyledonous plants?

A In the apoplast pathway, water may move through plasmodesmata.

B In the symplast pathway, water may move through intercellular spaces.

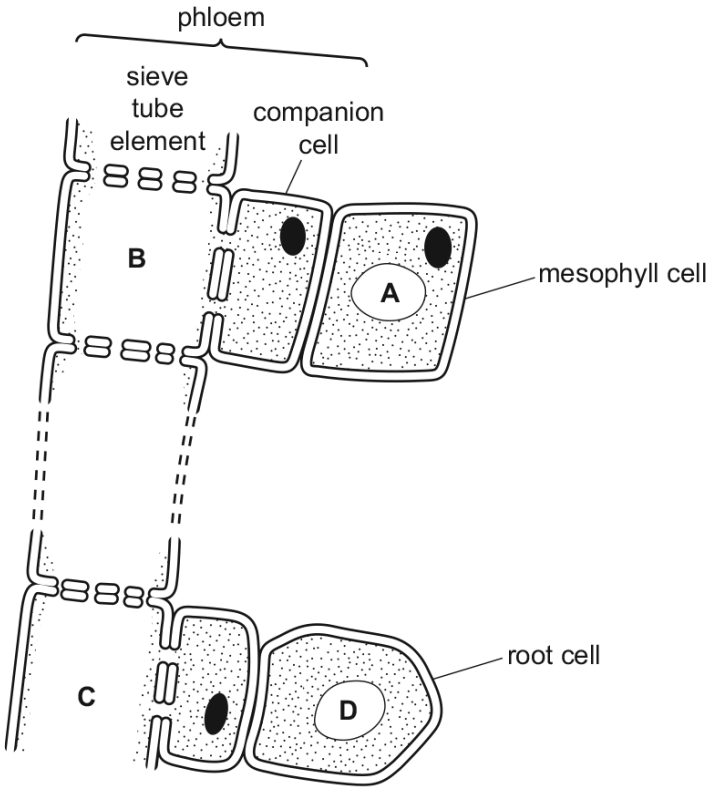
C The apoplast pathway may be blocked by the Casparian strip.

D The symplast pathway may be blocked by the tonoplast.

1061. 9700_s17_qp_13 Q: 24

The diagram shows the tissues involved in the transport of sucrose in a plant.

Where is the highest concentration of sucrose?



1062. 9700_s17_qp_13 Q: 25

Which features adapt root hair cells for efficient absorption of water?

1 a large number of mitochondria

2 a large number of protein carriers in the cell surface membrane

3 a large surface area to volume ratio

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

---

1063. 9700_w17_qp_11 Q: 23

Transpiration is the consequence of which feature of plants?

A the presence of symplast and apoplast pathways

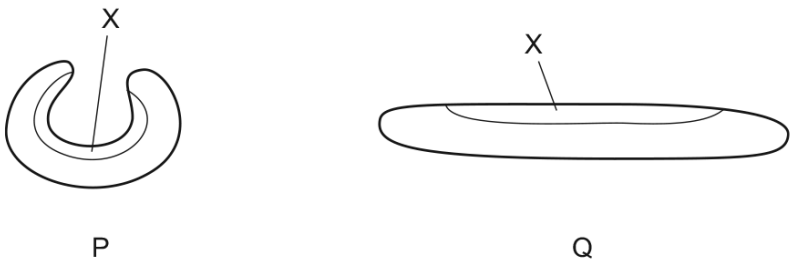
B the requirement for a transport system in plants

C the requirement for leaves to exchange gases

D the thin waxy cuticle on the lower epidermis of leaves

1064. 9700_w17_qp_11 Q: 25

The diagram shows a xerophytic leaf in different conditions, P and Q.



Which statements describe the difference between the cells in layer X in conditions P and Q?

1 more negative water potential in P than Q

2 more cells plasmolysed in P

3 cells less turgid in Q

4 water potential becomes zero in Q

A 1, 2 and 3 **B** 1 and 2 only **C** 2 and 4 **D** 3 and 4

1065. 9700_w17_qp_11 Q: 26

What could increase the rate of transpiration?

A increasing the humidity

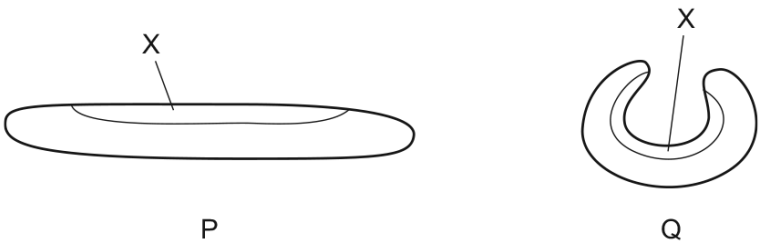
B increasing the light intensity

C decreasing the temperature

D decreasing the wind speed

1066. 9700_w17_qp_12 Q: 27

The diagram shows a xerophytic leaf in different conditions, P and Q.



Which statements about the cells in layer X of the leaf in each of the conditions P and Q are correct?

1 less negative water potential in P than Q

2 cells may be turgid in P and plasmolysed in Q

3 cells less turgid in P than Q

4 no net diffusion of water into X in either P or Q

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 4 only

D 2 and 3 only

1067. 9700_w17_qp_12 Q: 28

What are features that adapt root hair cells for efficient uptake of mineral ions?

1 a large number of mitochondria

2 a large number of protein carriers in the cell surface membrane

3 a large surface area to volume ratio

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

---

1068. 9700_w17_qp_13 Q: 29

Mass flow is the bulk movement of materials from one place to another.

Which vessels carry fluids by mass flow?

1 artery

2 phloem sieve tube

3 vein

4 xylem vessel

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1 and 3 only

D 2 and 4 only

1069. 9700_w17_qp_13 Q: 30

Amino acids move from a phloem sieve tube element into a root cell.

Which changes to the water potential and the volume of liquid in the phloem sieve tube element are correct?

	water potential	volume of liquid
A	becomes higher	decreases
B	becomes higher	increases
C	becomes lower	decreases
D	becomes lower	increases

1070. 9700_w17_qp_13 Q: 31

The table shows the volume of water taken up over a 10 minute period for two species of plant, X and Y.

time / minutes	water uptake / mm^3	
	X	Y
2	4.2	1.2
4	7.8	2.3
6	10.9	3.7
8	13.3	4.4
10	16.9	4.9

Both plants were tested at the same time, in the same room and using identical potometers. A student concluded that Y was a xerophyte so lost less water.

What feature of the experiment could bring this conclusion into doubt?

A The student did not control air flow or temperature surrounding the plants.

B The student did not leave the plants to acclimatise to their surroundings.

C The student did not take measurements at 0 minutes.

D The student did not take account of the area of leaves.

1071. 9700_m16_qp_12 Q: 24

Which statement describes movement through a plant in the apoplast pathway?

A Water moves through the cell walls.

B Water moves through the cytoplasm.

C Water moves through the plasmodesmata.

D Water moves through the vacuoles.

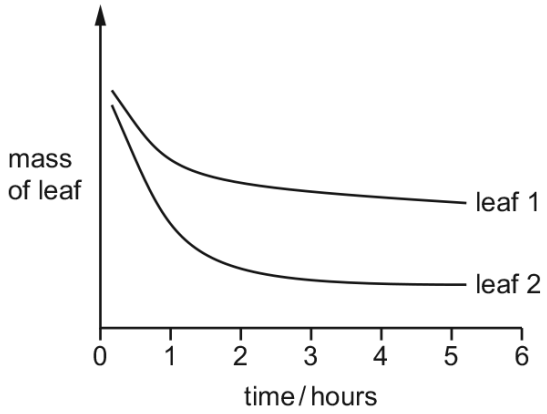
1072. 9700_m16_qp_12 Q: 25

Which changes to the water potential and the volume of liquid in the phloem occur when sucrose is moved from the phloem sieve tube to an actively dividing root tip?

	water potential in phloem sieve tube becomes	volume of liquid in phloem sieve tubes
A	less negative	decreases
B	less negative	increases
C	more negative	decreases
D	more negative	increases

1073. 9700_m16_qp_12 Q: 26

The diagram shows the results of an experiment using leaves with the same surface area from two different species of plant. Each leaf was left on a balance in daylight in a closed room and its mass recorded at 1 hour intervals.



Which features of leaf 2 could explain these results?

1 more stomata per unit area of leaf

2 fewer trichomes (hairs) on the leaf

3 sunken stomata

4 thinner cuticle

A 1, 2 and 3 **B** 1, 2 and 4 **C** 1 and 4 only **D** 2 and 3 only

---

1074. 9700_m16_qp_12 Q: 27

Which evidence supports the cohesion-tension theory for the movement of water in flowering plants?

1 When the rate of transpiration of a tree is at its maximum, the diameter of the trunk is at its minimum.

2 When a plant shoot is removed close to the base of the stem, sap leaks out from the cut.

3 Evaporation of water from a porous pot can exert a force that draws water up a glass tube attached underneath the pot.

4 Droplets of water form at the edge of leaves of plants growing in conditions of soil with high water content and air with high humidity.

A 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

1075. 9700_s16_qp_11 Q: 24

Water that is present inside a root hair cell may leave the cell and pass to the vascular tissue.

Through which route **must** the water travel?

A apoplast

B plasmodesmata

C symplast

D vacuoles

1076. 9700_s16_qp_11 Q: 25

What is a correct definition of the term transpiration?

A diffusion of water from intercellular air spaces to the atmosphere where it evaporates

B evaporation of water from the leaf surface of a plant via the stomata

C loss of water vapour from the aerial parts of a plant to the atmosphere

D movement of water from the xylem to the atmosphere through the cell walls only

---

1077. 9700_s16_qp_11 Q: 26

Which changes to the water potential and the volume of liquid in the phloem sieve tube element occur when sucrose is moved from a photosynthesising leaf into the phloem sieve tube element?

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

1078. 9700_s16_qp_11 Q: 27

Which statement supports the theory of active loading of sucrose into companion cells?

A The pH decreases in the cell wall of the companion cells compared to the cytoplasm.

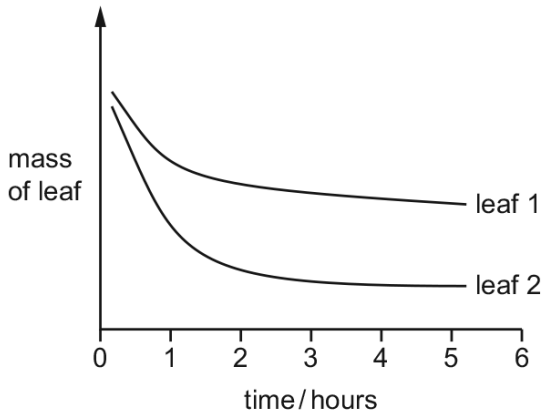
B The pH decreases in the cytoplasm of the companion cells compared to the cell wall.

C The pH decreases in the plasmodesmata between companion cells and sieve tube elements.

D The pH decreases in the sieve tube elements compared to the companion cells.

1079. 9700_s16_qp_12 Q: 25

The diagram shows the results of an experiment on transpiration using two different leaves. Each leaf was left on a balance in daylight in a closed room and its mass recorded at 1 hour intervals.



Which conclusions could be correct?

1 The loss of mass is mainly due to evaporation of water.

2 Most stomata close in both leaves after 1 hour.

3 Leaf 1 has a larger surface area than leaf 2.

4 Leaf 1 has a thicker cuticle than leaf 2.

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 2 and 3 only

D 3 and 4 only

1080. 9700_s16_qp_12 Q: 26

Which statement about the transport of sucrose is correct?

A ATP synthesised by mitochondria of companion cells provides the energy to move sucrose from phloem sieve tube elements in leaves to sinks.

B Sucrose moves through plasmodesmata by passive diffusion from mesophyll cells through companion cells to phloem sieve tube elements.

C The water potential in phloem sieve tube elements becomes more negative following the entry of sucrose.

D Water enters companion cells and hydrostatic pressure builds up to push sucrose into phloem sieve tube elements by mass flow.

1081. 9700_s16_qp_13 Q: 23

During transpiration, what is the site of evaporation of water in the leaves?

A air spaces

B guard cell walls

C mesophyll cell walls

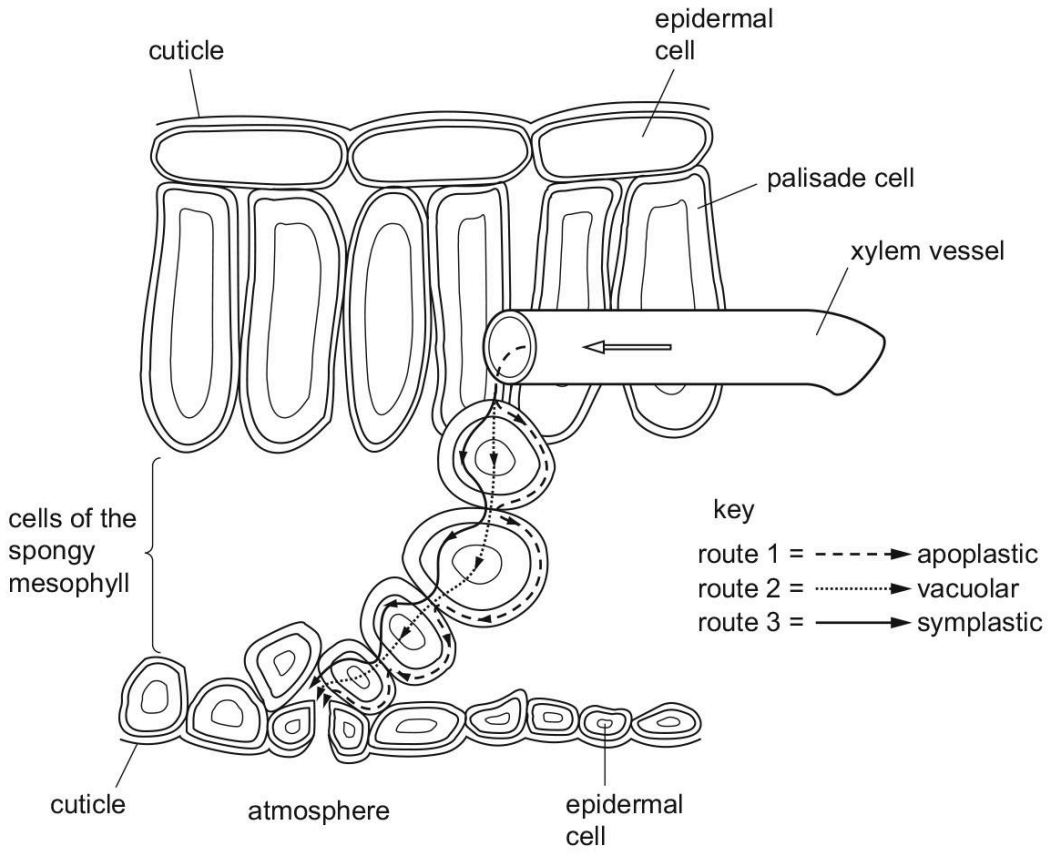
D stomata

1082. 9700_s16_qp_13 Q: 24

Water passes across leaf tissues by different routes as a result of:

- differences in water potential
- the pull transmitted by cohesive forces between water molecules.

The diagram shows three routes by which water can travel.



Which row correctly identifies why water passes across leaf tissues by the different routes?

	differences in water potential	pull transmitted by cohesive forces
A	route 1	routes 2 and 3
B	routes 1 and 3	route 2
C	route 2	routes 1 and 3
D	routes 2 and 3	route 1

1083. 9700_s16_qp_13 Q: 25

Which factors contribute to the increase in transpiration rate when the temperature rises?

1 concentration of water molecules increases in air spaces due to evaporation

2 increased rate of diffusion as water molecules have more kinetic energy

3 increased hydrogen bonding between water molecules in air spaces

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

---

1084. 9700_s16_qp_13 Q: 26

ATP is used in companion cells to provide the energy for loading a sieve tube element with sucrose.

How does the co-transporter mechanism use this energy?

A to pump protons into the sieve tube element

B to pump protons out of the companion cell

C to pump sucrose into the sieve tube element

D to pump sucrose out of the companion cell

1085. 9700_s16_qp_13 Q: 27

Which changes to the water potential and the volume of liquid in the phloem sieve tube element occur when sucrose is moved from the phloem sieve tube element to an actively dividing shoot tip?

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

1086. 9700_w16_qp_11 Q: 24

A dendrograph records changes in the diameter of a tree. The diagram shows a dendrograph fixed to a tree.

Some results are shown on the chart recording.

dendrograph fixed to a tree

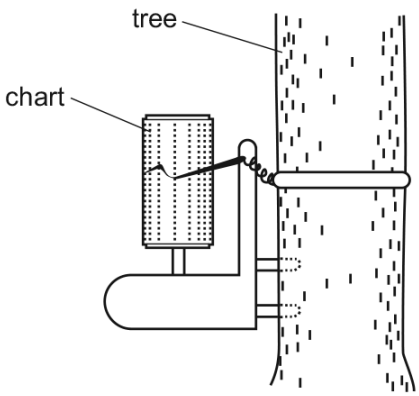
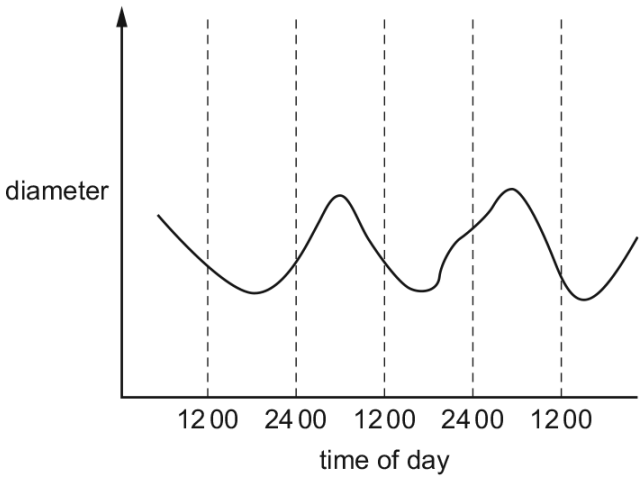


chart recording



What explains the diameter changes recorded during the day and night?

A Adhesion forces decrease during the night.

B Cohesive tension forces increase during the day.

C Mass flow of sucrose increases during the night.

D Root pressure decreases during the day.

1087. 9700_w16_qp_11 Q: 25

Which description is correct for xylem vessel elements?

A cells joined to form a tube, pits at intervals, sieve plates between cells, surrounded by the endodermis in roots

B contains cells joined end to end, containing cytoplasm, cell walls with lignin, located to the outside of phloem in vascular bundles

C contains elongated cells with end walls broken down, located in vascular bundles in the stem and centrally in the roots

D dead elongated cells, lignified cell walls with pits at intervals, associated with companion cells in the roots only

---

1088. 9700_w16_qp_11 Q: 26

Different substances, such as sucrose and amino acids, can move in different directions in the phloem sieve tube elements.

Which statement explains this?

A Active transport occurs in some phloem sieve tube elements and mass flow occurs in other sieve tube elements.

B Both active transport and mass flow occur in each individual phloem sieve tube element.

C Mass flow occurs in both directions at the same time in each individual phloem sieve tube element.

D Mass flow occurs in different directions in different phloem sieve tube elements at the same time.

1089. 9700_w16_qp_11 Q: 27

Which describes possible mechanisms by which sucrose is transferred from a mesophyll cell into a companion cell?

1 co-transport with the active transport of hydrogen ions

2 co-transport by passive diffusion of hydrogen ions

3 facilitated diffusion through plasmodesmata

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

1090. 9700_w16_qp_12 Q: 27

External factors change the rate of transpiration, which also affects the water potential gradient of cells in the leaf.

Which combination of statements is correct?

	external factor changing the rate of transpiration	water potential gradient in the leaf
A	decreasing temperature	increases
B	decreasing wind speed	increases
C	increasing relative humidity	decreases
D	increasing sunlight	decreases

1091. 9700_w16_qp_13 Q: 23

Which statements about water movement in plants are correct?

1 Water cannot pass through cellulose.

2 Water cannot pass through lignin.

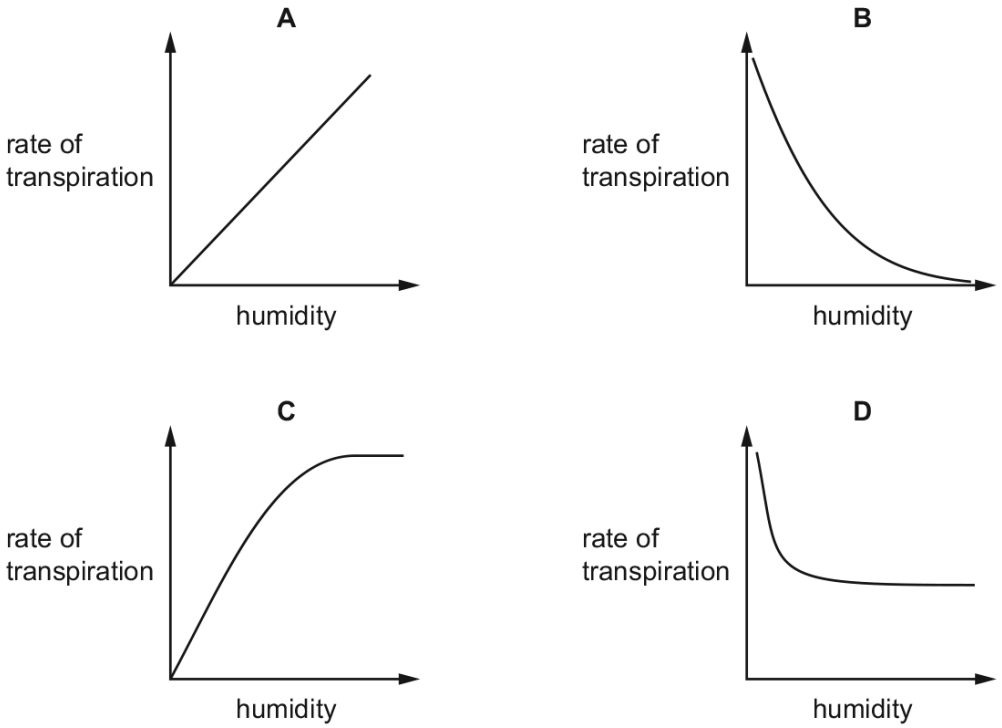
3 Water cannot pass through the Casparian strip.

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

---

1092. 9700_w16_qp_13 Q: 25

Which diagram represents the effect of atmospheric humidity on the rate of transpiration?



1093. 9700_w16_qp_13 Q: 26

Which parts of a plant have plasmodesmata?

1 companion cells

2 phloem sieve tube elements

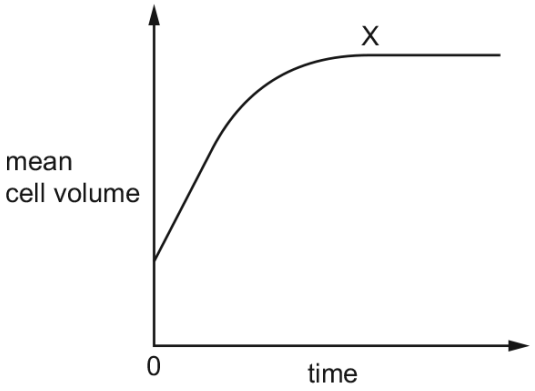
3 root hair cell

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

---

1094. 9700_s15_qp_11 Q: 24

A tissue composed of plasmolysed plant cells was put into distilled water. The graph shows how the mean cell volume changes with time.



What is the cause of the plateau at X?

1 water potential in the plant cell has become more negative

2 cells have become fully turgid

3 no net movement of water into cells

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

---

1095. 9700_s15_qp_11 Q: 26

Which changes to the water potential and the volume of liquid in the phloem occur when amino acids are moved into a sink from phloem sieve tubes?

	water potential in a phloem sieve tube	volume of liquid in phloem sieve tubes
A	higher	decreased
B	higher	increased
C	lower	decreased
D	lower	increased

1096. 9700_s15_qp_12 Q: 24

What is the sequence of events in the translocation of sucrose?

A active loading of sucrose into sieve elements at the source, increased hydrostatic pressure, mass flow, unloading at the sink

B hydrolysis of storage compounds in sinks, lowered water potential, unloading of sucrose from sieve elements, mass flow from the source

C lowered pressure in sieve elements at the source, movement of sucrose down the pressure gradient, mass flow down a diffusion gradient to the sink

D mass flow of dissolved sucrose into the sieve element at the source, lowered hydrostatic pressure, diffusion of sucrose to sink, active unloading

---

1097. 9700_s15_qp_12 Q: 25

Where does water evaporate from during transpiration?

A inside the guard cells

B the outer surface of the epidermal cell layer

C the sub-stomatal cavity

D the surface of spongy mesophyll cell walls

1098. 9700_s15_qp_12 Q: 26

Which changes to the water potential and the volume of liquid in the phloem occur when amino acids are taken out of a sink in a phloem sieve tube?

	water potential in phloem sieve tubes	volume of liquid in phloem sieve tubes
A	higher	decreased
B	higher	increased
C	lower	decreased
D	lower	increased

1099. 9700_s15_qp_12 Q: 39

A farmer grows a different crop in a field each year for three years.

In the fourth year he grows a leguminous crop, such as clover, and then ploughs this into the soil. The next year he starts the rotation again.

How does the fourth year crop add mineral ions to the soil?

	decomposition	nitrification	nitrogen fixation
A	no	yes	yes
B	yes	no	yes
C	yes	yes	no
D	yes	yes	yes

1100. 9700_s15_qp_13 Q: 3

Which comparison of a phloem companion cell with a B-lymphocyte is correct?

A Both cell types have proteins embedded in their cell surface membranes.

B B-lymphocytes have a spherical nucleus but companion cells do not have a nucleus.

C Companion cells always contain chloroplasts, which are not present in B-lymphocytes.

D Neither B-lymphocytes nor companion cells possess plasmodesmata.

1101. 9700_s15_qp_13 Q: 5

Which structures in plant cells have a double membrane?

A chloroplasts and vacuoles

B lysosomes and nuclei

C mitochondria and vacuoles

D nuclei and mitochondria

1102. 9700_s15_qp_13 Q: 10

Which properties of water are a result of only cohesion?

1 The water has a high surface tension.

2 Water moves up xylem vessels.

3 Water is an excellent solvent.

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

1103. 9700_s15_qp_13 Q: 23

Which force holds water molecules on the surface of cell walls?

A adhesion

B capillarity

C cohesion

D surface tension

1104. 9700_s15_qp_13 Q: 24

The statements are about the properties of water.

1 requires a lot of heat to evaporate

2 holds a lot of heat

3 is able to form hydrogen bonds with other water molecules

4 is able to form hydrogen bonds with other polar molecules

Which properties are important for translocation in phloem?

A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 3 and 4

1105. 9700_s15_qp_13 Q: 25

Which changes to the water potential and the volume of liquid in the phloem occur when amino acids are moved into a phloem sieve tube at a source?

	water potential in phloem sieve tubes	volume of liquid in phloem sieve tubes
A	higher	decreased
B	higher	increased
C	lower	decreased
D	lower	increased

1106. 9700_s15_qp_13 Q: 26

Which feature of transport in xylem depends on the use of energy?

A mass flow of water to the leaves

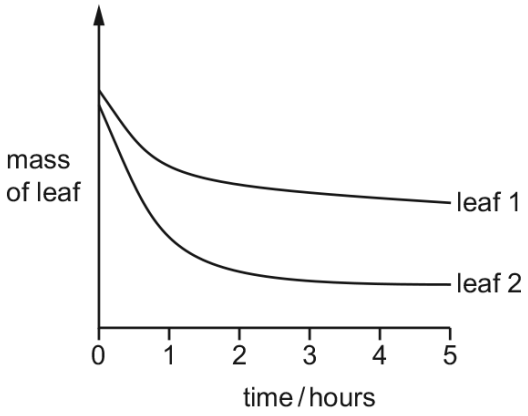
B osmosis of water into xylem

C uptake of ions into the root

D transpiration of water from the leaves

1107. 9700_w15_qp_11 Q: 24

The diagram shows the results of an experiment using leaves with the same surface area from two different species. Each leaf was left on a balance in daylight in a closed room and their mass recorded at 1 hour intervals.



What could explain these results?

A Leaf 1 has a thicker cuticle than leaf 2.

B Leaf 1 is thinner than leaf 2.

C Leaf 2 has stomata protected by hairs and leaf 1 does not.

D Leaf 2 has sunken stomata and leaf 1 does not.

1108. 9700_w15_qp_11 Q: 25

Which description of the movement of water through a leaf is **not** correct?

A Water evaporates into an air space from the higher water potential in the cell wall of a mesophyll cell.

B Water moves from the higher water potential of the cytoplasm of a mesophyll cell to the lower water potential in its cell wall.

C Water moves from the lower water potential of a xylem vessel to the higher water potential of a mesophyll cell.

D Water vapour diffuses from an air space, through an open stoma, to the lower humidity of the surrounding air.

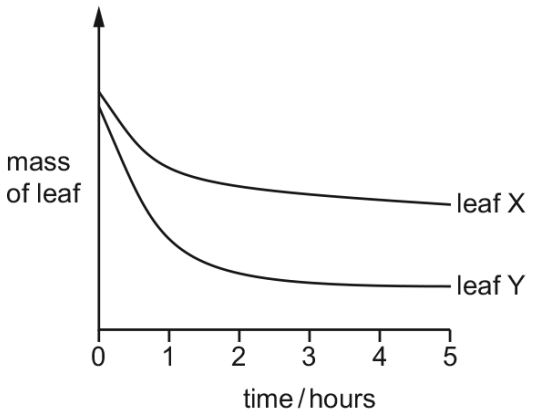
1109. 9700_w15_qp_12 Q: 25

Which changes to the water potential and the volume of liquid in the phloem occur when sucrose is transferred from leaves into phloem sieve tubes to be transported to a sink?

	water potential in phloem sieve tubes becomes	volume of liquid in phloem sieve tubes
A	less negative	decreased
B	less negative	increased
C	more negative	decreased
D	more negative	increased

1110. 9700_w15_qp_12 Q: 26

The diagram shows the results of an experiment using leaves with the same surface area from two different species. Each leaf was left on a balance in daylight in a closed room and their mass recorded at 1 hour intervals.



Which features of leaf X could explain these results?

1 thinner cuticle

2 sunken stomata

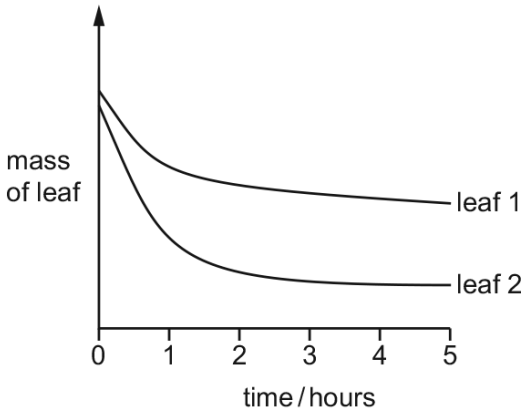
3 ability to roll the leaf

4 no trichomes on the leaf

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 1 only

1111. 9700_w15_qp_13 Q: 24

The diagram shows the results of an experiment on transpiration using two different leaves. Each leaf was left on a balance in daylight in a closed room and their mass recorded at 1 hour intervals.



Which conclusions could be correct?

1 The loss in mass is mainly due to evaporation of water.

2 The stomata in both leaves close after 1 hour.

3 Leaf 1 has a larger surface area than leaf 2.

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

---

1112. 9700_w15_qp_13 Q: 25

Which processes are involved in the transport of sucrose in plants?

1 active transport

2 mass flow

3 osmosis

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

---

1113. 9700_w15_qp_13 Q: 26

Which changes to the water potential and the volume of liquid in the phloem occur when carbohydrate is moved from phloem sieve tubes into a sink?

	water potential in phloem sieve tubes becomes	volume of liquid in phloem sieve tubes
A	less negative	decreased
B	less negative	increased
C	more negative	decreased
D	more negative	increased

Paper 1 Multiple Choice Answers: Transport in Plants

Question	Paper	Q. No.	Answer
934	9700_m20_qp_12	25	C
935	9700_s20_qp_13	24	A
936	9700_s20_qp_13	25	A
937	9700_w20_qp_11	23	C
938	9700_w20_qp_11	24	A
939	9700_w20_qp_12	23	A
940	9700_w20_qp_13	25	B
941	9700_m19_qp_12	23	A
942	9700_m19_qp_12	24	C
943	9700_s19_qp_11	26	D
944	9700_s19_qp_11	27	C
945	9700_s19_qp_11	28	A
946	9700_s19_qp_12	22	D
947	9700_s19_qp_12	23	B
948	9700_s19_qp_12	24	C
949	9700_s19_qp_13	29	C
950	9700_w19_qp_11	24	A
951	9700_w19_qp_11	25	C
952	9700_w19_qp_12	25	A
953	9700_w19_qp_13	24	C
954	9700_m18_qp_12	26	B
955	9700_m18_qp_12	27	D
956	9700_s18_qp_11	24	D
957	9700_s18_qp_12	26	C
958	9700_s18_qp_12	29	C
959	9700_s18_qp_13	26	C
960	9700_s18_qp_13	28	B
961	9700_w18_qp_11	25	B
962	9700_w18_qp_11	26	A
963	9700_w18_qp_11	27	A
964	9700_w18_qp_12	25	D
965	9700_w18_qp_12	26	D
966	9700_w18_qp_12	27	D
967	9700_w18_qp_13	24	A
968	9700_w18_qp_13	25	C
969	9700_m17_qp_12	28	A
970	9700_m17_qp_12	29	D
971	9700_m17_qp_12	30	A
972	9700_m17_qp_12	31	B
973	9700_m17_qp_12	32	A
974	9700_s17_qp_11	28	C
975	9700_s17_qp_11	29	A
976	9700_s17_qp_13	22	C
977	9700_s17_qp_13	23	D
978	9700_w17_qp_11	22	D
979	9700_w17_qp_11	24	D

Paper 1 Multiple Choice Answers: Transport in Plants (continued)

Question	Paper	Q. No.	Answer
980	9700_w17_qp_12	26	A
981	9700_w17_qp_12	29	C
982	9700_w17_qp_12	30	B
983	9700_w17_qp_13	27	B
984	9700_w17_qp_13	28	D
985	9700_m16_qp_12	23	C
986	9700_s16_qp_11	23	A
987	9700_s16_qp_12	23	C
988	9700_s16_qp_12	24	A
989	9700_w16_qp_11	23	D
990	9700_w16_qp_12	24	A
991	9700_w16_qp_12	25	B
992	9700_w16_qp_12	26	D
993	9700_w16_qp_12	28	B
994	9700_s15_qp_11	23	C
995	9700_s15_qp_11	25	B
996	9700_s15_qp_12	23	D
997	9700_w15_qp_11	5	A
998	9700_w15_qp_11	23	D
999	9700_w15_qp_11	26	D
1000	9700_w15_qp_12	23	D
1001	9700_w15_qp_12	24	A
1002	9700_w15_qp_13	23	A
1003	9700_m20_qp_12	26	B
1004	9700_m20_qp_12	27	D
1005	9700_s20_qp_11	24	C
1006	9700_s20_qp_11	25	A
1007	9700_s20_qp_11	26	D
1008	9700_s20_qp_11	27	B
1009	9700_s20_qp_11	28	C
1010	9700_s20_qp_12	25	C
1011	9700_s20_qp_12	26	C
1012	9700_s20_qp_12	27	D
1013	9700_s20_qp_13	26	B
1014	9700_s20_qp_13	27	D
1015	9700_w20_qp_11	25	A
1016	9700_w20_qp_11	26	B
1017	9700_w20_qp_11	27	A
1018	9700_w20_qp_12	24	A
1019	9700_w20_qp_12	25	A
1020	9700_w20_qp_12	26	B
1021	9700_w20_qp_13	26	D
1022	9700_w20_qp_13	27	B
1023	9700_m19_qp_12	25	B
1024	9700_m19_qp_12	26	A
1025	9700_m19_qp_12	27	C

Paper 1 Multiple Choice Answers: Transport in Plants (continued)

Question	Paper	Q. No.	Answer
1026	9700_s19_qp_11	29	C
1027	9700_s19_qp_12	25	D
1028	9700_s19_qp_12	26	D
1029	9700_s19_qp_13	30	C
1030	9700_s19_qp_13	31	B
1031	9700_w19_qp_11	26	C
1032	9700_w19_qp_11	27	C
1033	9700_w19_qp_11	28	B
1034	9700_w19_qp_12	24	A
1035	9700_w19_qp_12	26	B
1036	9700_w19_qp_13	25	A
1037	9700_w19_qp_13	26	B
1038	9700_w19_qp_13	27	B
1039	9700_w19_qp_13	28	B
1040	9700_m18_qp_12	28	C
1041	9700_m18_qp_12	29	A
1042	9700_s18_qp_11	25	D
1043	9700_s18_qp_11	26	C
1044	9700_s18_qp_12	27	D
1045	9700_s18_qp_12	28	C
1046	9700_s18_qp_13	18	C
1047	9700_s18_qp_13	27	D
1048	9700_s18_qp_13	29	B
1049	9700_w18_qp_11	24	A
1050	9700_w18_qp_11	28	B
1051	9700_w18_qp_12	28	B
1052	9700_w18_qp_13	26	B
1053	9700_w18_qp_13	27	C
1054	9700_s17_qp_11	30	A
1055	9700_s17_qp_11	31	C
1056	9700_s17_qp_11	32	A
1057	9700_s17_qp_12	22	D
1058	9700_s17_qp_12	23	C
1059	9700_s17_qp_12	24	A
1060	9700_s17_qp_12	25	C
1061	9700_s17_qp_13	24	B
1062	9700_s17_qp_13	25	D
1063	9700_w17_qp_11	23	C
1064	9700_w17_qp_11	25	B
1065	9700_w17_qp_11	26	B
1066	9700_w17_qp_12	27	B
1067	9700_w17_qp_12	28	A
1068	9700_w17_qp_13	29	A
1069	9700_w17_qp_13	30	A
1070	9700_w17_qp_13	31	D
1071	9700_m16_qp_12	24	A

Paper 1 Multiple Choice Answers: Transport in Plants (continued)

Question	Paper	Q. No.	Answer
1072	9700_m16_qp_12	25	A
1073	9700_m16_qp_12	26	B
1074	9700_m16_qp_12	27	B
1075	9700_s16_qp_11	24	C
1076	9700_s16_qp_11	25	C
1077	9700_s16_qp_11	26	D
1078	9700_s16_qp_11	27	A
1079	9700_s16_qp_12	25	B
1080	9700_s16_qp_12	26	C
1081	9700_s16_qp_13	23	C
1082	9700_s16_qp_13	24	D
1083	9700_s16_qp_13	25	B
1084	9700_s16_qp_13	26	B
1085	9700_s16_qp_13	27	A
1086	9700_w16_qp_11	24	B
1087	9700_w16_qp_11	25	C
1088	9700_w16_qp_11	26	D
1089	9700_w16_qp_11	27	D
1090	9700_w16_qp_12	27	C
1091	9700_w16_qp_13	23	D
1092	9700_w16_qp_13	25	B
1093	9700_w16_qp_13	26	A
1094	9700_s15_qp_11	24	D
1095	9700_s15_qp_11	26	A
1096	9700_s15_qp_12	24	A
1097	9700_s15_qp_12	25	D
1098	9700_s15_qp_12	26	D
1099	9700_s15_qp_12	39	D
1100	9700_s15_qp_13	3	A
1101	9700_s15_qp_13	5	D
1102	9700_s15_qp_13	10	C
1103	9700_s15_qp_13	23	A
1104	9700_s15_qp_13	24	D
1105	9700_s15_qp_13	25	D
1106	9700_s15_qp_13	26	C
1107	9700_w15_qp_11	24	A
1108	9700_w15_qp_11	25	C
1109	9700_w15_qp_12	25	D
1110	9700_w15_qp_12	26	C
1111	9700_w15_qp_13	24	B
1112	9700_w15_qp_13	25	A
1113	9700_w15_qp_13	26	A

Chapter 7

Transport in plants

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7.1 Structure of transport tissues

87. 9700_s20_qp_22 Q: 5

In most plants, sucrose is the main sugar that is transported from sources to sinks.

(a) In the source, sucrose is transferred from a mesophyll cell to a phloem sieve tube through a companion cell.

Describe **and** explain how the transfer of sucrose into a phloem sieve tube from a companion cell can lead to the transport of the sugar to a sink.

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..... [4]

(b) Fig. 5.1 shows part of one pathway that is used in plant cells to synthesise sucrose. The enzyme sucrose synthase catalyses the transfer of glucose from UDPG (uridine diphosphate glucose) to fructose.

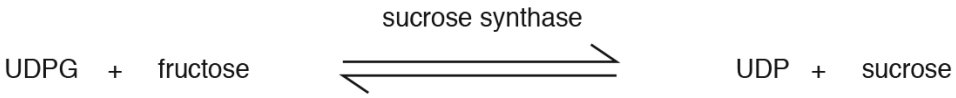


Fig. 5.1

The structure of UDPG is shown in Fig. 5.2.

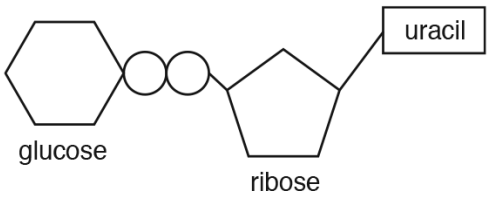


Fig. 5.2

(i) Name the type of bond formed when sucrose is synthesised.

..... [1]

(ii) Explain why UDP can be described as a phosphorylated nucleotide.

.....

.....

.....

.....

.....

.....

..... [2]

(iii) Sucrose synthase acts by using an induced fit mechanism rather than a lock and key mechanism.

With reference to sucrose synthase and the **synthesis** of sucrose, outline the difference between the induced fit mechanism and lock and key mechanism of enzyme action.

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..... [4]

(c) UDPG is used in some algae (photosynthetic protoctists) to synthesise a storage compound known as floridean starch.

The molecular structure of floridean starch has been described as an intermediate between amylopectin and glycogen, with little or no amylose.

Describe the molecular structure of floridean starch by completing the passage.

Floridean starch is a polysaccharide composed of ..... monomers.

The monomers are joined by ..... and ..... linkages,

to give a branching structure that is less highly branched than

..... .

[4]

[Total: 15]

---

88. 9700_s18_qp_21 Q: 2

(a) Sucrose is a disaccharide.

Fig. 2.1 shows how sucrose is broken down in a reaction with hydrochloric acid.

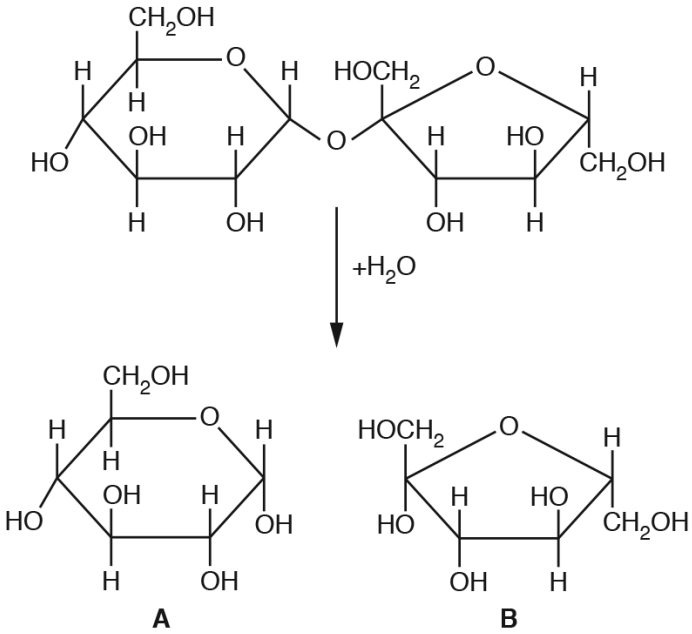


Fig. 2.1

(i) Name the products, **A** and **B**, of the reaction shown in Fig. 2.1.

A .....

B .....
[2]

(ii) Name the type of bond that is broken in the reaction shown in Fig. 2.1.

.....[1]

(iii) State the type of reaction shown in Fig. 2.1.

.....[1]

(b) When Benedict's solution is added to a sucrose solution and put into a boiling water-bath, no change in colour is observed.

State why no colour change is observed.

.....

.....

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.....[2]

(c) Sugar beet plants, *Beta vulgaris*, store sucrose in their roots.

Describe **and** explain how sucrose is transported from the phloem in the leaves of sugar beet to storage tissues in the root.

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.....[4]

[Total: 10]

89. 9700_w18_qp_21 Q: 5

(a) Fig. 5.1 shows the structure of a prokaryotic cell.

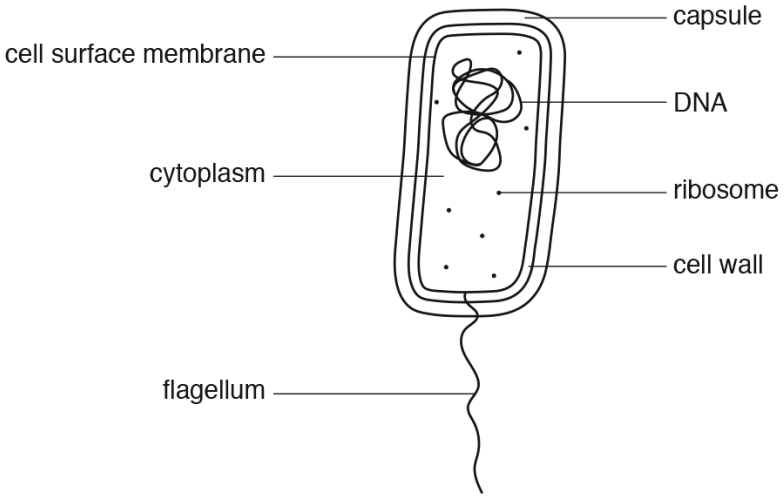


Fig. 5.1

Fig. 5.1 has **not** been fully labelled to confirm that the cell is prokaryotic.

State what **other** information could be added to **two** of the labels to confirm that this cell is prokaryotic and **not** eukaryotic.

.....

.....

..... [2]

(b) Some prokaryotes are plant pathogens.

Liberibacter is a group of prokaryotic plant pathogens that causes severe damage to a variety of plant crops across the world.

Scientists made observations about plants infected with these pathogens compared to uninfected plants:

- starch accumulates in the leaves
- starch does not accumulate in roots and other storage organs
- fruits are smaller
- the pathogen is widely distributed throughout the plant and is found in a number of different organs including the root and leaf.

The scientists deduced that the pathogen infected the phloem tissue.

Suggest why the scientists were able to deduce that the pathogen infected the phloem tissue.

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..... [2]

(c) DNA and RNA both contain nucleotides with adenine.

Complete Table 5.1 to compare:

- a DNA nucleotide with adenine
- an RNA nucleotide with adenine
- ATP.

Table 5.1

feature	DNA nucleotide with adenine	RNA nucleotide with adenine	ATP
contains nitrogen (yes or no)			
contains a pyrimidine base (yes or no)			
number of phosphate groups			
name of the sugar component			

[5]

[Total: 9]

90. 9700_M16_qp_22 Q: 5

(a) Fig. 5.1 is a diagram of an ATP molecule.

Label Fig. 5.1 to show the structure of an ATP molecule.

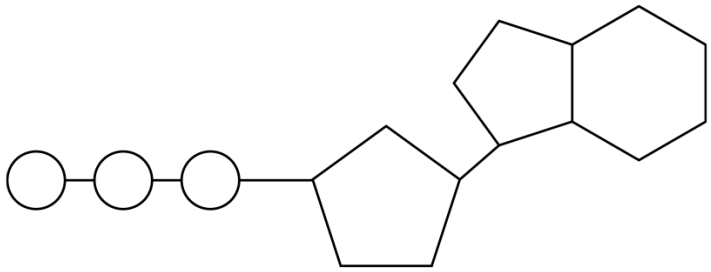


Fig. 5.1

[3]

(b) Statements **A**, **B**, **C** and **D** are part of the sequence of events that occur during the loading of sucrose into a phloem sieve tube.

A hydrogen ions bind to co-transporter protein
B diffusion of sucrose via plasmodesmata
C co-transport of hydrogen ions and sucrose
D hydrogen ions move out of companion cell

(i) State which event, **A**, **B**, **C** or **D**, requires ATP.

.....[1]

(ii) Place the letters **A** to **D** in the sequence that they would occur in the loading of sucrose into a phloem sieve tube.

.....[1]

(iii) State the name used to describe any area within a plant where sucrose is loaded into a phloem sieve tube.

.....[1]

(c) ATP is used during translation in amino acid activation, when an amino acid becomes attached to its specific tRNA molecule having a particular anticodon. The reaction requires an enzyme called aminoacyl tRNA synthetase.

(i) Explain why a particular amino acid needs to be linked to a specific tRNA molecule.

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.....[2]

(ii) The pH of the cytoplasm of most cells varies slightly around pH7. At extremes of pH, enzymes can become denatured.

Explain how the structure of an enzyme such as aminoacyl tRNA synthetase would be altered if the pH of the cytoplasm became too acidic.

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.....[2]

(iii) Aminoacyl tRNA synthetase uses the induced fit mechanism.

Explain the induced fit mechanism.

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.....

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.....

.....[2]

[Total: 12]

91. 9700_s15_qp_23 Q: 5

Fig. 5.1 is a light micrograph of some unicellular photosynthetic organisms called *Chlamydomonas*.

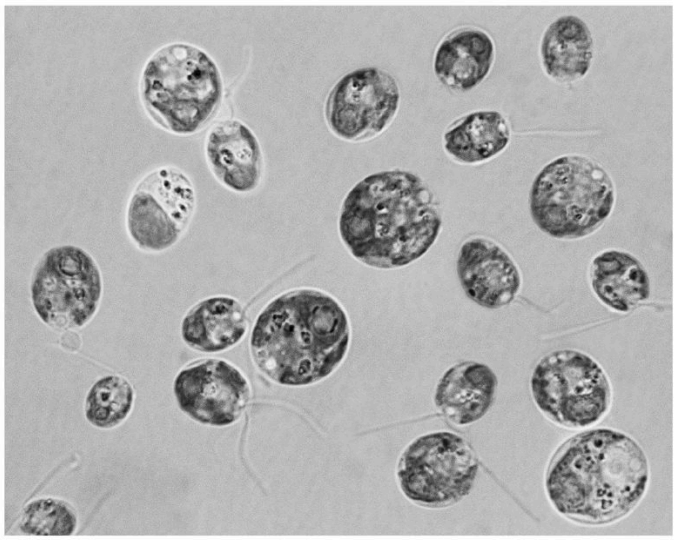


Fig. 5.1

(a) *Chlamydomonas* moves through water.

Explain why the light microscope rather than the electron microscope is used to observe the movement of *Chlamydomonas*.

.....

.....

.....

.....

.....[2]

(b) *Chlamydomonas* live in water and obtain minerals, such as magnesium ions, from the water.

(i) State **one** role of magnesium ions in photosynthetic organisms.

.....

.....[1]

(ii) State two properties of water which make it possible for organisms such as *Chlamydomonas* to live in water.

1 .....

.....

2 .....

..... [2]

(c) Explain why multicellular organisms require transport systems while unicellular organisms, such as *Chlamydomonas*, do not.

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.....[4]

(d) Some plants, such as the banana plant, *Musa acuminata*, produce fruit. The banana fruit has a high content of carbohydrate.

Describe how sugars are transported in phloem sieve tubes from source to sink in plants such as *M. acuminata*.

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.....[5]

[Total: 14]

7.2 Transport mechanisms

92. 9700_m20_qp_22 Q: 1

Phloem sap is transported from sources to sinks in phloem sieve tubes. Each sieve tube is constructed from phloem sieve tube elements.

(a) The structure of a phloem sieve tube element is adapted to its function.

Each of explanations **A** to **F** describes how a particular structural feature of a phloem sieve tube element in a source is suited to the function of transporting phloem sap.

The matching structural feature for each explanation is listed in Table 1.1.

A for entry of sucrose and other organic compounds

B for rapid entry of water to create high hydrostatic pressure

C provides pores to allow the flow of phloem sap from one sieve tube element to the next

D to form very long tubular structures for the transport of phloem sap from source to sink

E decreases resistance to the flow of phloem sap within each sieve tube element, so the speed of flow is maintained

F provides more space to increase the volume of phloem sap transported per unit time

Complete Table 1.1 by writing the correct letter from **A** to **F** in the last column of each row, so that each structural feature is matched to the correct explanation.

Use each letter only **once**.

The first row has been completed for you.

Table 1.1

structural feature of phloem sieve tube element	explanation
There is no nucleus or large permanent vacuole.	**F**
The end walls are perforated to form sieve plates.	
There is only a thin layer of cytoplasm around the edge of the cell.	
The cell is elongated and arranged end to end with other cells.	
The cell has plasmodesmata connecting to a companion cell.	
There is a thin cellulose cell wall.	

[4]

(b) At the sink, sucrose and other organic compounds are unloaded from the phloem sieve tube element.

Explain why the process of unloading helps the mass flow of phloem sap from the source to the sink.

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..... [3]

[Total: 7]

93. 9700_m20_qp_22 Q: 6

Fig. 6.1 is a transmission electron micrograph of a plant parenchyma cell.

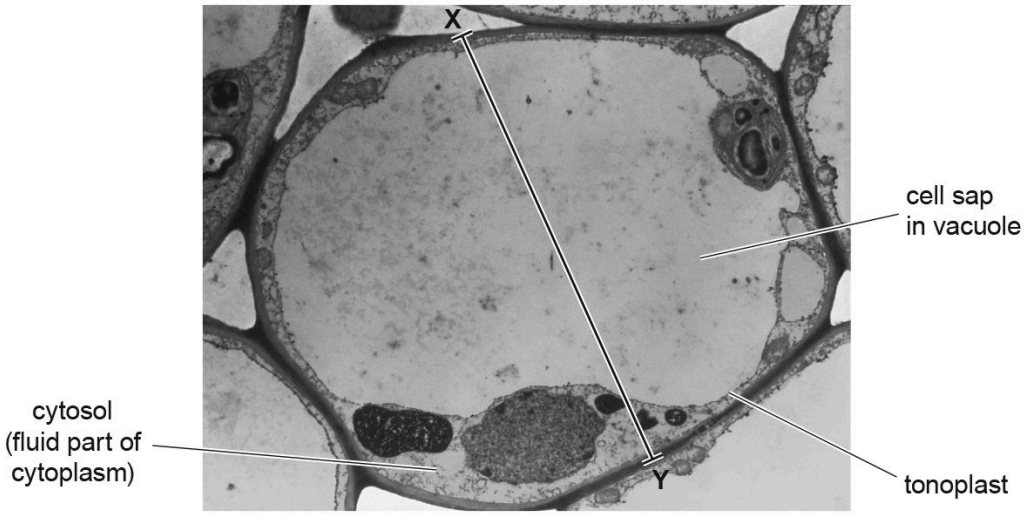


Fig. 6.1

(a) The external environment of the parenchyma cell has a higher water potential than the internal environment of the cell.

One function of parenchyma cells is to provide support to the plant.

With reference to Fig. 6.1, suggest how parenchyma cells provide support to the plant.

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..... [2]

(b) The image shown in Fig. 6.1 is at a higher magnification than can be obtained using a typical light microscope.

(i) Explain what is meant by the term *magnification*.

.....

.....

..... [1]

(ii) The actual diameter of the parenchyma cell in Fig. 6.1 along the line **X—Y** is 35 μm.

Calculate the magnification of the image.

magnification = × .....

[2]

(c) The cell sap in the vacuole of the cell shown in Fig. 6.1 has a pH of 5.0. The cytosol has a pH of 7.2.

The tonoplast controls the passage of hydrogen ions from the cytosol into the vacuole. The low pH created by the entry of hydrogen ions is optimum for the action of acid hydrolase enzymes in the vacuole. Acid hydrolase enzymes are also found in lysosomes in animal cells.

(i) Suggest which transport mechanism is used to move hydrogen ions from the cytosol of the parenchyma cell into the vacuole.

Explain your choice.

transport mechanism .....

explanation .....

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[3]

(ii) Suggest how the structure of the tonoplast allows hydrogen ions to be transported into the vacuole, but does not allow the ions to leave the vacuole.

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..... [3]

(iii) The acid hydrolases in the vacuole cannot function in neutral conditions (pH 7.0) or alkaline conditions.

Explain the advantage to the plant cell of having acid hydrolases that cannot function in neutral, near neutral or alkaline conditions.

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..... [2]

[Total: 13]

94. 9700_s20_qp_23 Q: 1

Water and mineral ions are transported up the stem of a plant to the leaves within xylem vessels.

Some water and mineral ions can pass out of xylem vessel elements to supply parenchyma tissue in the stem.

(a) Fig. 1.1 is a plan diagram of a section through a stem.

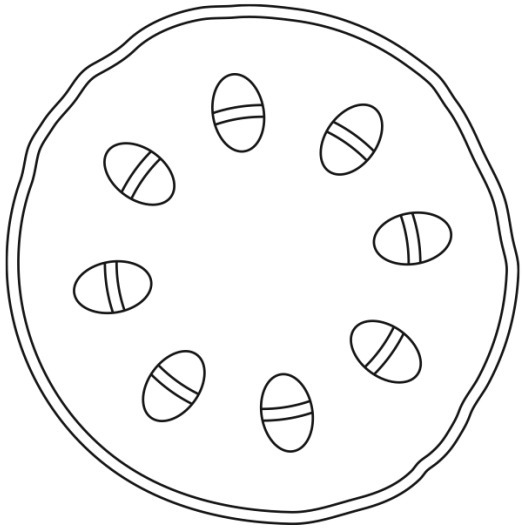


Fig. 1.1

Identify **one** location where xylem tissue occurs in the stem by drawing a label line and the letter **X** on Fig. 1.1. [1]

(b) Explain how hydrogen bonding between water molecules contributes to the movement of water within xylem vessels up the stem to the leaves.

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..... [3]

(c) Fig. 1.2 is a diagram of a photomicrograph showing three adjacent parenchyma cells in the stem. These parenchyma cells can be described as typical plant cells.

The arrows show the direction of movement of water between the cells.

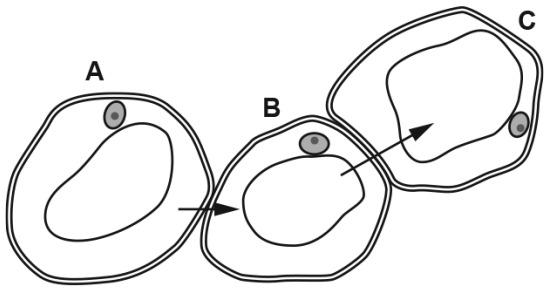


Fig. 1.2

(i) Describe **and** explain the movement of water shown in Fig. 1.2.

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..... [3]

(ii) Only some of the structures visible using the light microscope have been included in Fig. 1.2.

List the features that can be seen using the high power of a light microscope that help identify a parenchyma cell as a plant cell and **not** as an animal cell.

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..... [3]

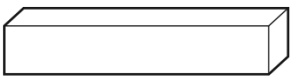
[Total: 10]

95. 9700_s20_qp_23 Q: 6

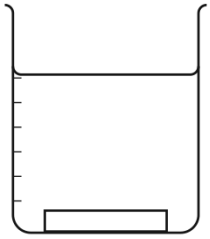
A student carried out an investigation to estimate the water potential of potato tissue. The main steps in the procedure and in the analysis of results are outlined in Fig. 6.1.

beaker	concentration of sucrose solution / mol dm^{-3}
1	0.0
2	0.1
3	0.2
4	0.3
5	0.4
6	0.5

Six different concentrations of sucrose solution were prepared and an equal volume of each was placed in a labelled beaker.



Six equal-sized blocks of potato tissue were cut out of the same potato, blotted dry and weighed.



One potato block was immersed in the solution in each beaker for 30 minutes.

After this time, the block was removed, blotted dry and reweighed.

The experiment was repeated twice.

The mean percentage change in mass of potato tissue was calculated for each concentration of sucrose used.

A graph was drawn of mean percentage change in the mass of potato tissue against concentration of sucrose.

Fig. 6.1

(a) Explain why the different concentrations of sucrose result in different mean percentage changes in mass of potato tissue.

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..... [3]

(b) State how the graph is used to estimate the water potential of the potato tissue.

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..... [1]

[Total: 4]

96. 9700_w20_qp_21 Q: 4

(a) Fig. 4.1 is a scanning electron micrograph of a section of a plant cell wall.

In living plant tissue cytoplasmic strands form part of structure **W**.

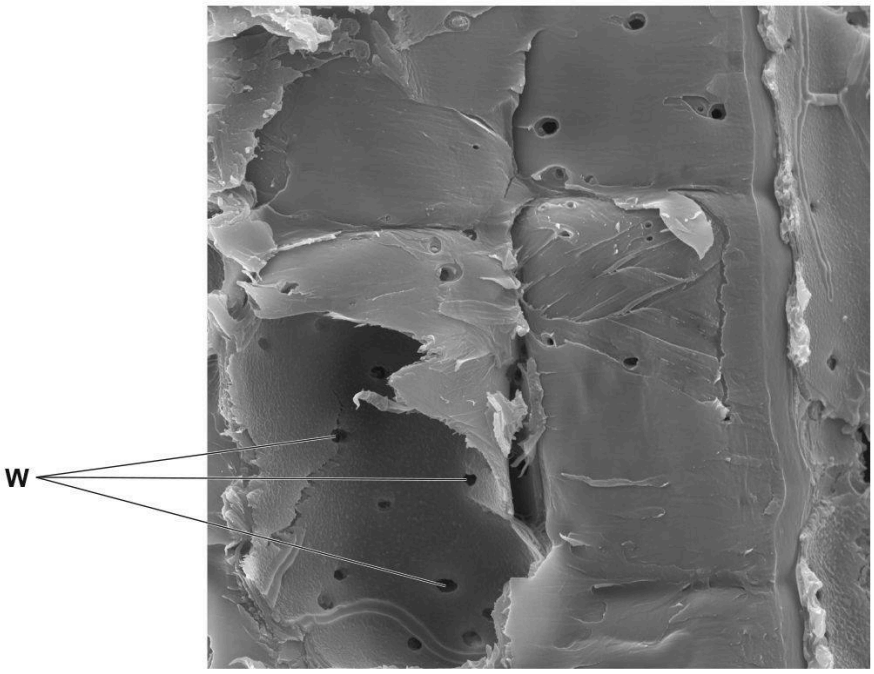


Fig. 4.1

(i) Identify the structures labelled **W** in Fig. 4.1.

..... [1]

(ii) Describe the function of structure **W**.

.....

.....

.....

.....

..... [2]

(b) Viruses can infect plant cells.

(i) Outline the key structural features of a virus.

.....

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..... [2]

(ii) Many plant viruses can travel through the plant to enter companion cells in the phloem tissue. The viruses then travel with assimilates in the phloem sap to other areas of the plant.

Explain the mechanism that allows assimilates and viruses to travel through phloem sieve tubes to other areas of the plant.

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..... [5]

[Total: 10]

97. 9700_w20_qp_22 Q: 1

Fig. 1.1 is a diagram drawn from a photomicrograph of a transverse section through part of a leaf.

The arrows in Fig. 1.1 show the movement of water through the cells of the leaf after it has left the xylem.

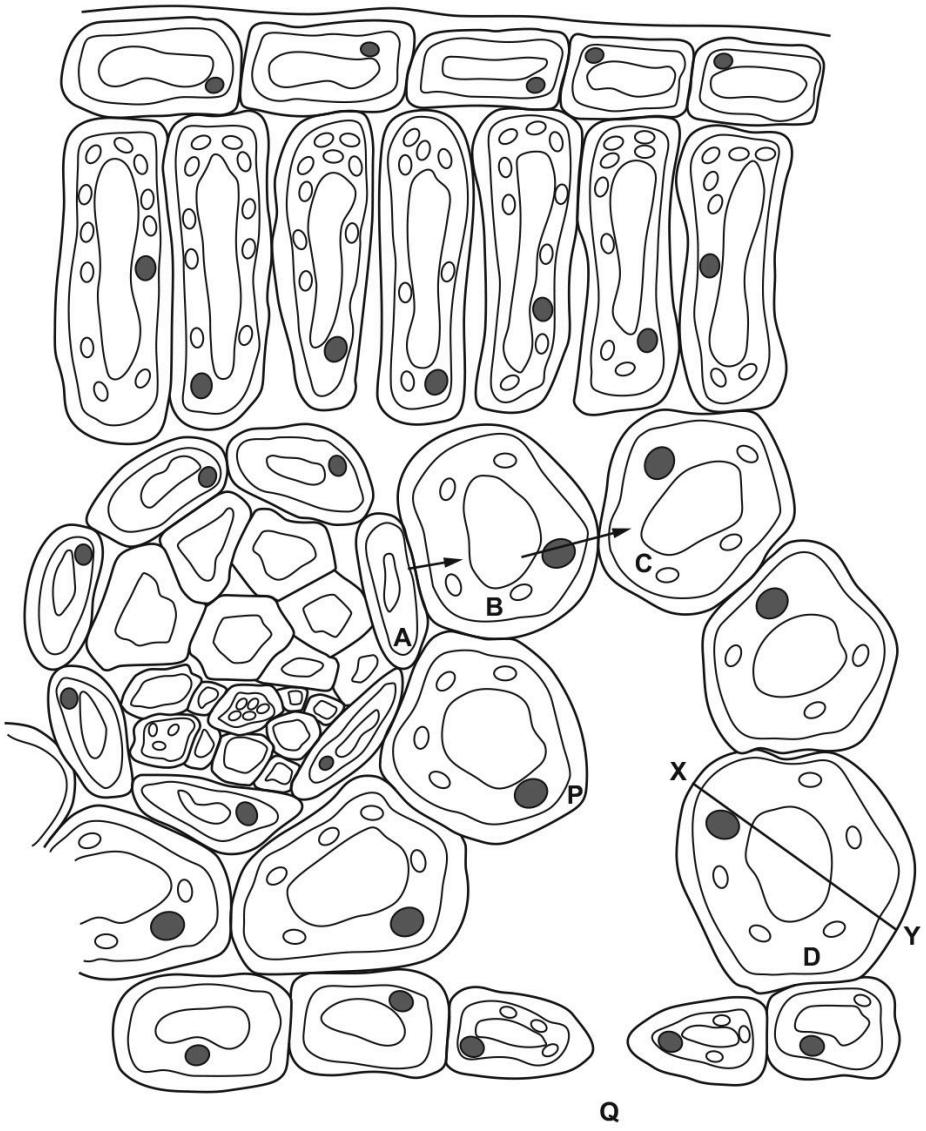


Fig. 1.1

(a) Water from the xylem can enter cell **A** and then moves to cells **B** and **C** without crossing their cell walls.

The cell structures through which water passes from cell **A** to cell **B** are **not** visible in Fig. 1.1.

(i) Name the cell structures through which water passes from cell **A** to cell **B** without crossing their cell walls.

..... [1]

(ii) Explain what causes water to move from cell **B** to cell **C**.

.....

.....

..... [1]

(iii) Name the pathway taken by water between cell **A** and cell **C**.

..... [1]

(b) Most of the water that arrives at the leaf passes to the external atmosphere.

With reference to Fig. 1.1, describe **and** explain the sequence of events occurring between point **P** and point **Q**.

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..... [4]

(c) The actual diameter of cell **D** in Fig. 1.1 along the length **X**–**Y** is 25 μm.

Calculate the magnification of the image.

Write down the formula used to make your calculation. Show your working.

formula

answer = × ..... [3]

[Total: 10]

98. 9700_w20_qp_23 Q: 2

The veins of a leaf contain transport tissues. Fig. 2.1 is a drawing made from an electron micrograph showing a cross-section of the transport tissue in a leaf vein.

The cells labelled **A** are modified companion cells, known as phloem transfer cells. Transfer cells move sucrose and other assimilates from mesophyll cells, **B**, into the phloem sieve tube element, **C**.

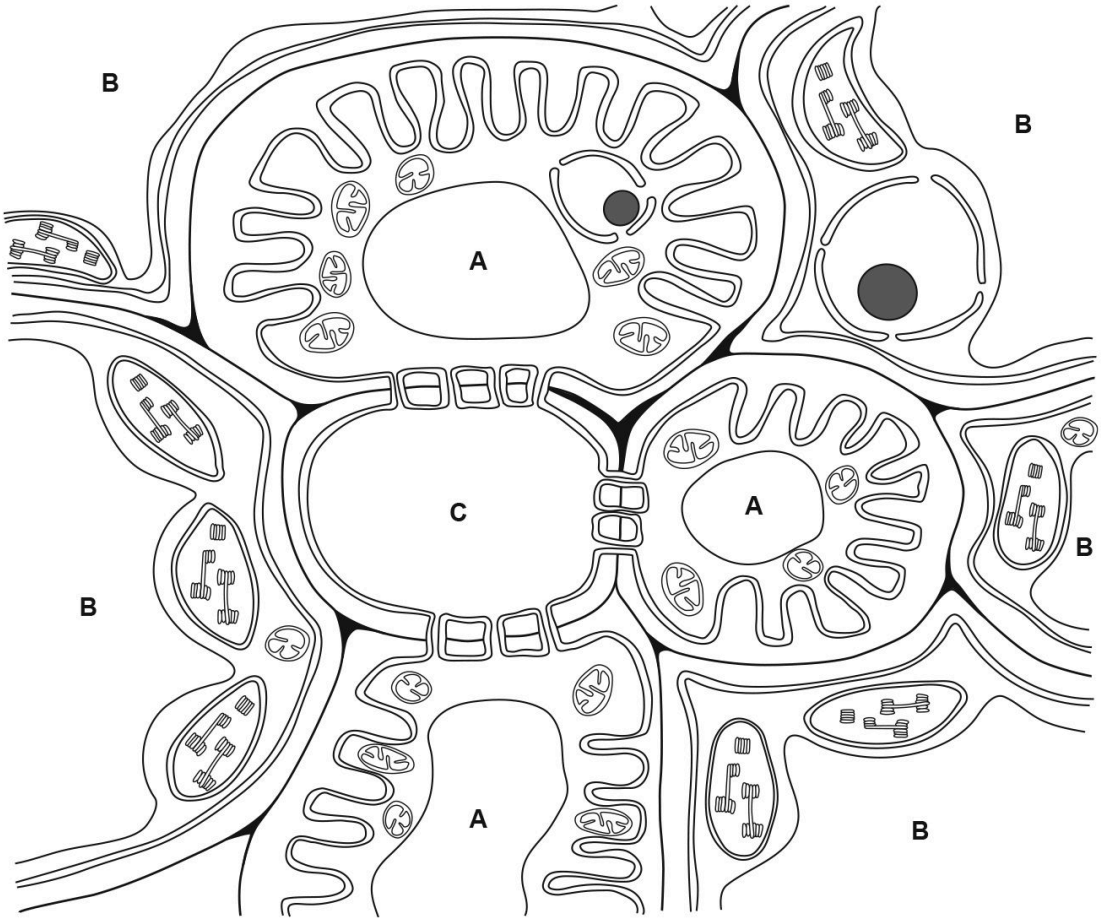


Fig. 2.1

(a) State the functions of the mesophyll cells, **B**, and sieve tube element, **C**, **and** explain how their structure is adapted for their function.

cell **B** – function .....

adaptation .....

.....

.....

.....

cell **C** – function .....

adaptation .....

.....

.....

.....

[5]

(b) The cell walls of the transfer cells, **A**, shown in Fig. 2.1, have infoldings.

Explain the advantages of these cell wall infoldings for the movement of sucrose from mesophyll cells to phloem sieve tubes.

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..... [3]

[Total: 8]

99. 9700_m19_qp_22 Q: 1

Fig. 1.1 and Fig. 1.2 are photomicrographs of sections through the leaves of two different plants.

Fig. 1.1 is a photomicrograph of a section through a leaf of Cornish heath, *Erica vagans*.

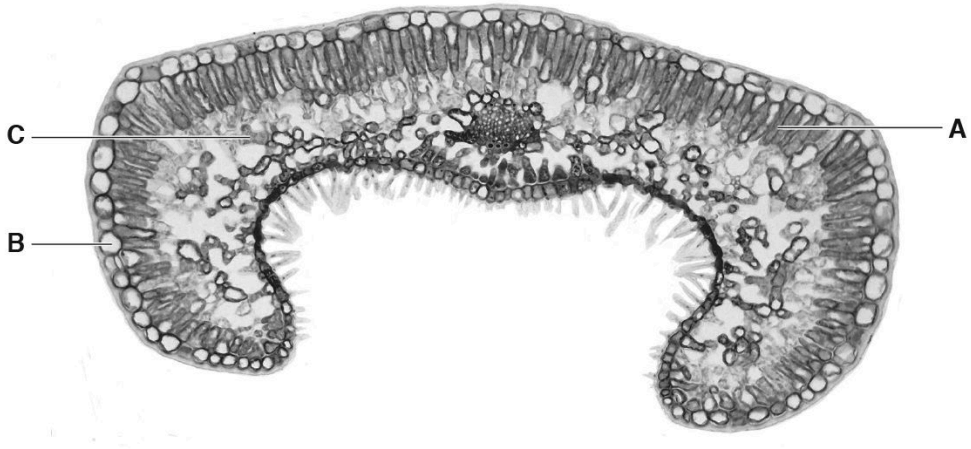


Fig. 1.1

Fig. 1.2 is a photomicrograph of a section through a leaf of Himalayan cedar, *Cedrus deodara*.

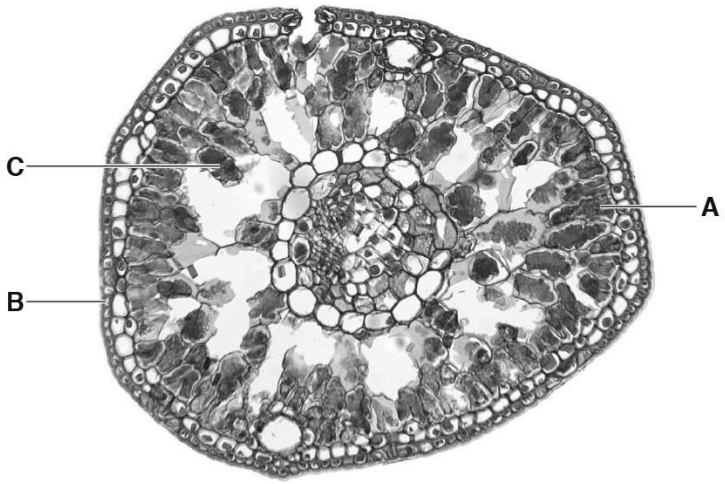


Fig. 1.2

Fig. 1.1 and Fig. 1.2 are not shown at the same magnification.

(a) Cells labelled **A**, **B** and **C** in Fig. 1.1 and Fig. 1.2 each form a different tissue.

Name each tissue formed.

tissue formed from **A** .....

tissue formed from **B** .....

tissue formed from **C** .....

[3]

(b) *Erica vagans* and *Cedrus deodara* are xerophytic plants.

With reference only to xerophytic features, describe the **differences** between the leaves of *E. vagans* and *C. deodara* **visible** in Fig. 1.1 and Fig. 1.2.

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..... [3]

(c) Transpiration is a consequence of gas exchange in leaves.

Explain why the rate of transpiration is greater during the day than during the night.

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..... [3]

[Total: 9]

100. 9700_s19_qp_21 Q: 4

Meristematic tissue is found in the growing regions of plants, such as shoot tips. Meristematic cells have a similar role to stem cells in animals.

Fig. 4.1 shows some of the stages in the formation of a mature phloem sieve tube element and companion cells from a meristematic cell.

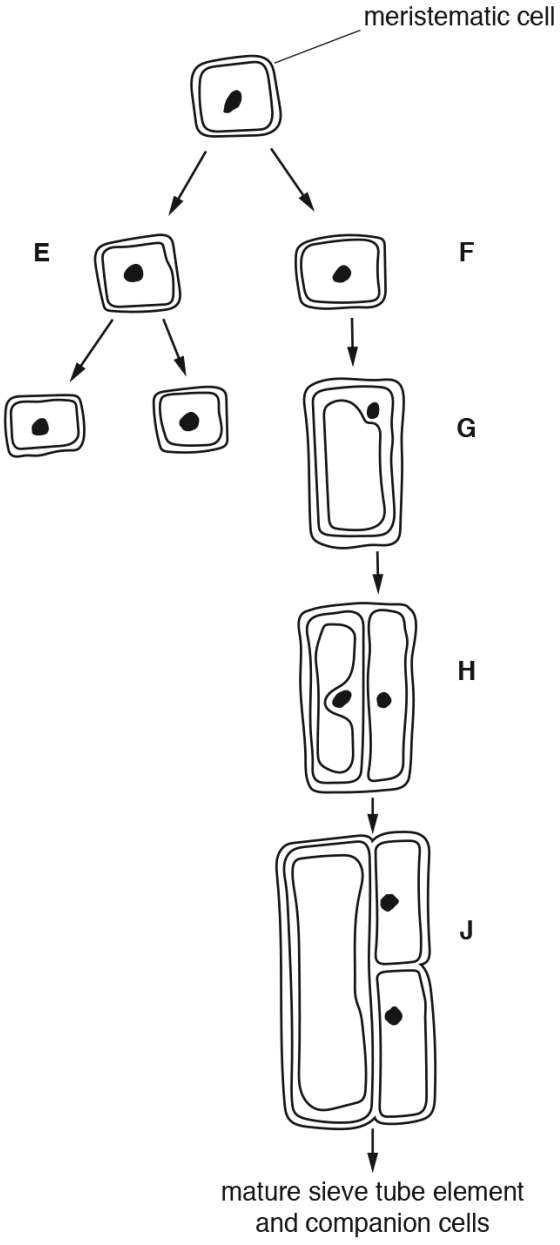


Fig. 4.1

(a) Cells **E** and **F** in Fig. 4.1 are daughter cells produced when the meristematic cell divides in the shoot tip.

Explain why it is important that one of the daughter cells (cell **E**) is a meristematic cell.

.....

.....

..... [1]

(b) Complete Table 4.1 to describe the changes that are shown in Fig. 4.1 between stages:

- **F** and **G**
- **G** and **H**
- **H** and **J**.

Table 4.1

stages	description
F and **G**	
G and **H**	
H and **J**	

[3]

(c) Explain how the structure of a mature sieve tube element is related to its function.

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.....

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..... [4]

(d) Describe the functions of companion cells in transport in the phloem.

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..... [2]

[Total: 10]

---

101. 9700_s19_qp_22 Q: 1

Fig. 1.1 is a photomicrograph of a low power image of part of the common sunflower, *Helianthus annuus*. Fig. 1.1 is a transverse section.

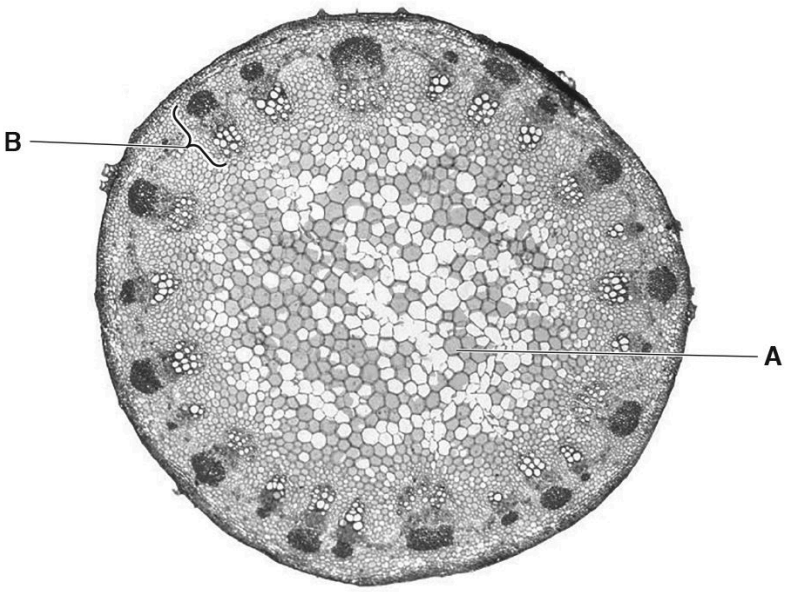


Fig. 1.1

(a) State, **with a reason**, whether Fig. 1.1 shows a section through the root or the stem of *H. annuus*.

.....

.....

..... [1]

(b) Cell type **A** in Fig. 1.1 has a large central vacuole.

Suggest, with reasons, the role of the tissue formed by this type of cell.

.....

.....

.....

..... [2]

(c) Structure **B** in Fig. 1.1 contains phloem tissue and xylem tissue and other tissues that provide support.

(i) Name structure **B**.

..... [1]

(ii) The actual length of structure **B** is 650 μm.

State the actual length of structure **B** in mm.

..... [1]

(d) When structure **B** is observed at a higher magnification, more detail of xylem vessel elements and phloem sieve tube elements can be seen.

Outline the differences in the structure of a xylem vessel element and a phloem sieve tube element.

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..... [3]

[Total: 8]

102. 9700_s19_qp_23 Q: 4

Phloem sieve tube elements and xylem vessel elements are cells that are involved with the transport of substances in plants.

(a) Describe **two** differences between the structure of a phloem sieve tube element and a xylem vessel element.

.....

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.....

.....

..... [2]

(b) Sucrose is transported in phloem sieve tubes.

A student carried out a test to identify the presence of sucrose in a sample of sap taken from inside a phloem sieve tube. One of the steps in the procedure instructed the student to heat the phloem sap with hydrochloric acid.

Explain why it is necessary to carry out this step in the procedure.

.....

.....

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.....

..... [2]

(c) The process of loading sucrose into a phloem sieve tube element involves a companion cell.

(i) Fig. 4.1 shows a stage in the process of loading sucrose into the phloem.

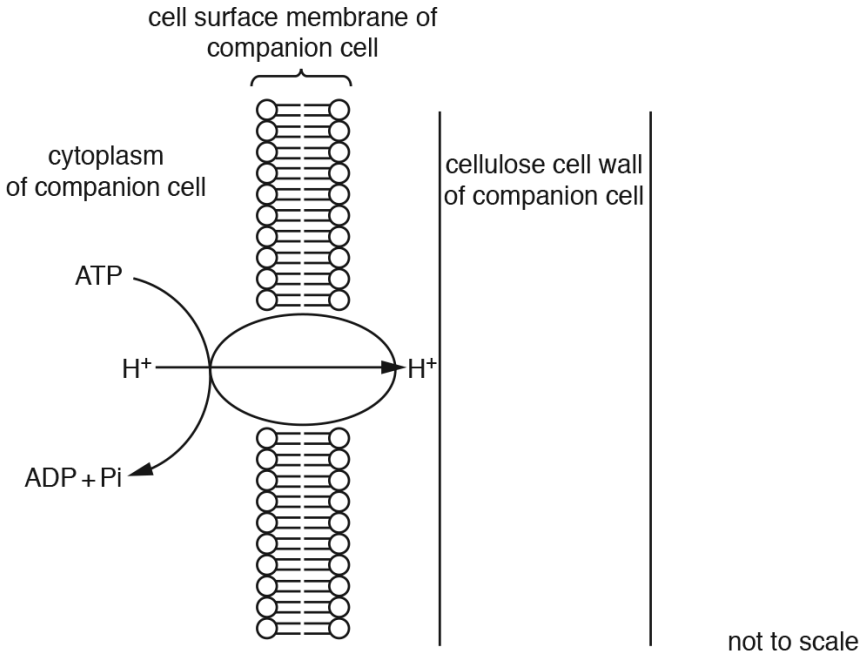


Fig. 4.1

Companion cells contain large numbers of mitochondria and ribosomes.

Explain the roles of mitochondria and ribosomes for the stage shown in Fig. 4.1.

.....

.....

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.....

..... [2]

(ii) Describe **and** explain how sucrose is transported from the cell wall of the companion cell into the cytoplasm.

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..... [3]

[Total: 9]

103. 9700_w19_qp_21 Q: 1

Fig. 1.1 shows the structure of the amino acid glycine.

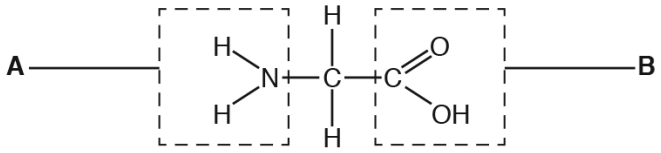


Fig. 1.1

(a) (i) Name the parts of the amino acid molecule labelled **A** and **B** in Fig. 1.1.

A .....

B .....

[2]

(ii) Amino acids are monomers used to build proteins.

Complete Fig. 1.2 by drawing a diagram to show the formation of a peptide bond between two molecules of glycine.

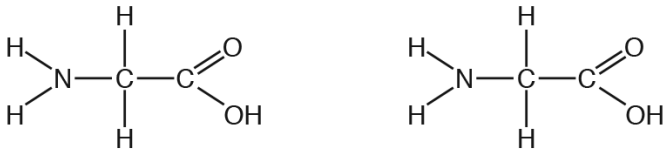
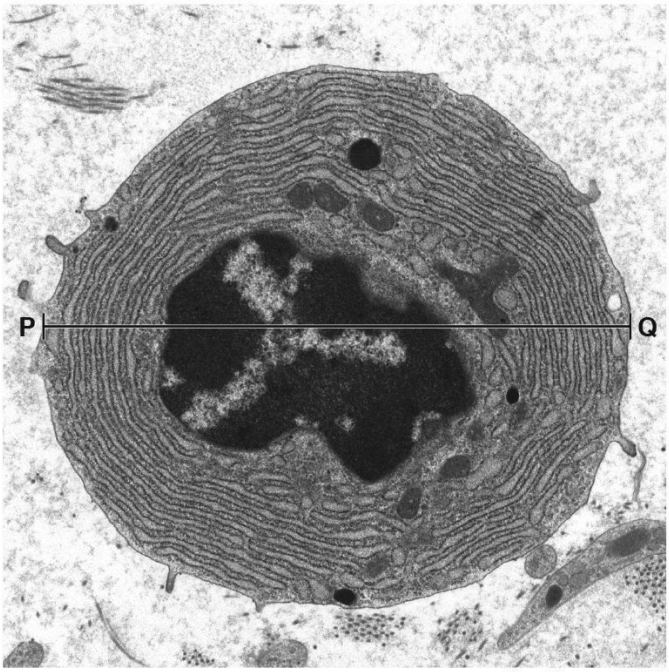


Fig. 1.2 [3]

(b) Plasma cells synthesise and secrete antibodies.

Fig. 1.3 is a transmission electron micrograph showing a plasma cell.



magnification ×6000

Fig. 1.3

(i) Use a label line and the label **T** on Fig. 1.3 to identify where the genes coding for the polypeptide chains of the antibodies are located. [1]

(ii) Calculate the actual diameter of the plasma cell shown by the line **P**–**Q**.

Write down the formula used to make your calculation.

Show your working and give your answer to the nearest micrometre (μm).

formula

actual diameter = ...μm [2]

(iii) The plasma cell in Fig. 1.3 is very metabolically active.

Suggest why there are very few mitochondria visible in the electron micrograph in Fig. 1.3.

.....

.....

..... [1]

(c) Sieve tube elements in plants have very few organelles such as mitochondria.

Explain how having very few organelles is an adaptation of the sieve tube element to its function.

.....

.....

.....

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..... [2]

[Total: 11]

104. 9700_w19_qp_21 Q: 3

A student carried out an experiment to investigate the effect of increasing the concentration of sucrose solution on the mass of potato tissue.

- Potato tissue was cut into cylinders of equal length and diameter.
- The mass of each cylinder was recorded.
- Each cylinder was put into a solution of sucrose, as shown in Fig. 3.1.

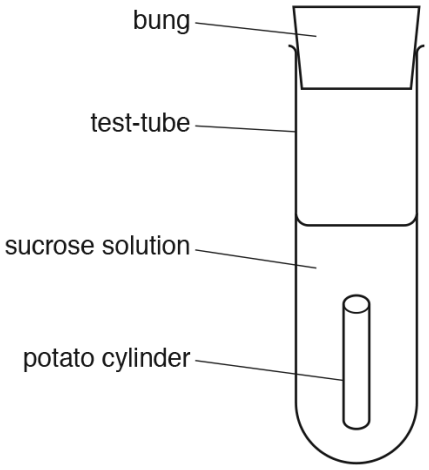


Fig. 3.1

- After one hour each cylinder was removed, blotted dry and reweighed.
- The percentage change in mass of each cylinder was calculated.
- The experiment was repeated three times.
- The mean percentage change in mass of the potato cylinders in each sucrose solution was calculated.

Fig. 3.2 shows the results of this investigation.

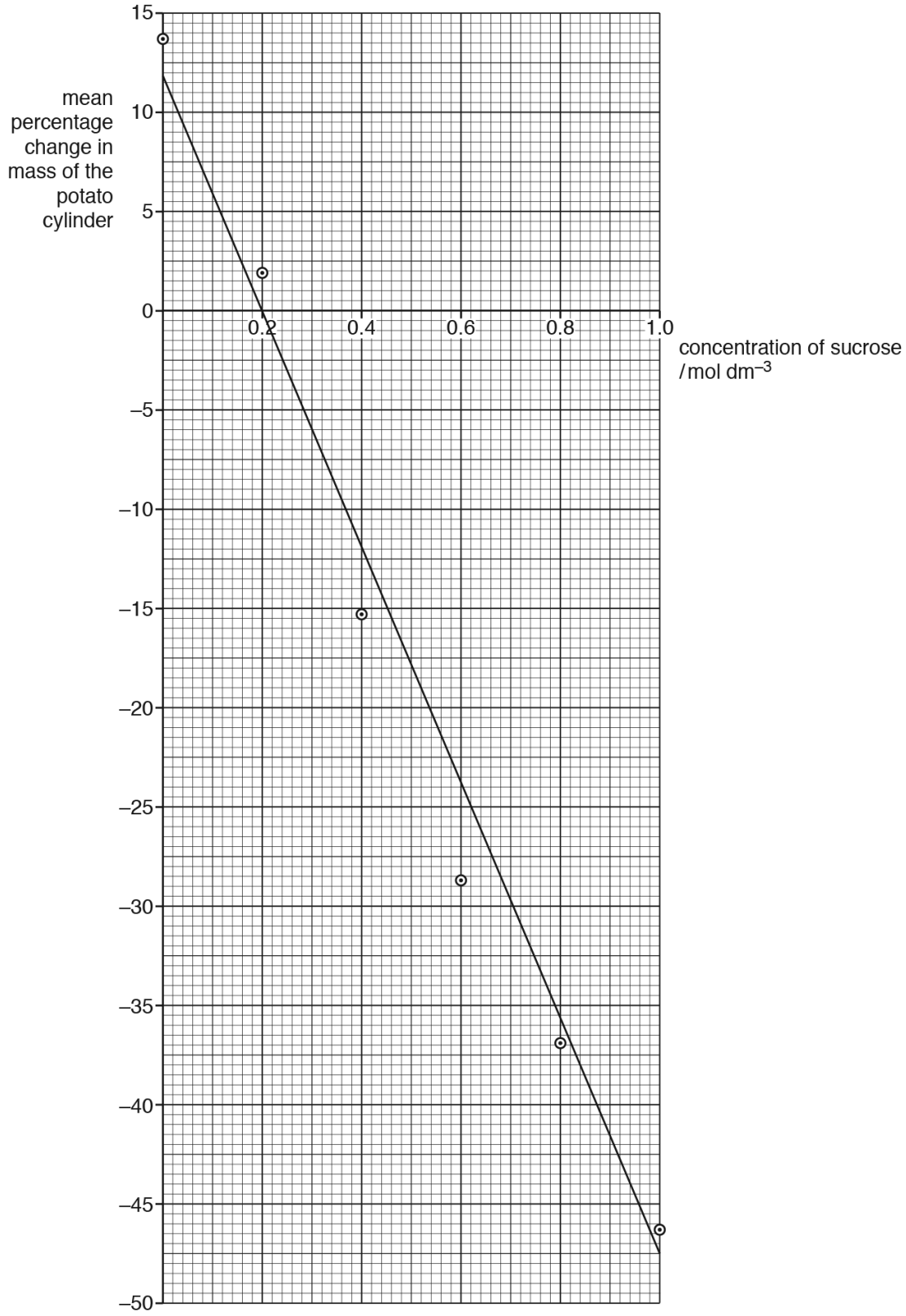

mean percentage change in mass of the potato cylinder
15
10
5
0
−5
−10
−15
−20
−25
−30
−35
−40
−45
−50
0.2
0.4
0.6
0.8
1.0
concentration of sucrose /mol dm−3

Fig. 3.2

(a) With reference to Fig. 3.2, describe the effect of increasing the concentration of sucrose solution on the mass of the potato cylinders.

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..... [3]

(b) Explain why there was a change in mass for the potato cylinders in 0.6 mol dm^{-3} sucrose solution.

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..... [3]

[Total: 6]

105. 9700_w19_qp_22 Q: 1

Fig. 1.1 is a photomicrograph of a transverse section through the stem of creeping buttercup, *Ranunculus repens*.

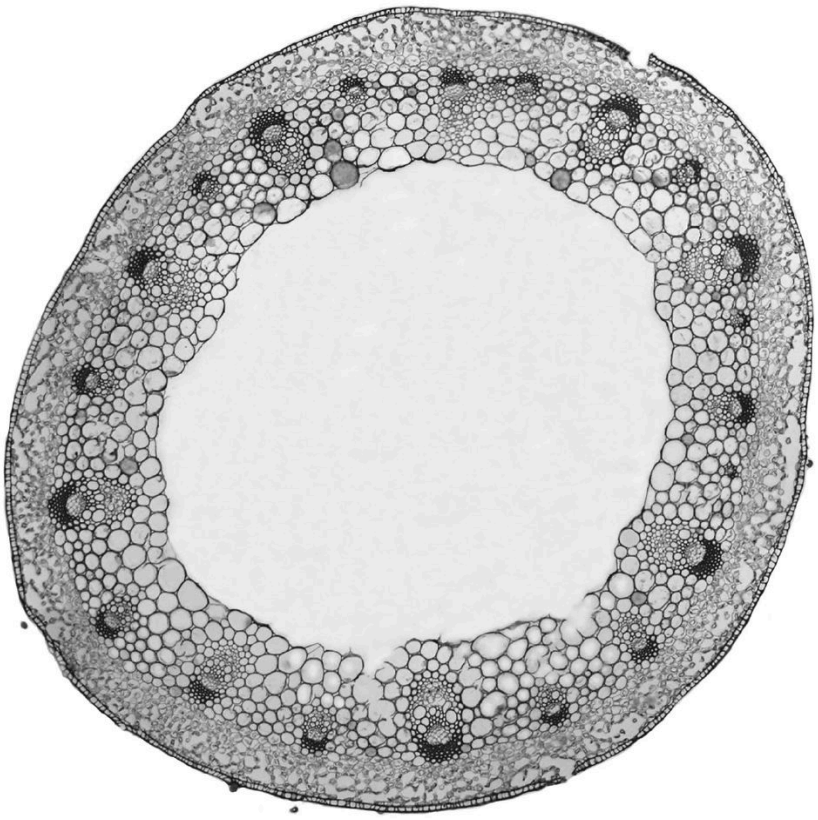


Fig. 1.1

(a) Draw **one** label line on Fig. 1.1 to indicate **one** precise location where phloem sieve tubes occur. [1]

(b) State the role of phloem sieve tubes.

.....

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.....

.....

..... [2]

(c) A good quality plan diagram of Fig. 1.1 will show only the tissues in the stem in their correct location and in the correct proportions.

(i) State the name of the tissue that forms the outer layer of the stem section of *R. repens* in Fig. 1.1.

..... [1]

(ii) State the piece of equipment that can be used in the light microscope to work out the correct proportions of the tissues.

..... [1]

(d) Draw a diagram in the space provided to show the structure of a typical plant cell.

Label your diagram with the name of any structures that are found **only** in plant cells.

Do **not** label any structures that are also found in animal cells.

[5]

[Total: 10]

106. 9700_w19_qp_23 Q: 3

(a) The tomato plant, *Solanum lycopersicum*, does not tolerate periods of drought (water shortage). Researchers have produced a tomato plant that has an improved tolerance of drought.

The researchers measured the width and the length of open stomata in plants that are tolerant of drought and tomato plants that are not tolerant.

Fig. 3.1 is the formula used to calculate the size of an open stoma (stomatal aperture).

$$\text{stomatal aperture} = \frac{\text{width of open stoma}}{\text{length of open stoma}}$$

Fig. 3.1

Fig. 3.2 shows the mean stomatal aperture of the two groups of tomato plants.

Fig. 3.3 shows the rates of transpiration of the two groups of tomato plants when kept in identical conditions of drought.

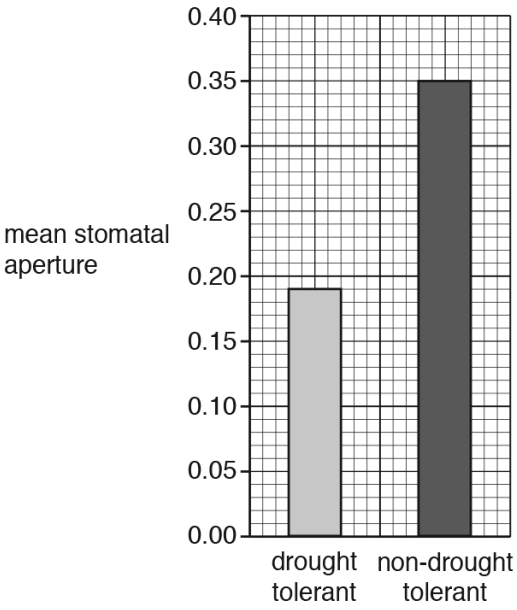


Fig. 3.2

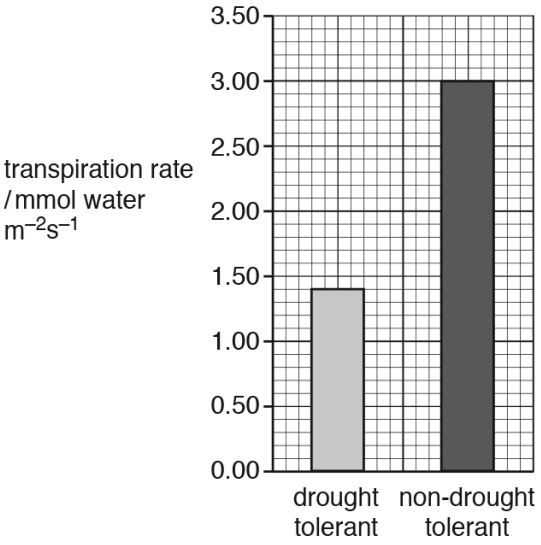


Fig. 3.3

The water uptake of leafy shoots taken from the two groups of tomato plants was measured using potometers. The leafy shoots were of similar mass and had the same number of leaves. The results are shown in Fig. 3.4.

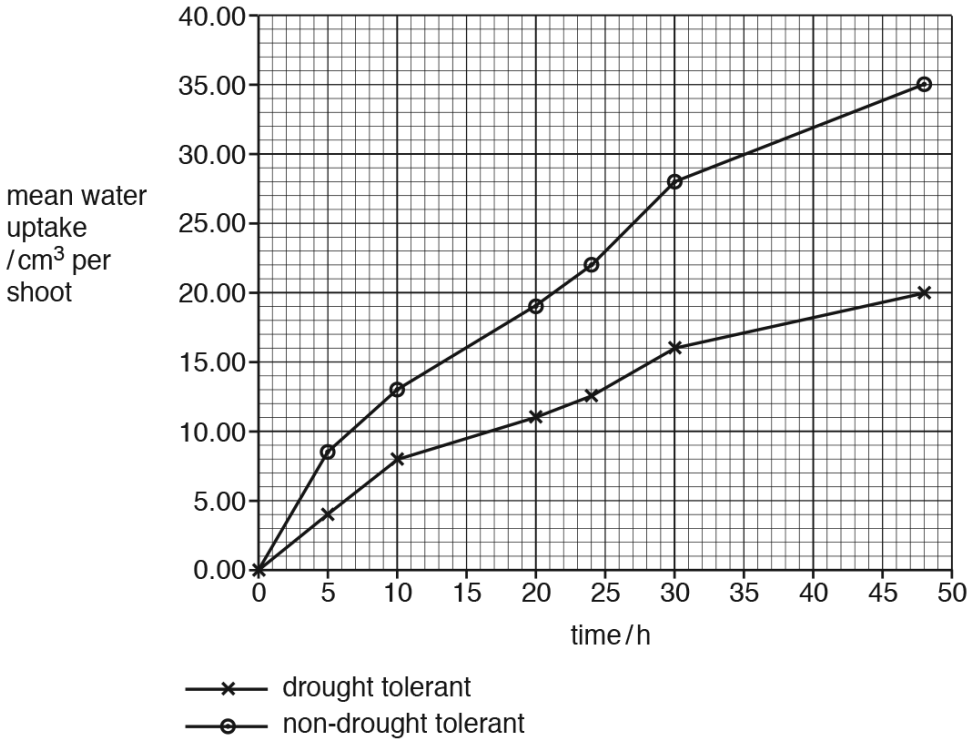


Fig. 3.4

With reference to Fig. 3.2, Fig. 3.3 **and** Fig. 3.4, describe **and** explain the differences between the plants that are drought tolerant and the plants that are non-drought tolerant.

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..... [5]

(b) The nuclei of plants produce small lengths of RNA known as microRNAs.

MicroRNAs in guard cells have been shown to prevent the synthesis of some proteins.

The guard cells of the drought-tolerant tomato plants produced more microRNA molecules than the guard cells of the non-tolerant plants.

MicroRNA molecules do **not** prevent transcription but interact with messenger RNA (mRNA).

Suggest how this microRNA can interact with mRNA to prevent the production of proteins in guard cells of *S. lycopersicum*.

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..... [3]

[Total: 8]

107. 9700_s18_qp_21 Q: 6

Water absorbed by plant roots travels by different pathways from root hairs to the xylem.

Fig. 6.1 shows these pathways in the root of *Ranunculus acris*.

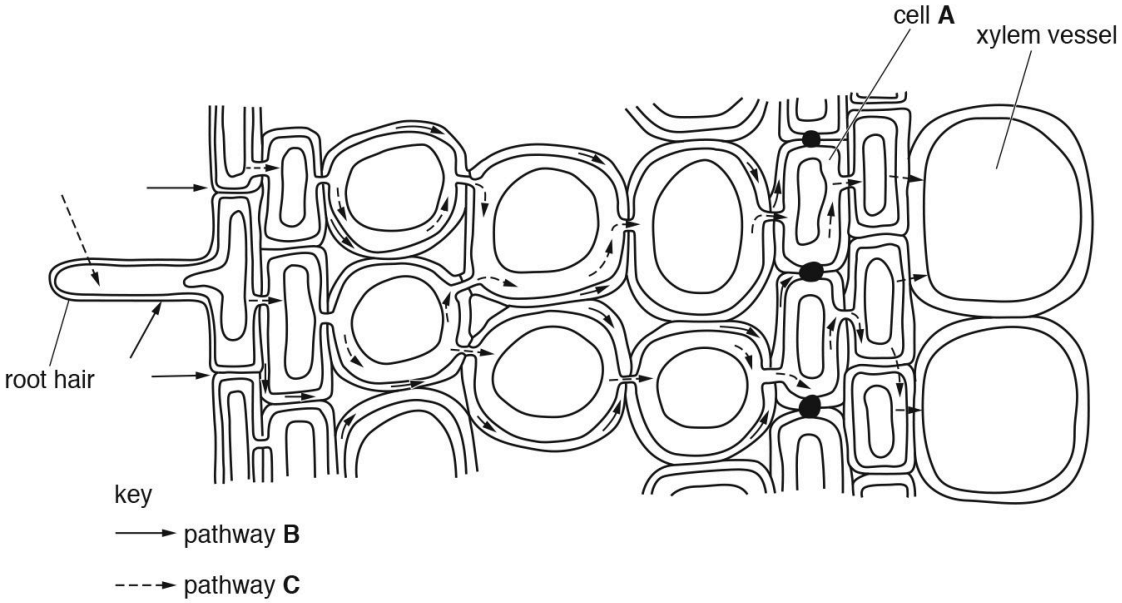


Fig. 6.1

(a) Name cell **A** and pathway **B** as shown in Fig. 6.1.

cell **A** .....

pathway **B** .....

[2]

(b) Transpiration occurring at the leaves is mainly responsible for movement of water across the root of *R. acris*.

Explain how transpiration is responsible for the movement of water across the root as shown in Fig. 6.1.

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.....[5]

(c) Explain why the movement of water in pathway **C** is slower than in pathway **B**.

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.....[2]

(d) Ions are taken up by root hair cells using active transport and facilitated diffusion.

Describe **two** ways in which facilitated diffusion differs from active transport.

1 .....

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2 .....

.....

.....

[2]

[Total: 11]

108. 9700_s18_qp_22 Q: 1

Fig. 1.1 is a drawing of a photomicrograph of a spongy mesophyll cell from a leaf.

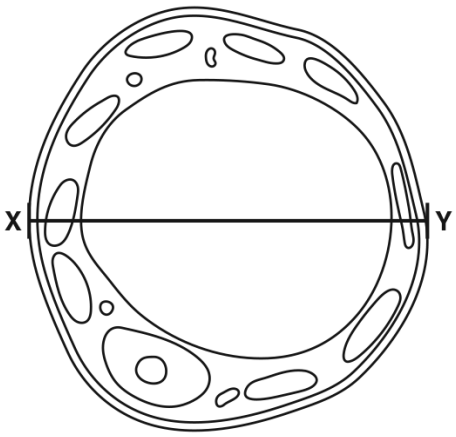


Fig. 1.1

(a) On Fig. 1.1, add a label line and the correct letter for each of the three cell structures listed.

- nucleolus = **N**
- tonoplast = **T**
- chloroplast = **C**

[3]

(b) The drawing in Fig. 1.1 is 2000 times larger than the actual size of the cell.

Describe the steps you would follow to determine the actual diameter of the cell in micrometres (μm), at **X**—**Y**.

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.....[2]

(c) The drawing in Fig. 1.1 was made using the high power objective lens of a light microscope. Some of the structures in Fig. 1.1 confirm that the cell is eukaryotic.

An electron micrograph of the same cell would reveal **additional** cell structures that are found in eukaryotes and not in prokaryotes.

List two examples of these additional cell structures.

1 .....

2 .....

[2]

(d) Some of the water that moves out of the xylem within the leaves takes an apoplastic pathway to the spongy mesophyll cells. There is a film of water on the external surfaces of these cells. This allows the intercellular air spaces to become saturated with water vapour.

(i) State, in terms of water movement from the xylem to the spongy mesophyll cells in the leaf, what is meant by the *apoplastic pathway*.

.....

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.....

.....

.....[2]

(ii) Outline the properties of water that contribute to the apoplastic movement of water to the spongy mesophyll cells **and** to the movement of water into the intercellular air spaces.

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.....[4]

(iii) Describe what happens to the water vapour in the intercellular air spaces during the day **and** explain why this happens.

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.....[2]

[Total: 15]

109. 9700_s17_qp_21 Q: 5

Sugar molecules enter cells through transport proteins.

(a) Explain why transport proteins are required for the movement of sugar molecules, such as glucose and fructose, into cells.

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.....[2]

Some plant cells convert fructose and glucose into sucrose for transport from sources to sinks. Sucrose is moved into phloem sieve tubes as shown in Fig. 5.1.

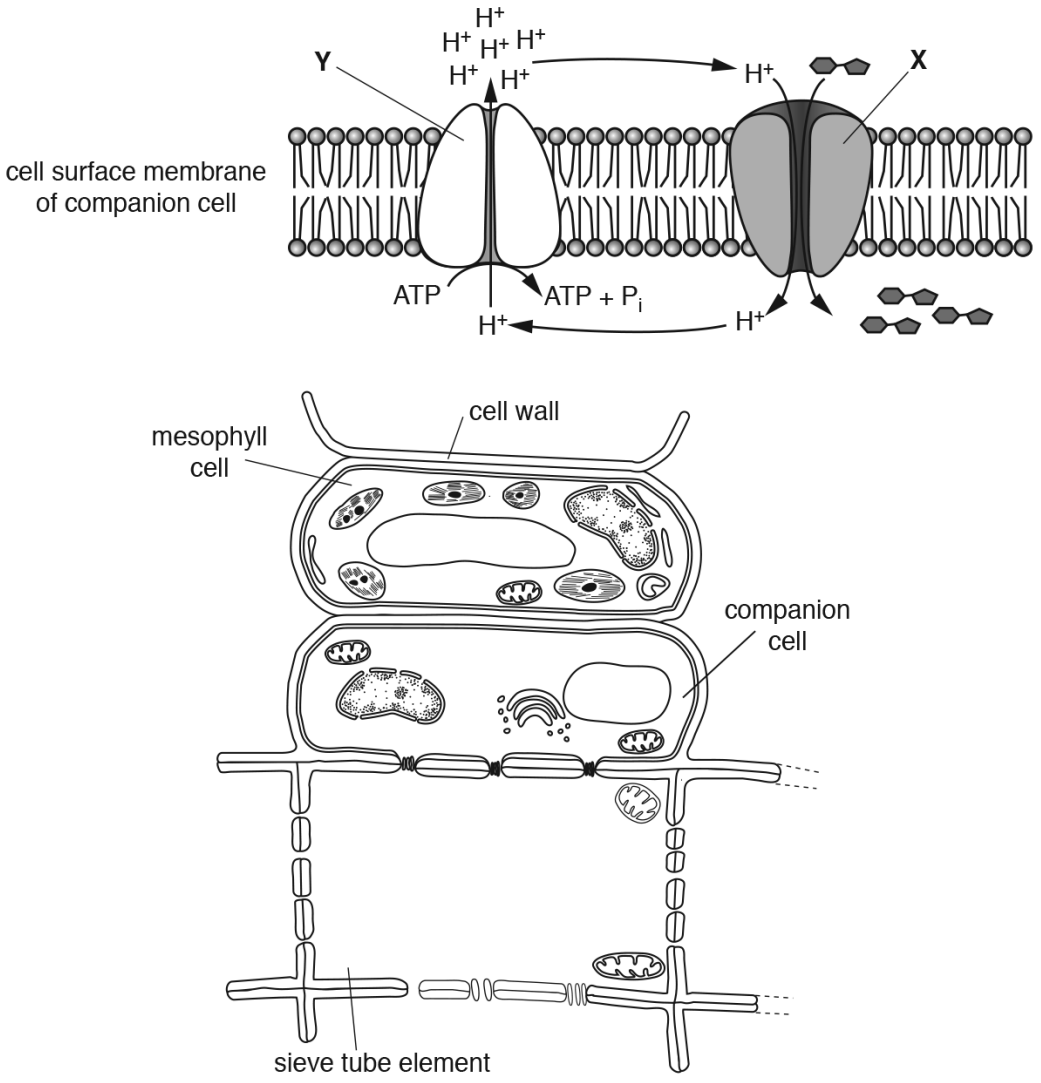


Fig. 5.1 not to scale

(b) Use the information in Fig. 5.1 to explain how sucrose:

- moves into the companion cell
- moves from the companion cell into the sieve tube element.

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.....[5]

(c) Sucrose travels in phloem sieve tubes to sinks.

State two examples of sinks.

1 .....

2 .....[1]

[Total: 8]

110. 9700_s17_qp_22 Q: 4

Meristematic tissue is found in the growing regions of plants, such as root tips.

(a) Fig. 4.1 summarises a cell cycle for a meristematic cell in the root tip. The two phases of this cell cycle are shown:

- interphase, which is divided into the G_1, S and G_2 stages
- cell division, which is divided into stages 1–5.

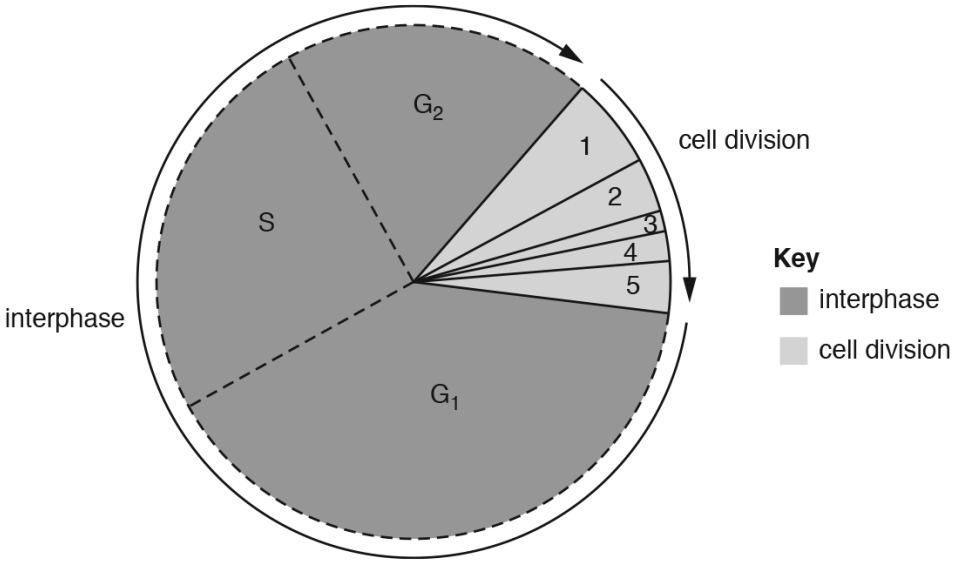


Fig. 4.1

(i) In Fig. 4.1, stage 2 is metaphase.

The stages shown in Fig. 4.1 are listed below. Draw a circle around the stage in the cell cycle that is cytokinesis **and** describe what happens in this stage in the root tip meristematic cell.

1 2 3 4 5 G_1 S G_2

.....

.....

.....

.....

.....

.....

.....[3]

(ii) The stages shown in Fig. 4.1 are listed below. Draw a circle around the stage in the cell cycle in which the semi-conservative replication of DNA occurs **and** state what is meant by semi-conservative replication.

1 2 3 4 5 G_1 S G_2

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.....[3]

(b) Meristematic cells have a similar role to stem cells found in animals.

Suggest the role of a meristematic cell **and** explain the features that help it to carry out its role.

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.....[3]

(c) Meristematic regions in the plant can sometimes be described as strong sinks.

(i) State what is meant by a *sink*.

.....

.....

.....[1]

(ii) Suggest what is meant by a **strong** sink.

.....

.....

.....[1]

(d) Describe **and** explain how sucrose is loaded into phloem sieve tubes.

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.....[4]

[Total: 15]

111. 9700_s17_qp_23 Q: 6

(a) In the space below, draw a diagram to show a hydrogen bond between two water molecules.

[3]

(b) **(i)** Movement of water in xylem depends on the force of attraction between water molecules as a result of hydrogen bonding.

State the name given to this force of attraction.

.....[1]

(ii) State the property of water that results in a cooling effect as water evaporates from the surface of organisms.

.....

.....[1]

[Total: 5]

112. 9700_w17_qp_21 Q: 6

Plants have two transport tissues, xylem and phloem.

(a) Describe **and** explain **two** ways in which the structure of xylem vessels is adapted to their function.

description 1 .....

.....

explanation 1 .....

.....

.....

description 2 .....

.....

explanation 2 .....

.....

.....[2]

(b) Describe **two** differences between the vessels that transport phloem sap in flowering plants and the vessels that transport blood in mammals.

.....

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.....[2]

Fig. 6.1 shows root hair cells.

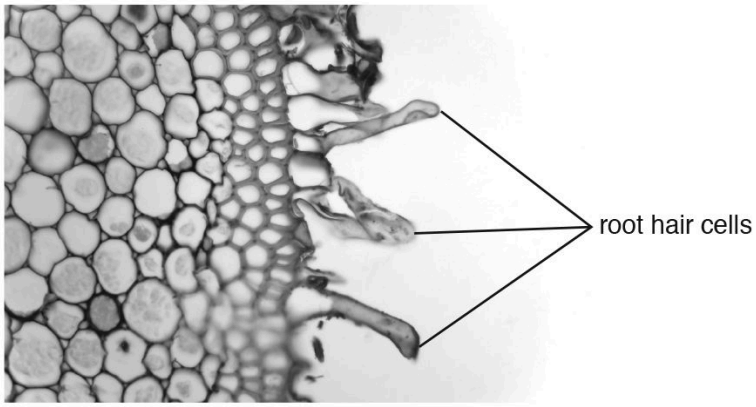


Fig. 6.1

(c) Explain why the root hair cells in Fig. 6.1 have more mitochondria than the other root cells shown.

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.....

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.....

.....

.....[3]

[Total: 7]

113. 9700_w17_qp_22 Q: 5

(a) Descriptions **A**, **B** and **C** relate to the movement of water from the soil to the xylem in roots.

State the correct term to match each of the descriptions **A**, **B** and **C**.

A The specialised root epidermal cell that provides a large surface area for the uptake of water from the soil.

.....

B The band of suberin in the cell walls of the endodermis that prevents the movement of water by the apoplastic pathway.

.....

C The cell structures that allow water to pass from one cell to the next as part of the symplastic pathway.

.....

[3]

(b) Explain, with reference to the structure of xylem vessel elements, why water does **not** take a symplastic pathway in the xylem to the leaves.

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.....[2]

(c) Explain why the rate of movement of water in the xylem may slow down at night.

.....

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.....

.....

.....[3]

[Total: 8]

114. 9700_w17_qp_23 Q: 5

The tree species *Caryocar brasiliense* grows in areas where there is very little rainfall for five months of the year. During this long dry season the trees have mechanisms to reduce the rate of transpiration.

An investigation was carried out on *C. brasiliense* to find out how the rate of transpiration and the mean water potential of leaf cells changed over 12 hours in one day during the dry season.

The results are shown in Fig. 5.1 **A** and **B**.

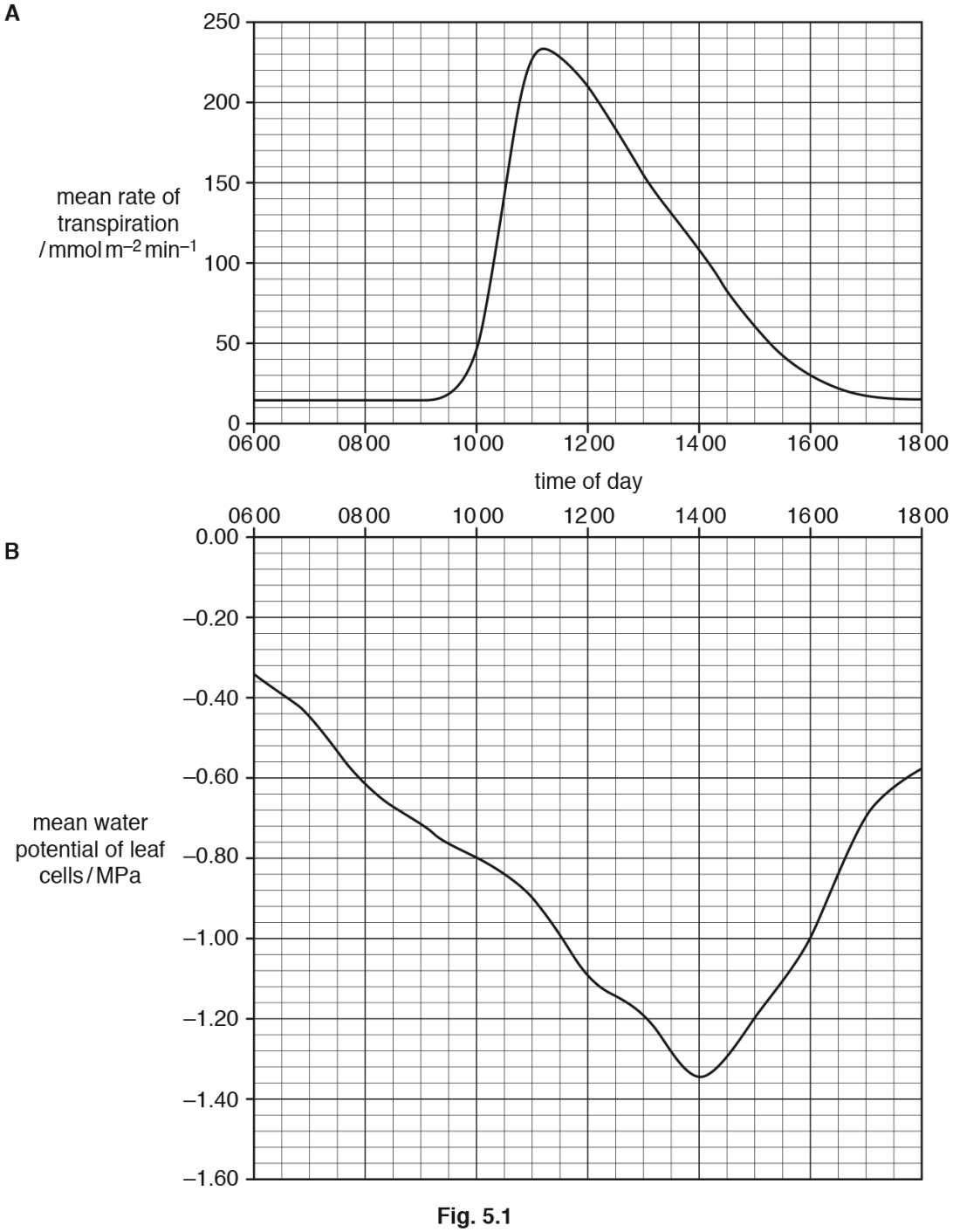


Fig. 5.1

STEMUP.CO.UK

(a) Define the term *transpiration*.

.....

.....

.....

.....[2]

(b) With reference to Fig. 5.1**A** and **B**, describe the changes recorded in the mean water potential of leaf cells over the 12 hour period. Suggest explanations for these changes.

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.....[4]

(c) The tree *C. brasiliense* is able to survive through long dry periods.

Many plant species that live in areas with little rainfall have features that reduce transpiration rates. Some adaptations reduce the water potential gradient for water vapour between the air spaces inside the leaves and the surrounding air.

Outline how leaves are adapted to reduce transpiration rates in this way.

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.....[3]

[Total: 9]

115. 9700_s16_qp_21 Q: 4

(a) Transpiration is often described as 'an inevitable consequence of gas exchange in leaves'.

Explain what is meant by this description.

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.....[3]

(b) Explain how hydrogen bonding is involved in the movement of water in the xylem.

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.....[3]

Southern beech trees of the genus *Nothofagus* grow in forests in the South Island of New Zealand. Fig. 4.1 shows a small part of a forest.

Most of the trees in the forests form a thick canopy of leaves. These are known as canopy trees. The tallest trees are known as emergent trees. Some trees do not reach the canopy and are known as suppressed trees.

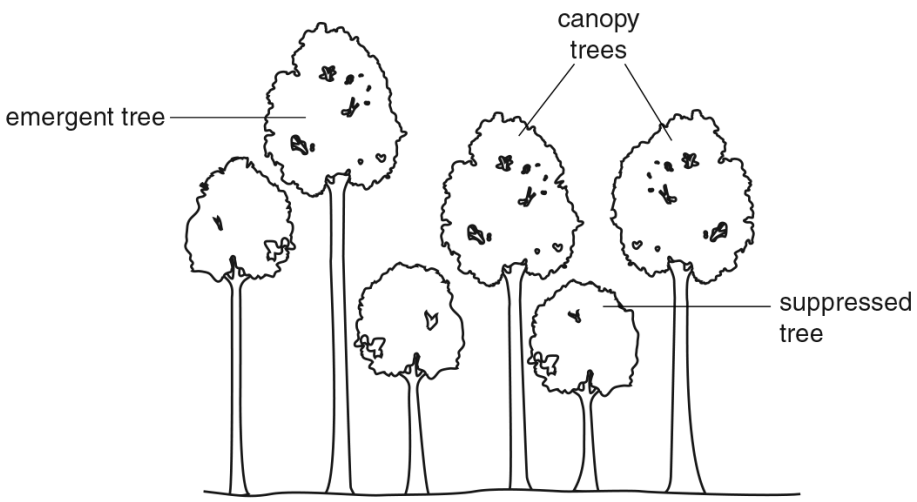


Fig. 4.1

Researchers determined the rates of transpiration of emergent, canopy and suppressed trees in a forest over a 14 hour period from 06.00 until 20.00 on one day in the summer. The results are shown in Fig. 4.2A. They also recorded changes in light intensity above the canopy over the same time period as shown in Fig. 4.2B.

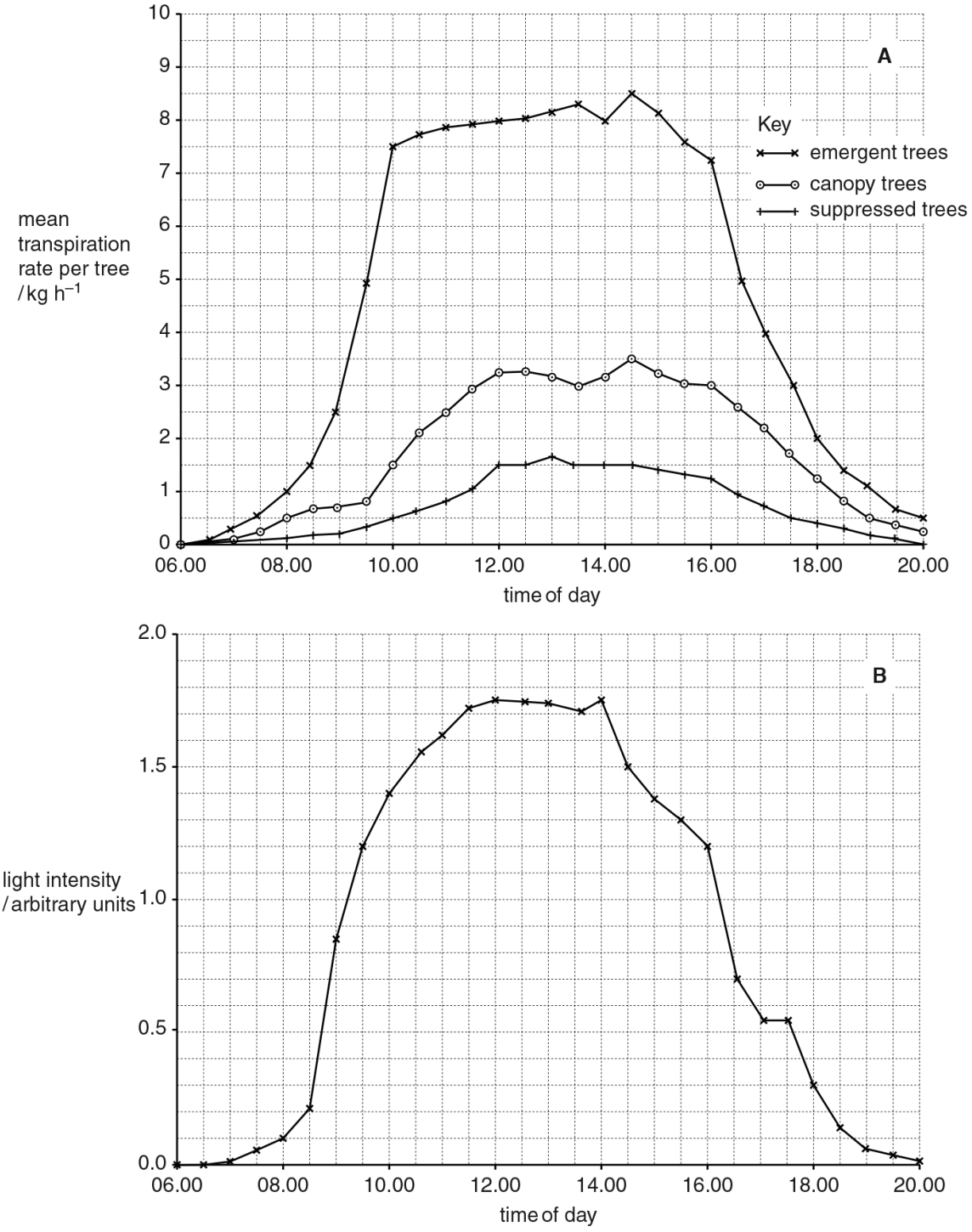


Fig. 4.2

(c) Use Fig. 4.2A to compare the transpiration rates of the emergent, canopy and suppressed trees in the forest over 14 hours.

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.....[4]

(d) The factors that affect transpiration rate vary considerably at different places inside forests.

Use the information in Fig. 4.1 and Fig. 4.2 to suggest reasons for the difference in the transpiration rates of the emergent and suppressed trees.

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.....[4]

[Total: 14]

116. 9700_s16_qp_22 Q: 2

Marram grass, *Ammophila arenaria*, is an important plant of sand dunes. Leaves of marram grass are well adapted to reduce water loss by transpiration.

Fig. 2.1 is a photomicrograph of a section though the leaf of marram grass.

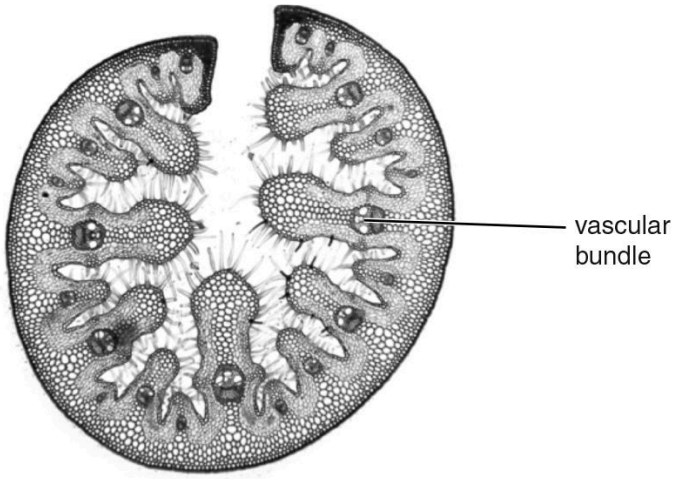


Fig. 2.1

(a) Examples of adaptations to reduce water loss by transpiration include a thick cuticle and no stomata on the outer surface, and stomata in pits on the inner surface.

(i) State **one** other adaptation, visible in Fig. 2.1, which reduces water loss by transpiration.

.....[1]

(ii) Explain how this adaptation reduces water loss.

.....

.....

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.....

.....[2]

(b) State the term used to describe a plant type that has adaptations to reduce water loss by transpiration.

.....[1]

[Total: 4]

117. 9700_s16_qp_23 Q: 4

Fig. 4.1 is an electron micrograph showing a section through the stem of Asian rice, *Oryza sativa*.

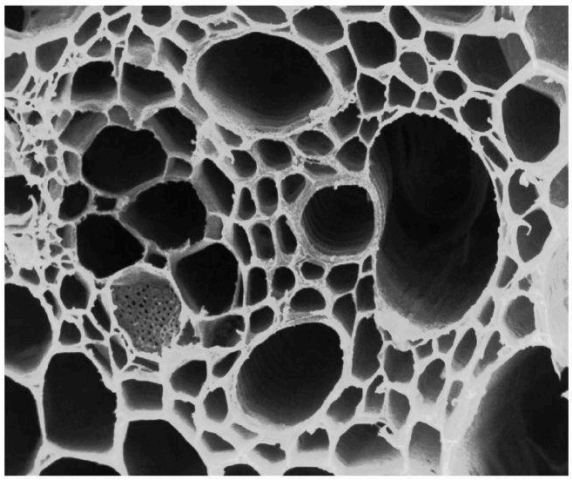


Fig. 4.1

(a) Draw a label line and label on Fig. 4.1 to show a phloem sieve tube. [1]

(b) Describe the function of phloem sieve tubes.

.....

.....

.....[2]

(c) In the root tip, some of the cells produced by mitosis differentiate into xylem vessel elements. During this differentiation, the structure of the cell wall changes.

Explain how the structure of the walls of xylem vessel elements are adapted to their functions.

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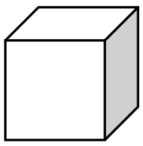
.....[3]

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(d) Organisms can be modelled as simple shapes for the calculation of surface area to volume ratios.

(i) Calculate the surface area to volume ratio of an animal modelled as a cube of side length 0.1 m.

Show your working.



surface area ..... m^2

volume ..... m^3

surface area to volume ratio .....
[3]

(ii) The surface area to volume ratio decreases as animals increase in size.

Use this fact to suggest why multicellular animals require transport systems.

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.....[2]

[Total: 11]

118. 9700_w16_qp_21 Q: 2

(a) (i) Define *transpiration*.

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.....[1]

(ii) State **two** environmental factors that affect the rate of transpiration.

Explain how each factor affects the rate of transpiration.

factor 1 .....

explanation.....

.....

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factor 2 .....

explanation.....

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.....[4]

(b) Explain how hydrogen bonding is involved in the movement of water through the xylem.

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.....[3]

[Total: 8]

119. 9700_w16_qp_22 Q: 2

Phloem sap containing sucrose is transported in phloem sieve tubes from the source to the sink.

(a) A student carried out an experiment using Visking tubing to investigate osmosis. The student prepared a sucrose solution to represent phloem sap at the source. This was put into Visking tubing that was tied at one end, so that the tubing was approximately 75% full.

The rest of the procedure is summarised in Fig. 2.1. The tubing was removed after 20 minutes, dried and re-weighed.

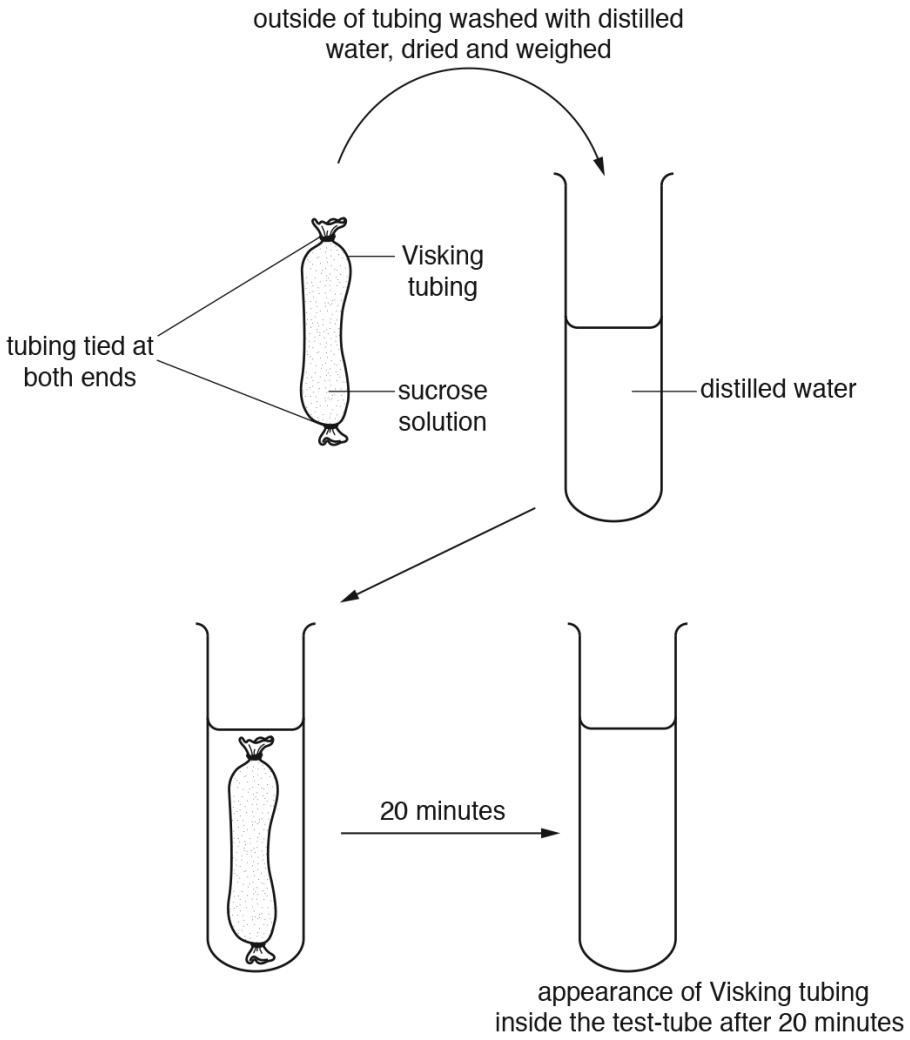


Fig. 2.1

(i) Complete Fig. 2.1 to show the appearance of the Visking tubing inside the test-tube after 20 minutes. [1]

(ii) State, **with reasons**, whether there would be a change in the mass of the Visking tubing containing the sucrose solution after 20 minutes.

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.....[3]

(b) Explain how osmosis is involved in the mass flow of phloem sap.

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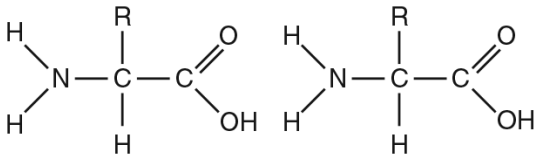
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.....[3]

(c) Amino acids synthesised in the mesophyll cells of leaves are also transported in phloem sap to other locations where they are used to synthesise polypeptides.

Amino acids are joined by peptide bonds to form the polypeptides.

Two amino acids are shown below. Describe the formation of a peptide bond between these two amino acids. You may use the space below.



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.....[2]

[Total: 9]

120. 9700_w16_qp_23 Q: 3

Fig. 3.1 shows part of a transverse section of a root of *Ranunculus repens*.

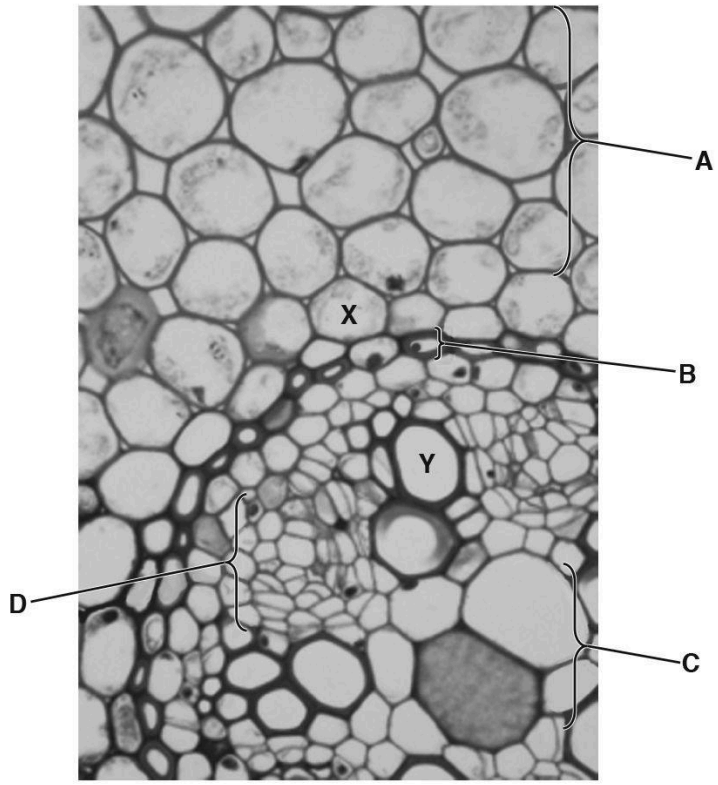


Fig. 3.1

(a) Name tissues **A** to **D**.

A .....

B .....

C .....

D .....[4]

(b) Explain how water moves from **X** to **Y**.

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.....[4]

[Total: 8]

121. 9700_s15_qp_21 Q: 3

When a leaf is first formed it is described as a sink for carbohydrate. As the leaf continues to grow, it starts to photosynthesise and becomes a source of carbohydrates and other assimilates.

Fig. 3.1 shows the changes that occur to the structure of plasmodesmata in the leaf as it grows.

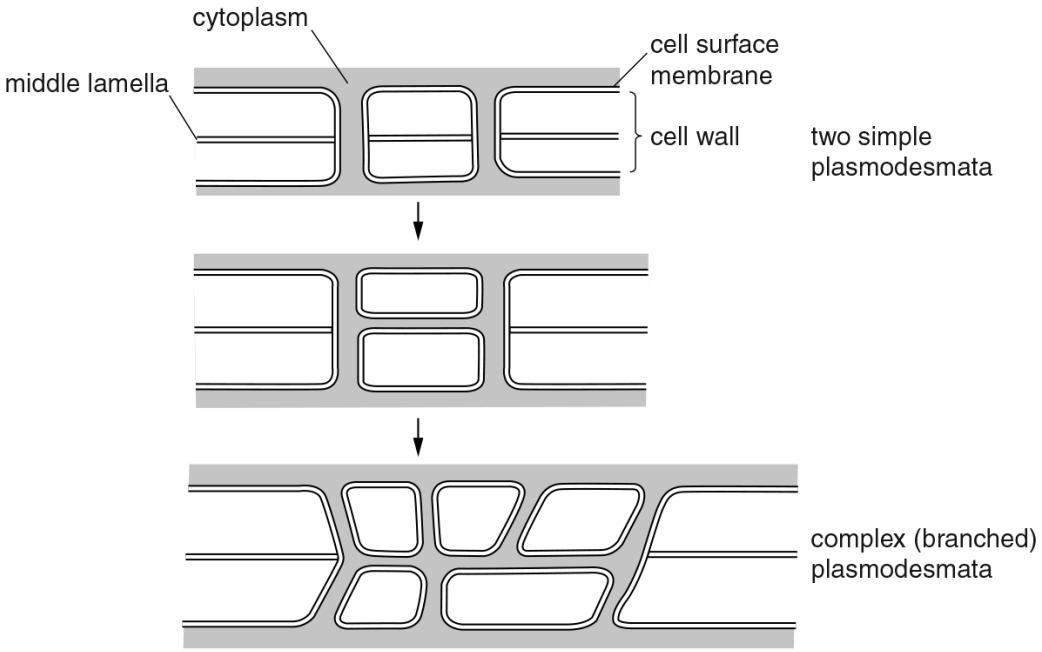


Fig. 3.1

(a) Suggest the advantage of complex plasmodesmata between cells in leaves.

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.....[2]

(b) Assimilates are transported into phloem sieve tubes.

Explain how assimilates in phloem sieve tubes move from the veins in a mature leaf to sinks, such as flowers and fruits, in the rest of the plant.

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.....[4]

[Total: 6]

122. 9700_s15_qp_21 Q: 5

Fig. 5.1 shows a diagram of the molecular structures of tristearin (a triglyceride) and phosphatidylcholine (a phospholipid).

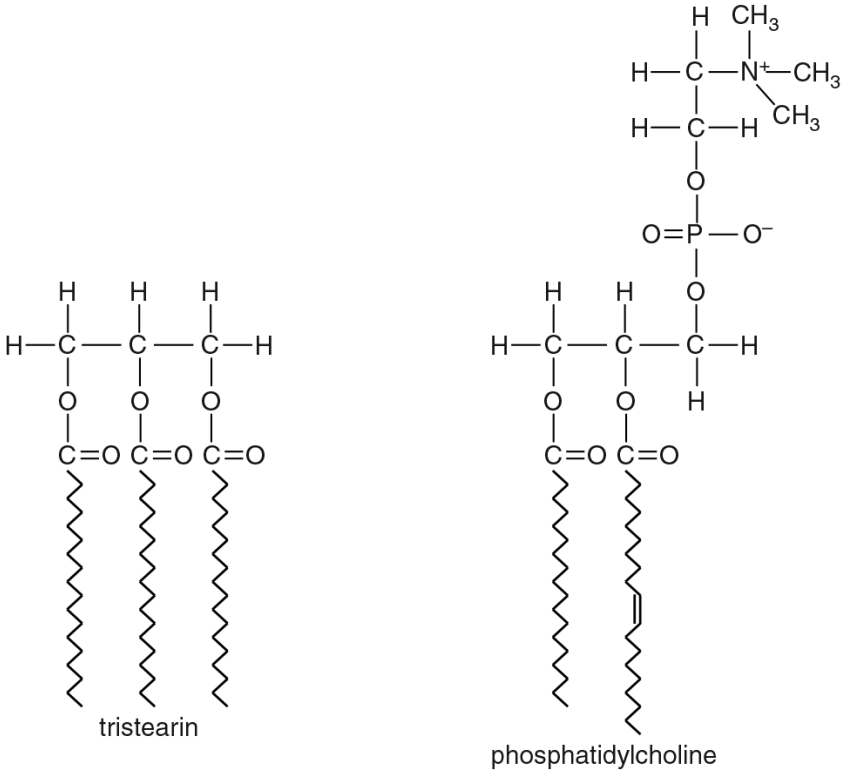


Fig. 5.1

(a) Table 5.1 shows a structural difference between the two molecules shown in Fig. 5.1.

Complete Table 5.1 with two further structural differences **other than** in numbers of different types of atoms.

Table 5.1

structural feature	tristearin	phosphatidylcholine
length of fatty acid chains	all the same length	different lengths

[2]

(b) Cells in the pancreas secrete enzymes, such as amylase and trypsin, into a duct.

The enzymes are packaged in vesicles so that they can be exported from these cells as shown in Fig. 5.2.

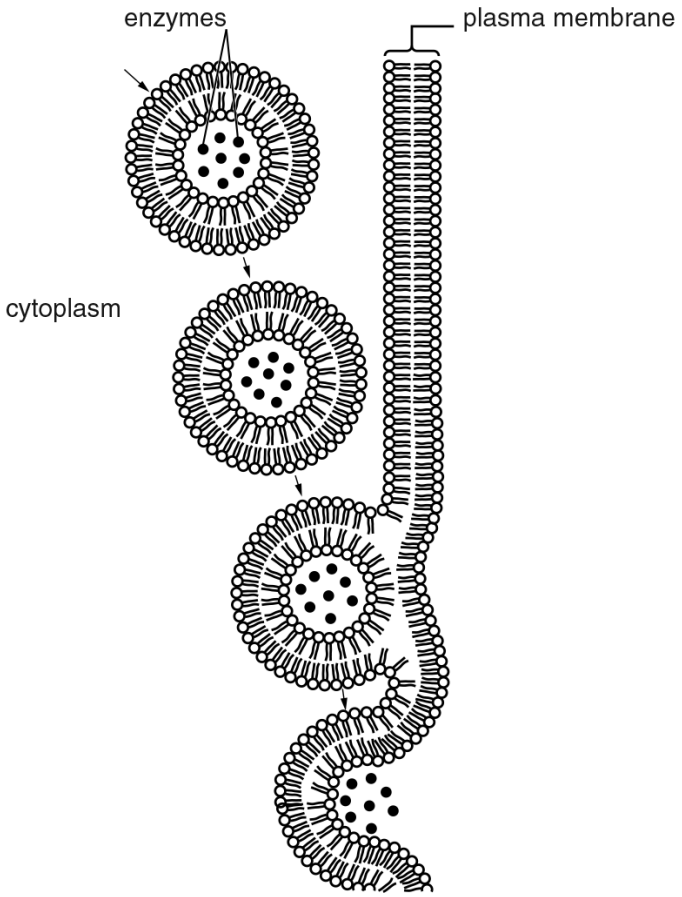


Fig. 5.2

With reference to Fig. 5.2, explain how enzymes that are secreted by cells in the pancreas are packaged into vesicles and exported.

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.....[4]

(c) Water has many significant roles to play in cells and living organisms.

Complete Table 5.2 below by stating the property of water that allows each of the following to take place.

Table 5.2

role of water	property of water
solvent for glucose and ions	
movement in xylem	
helps to decrease body temperature in mammals	

[3]

[Total: 9]

123. 9700_w15_qp_21 Q: 4

Marram grass, *Ammophila arenaria*, is a xerophyte adapted to grow in sandy soils in exposed locations.

Fig. 4.1 is a light micrograph of a section through a leaf of marram grass.

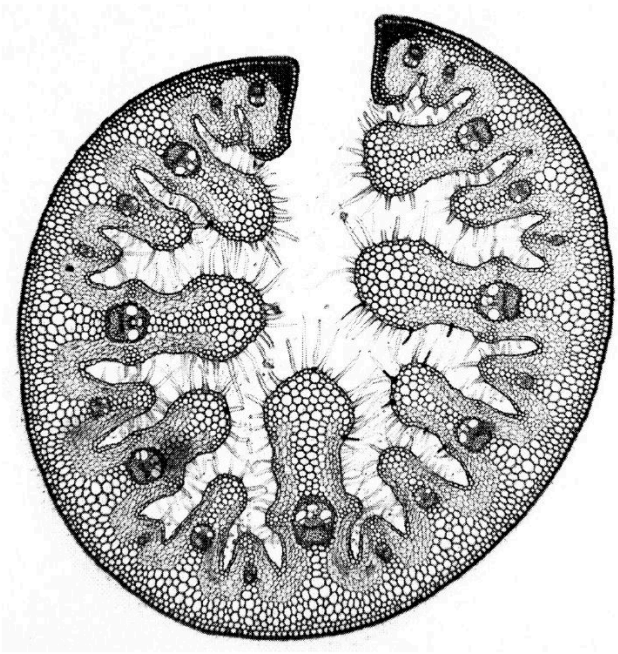


Fig. 4.1

(a) *A. arenaria* is adapted to reduce transpiration.

(i) State what is meant by the term *transpiration*.

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..... [3]

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(ii) One adaptation of *A. arenaria* is the curled leaf.

Give **one** other adaptation, **visible in Fig. 4.1**, and explain how this reduces transpiration.

adaptation

.....

.....

explanation

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..... [3]

(b) A student investigated the rates of transpiration and absorption of water by two species of plants, **P** and **Q**, over an 18 hour period between 0600 and 2400. The environmental conditions for the two species were the same.

The results are shown in Fig. 4.2.

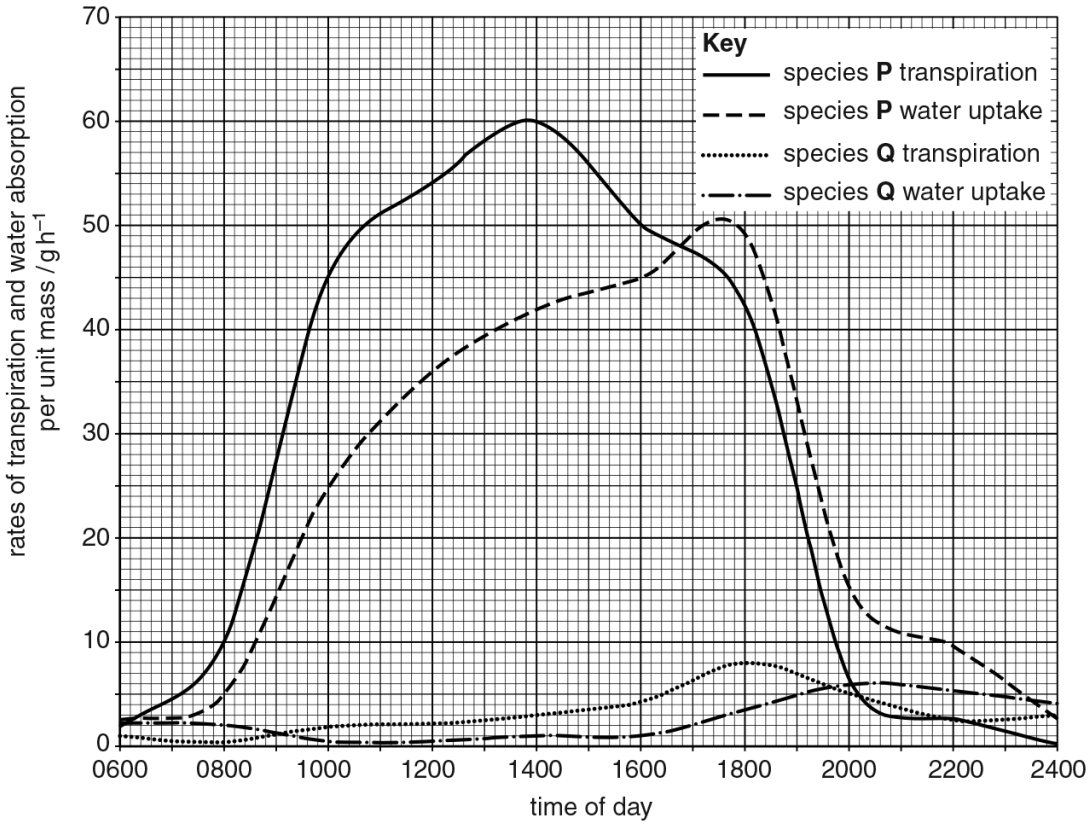


Fig. 4.2

(i) Use Fig. 4.2 to calculate the difference between the rates of transpiration and water absorption for species **P** at time 1400.

answer ..... [2]

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(ii) Describe **and** explain the patterns of transpiration **and** water absorption for species **P**.

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..... [4]

(iii) Suggest why the pattern of transpiration for species **Q** is not the same as for species **P**.

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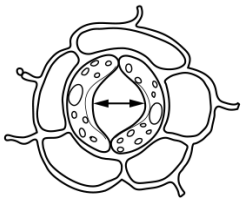
..... [2]

[Total: 14]

124. 9700_w15_qp_23 Q: 2

Most of the water lost from plants passes out through the stomata of leaves.

The distance between open guard cells is known as the stomatal aperture, as shown in Fig. 2.1.



↔ stomatal aperture

Fig. 2.1

Researchers investigated the effect of stomatal aperture on rates of transpiration in leaves of *Tradescantia zebrina* under two conditions:

- air kept moving by a fan (moving air)
- non-moving air.

The results are shown in Fig. 2.2.

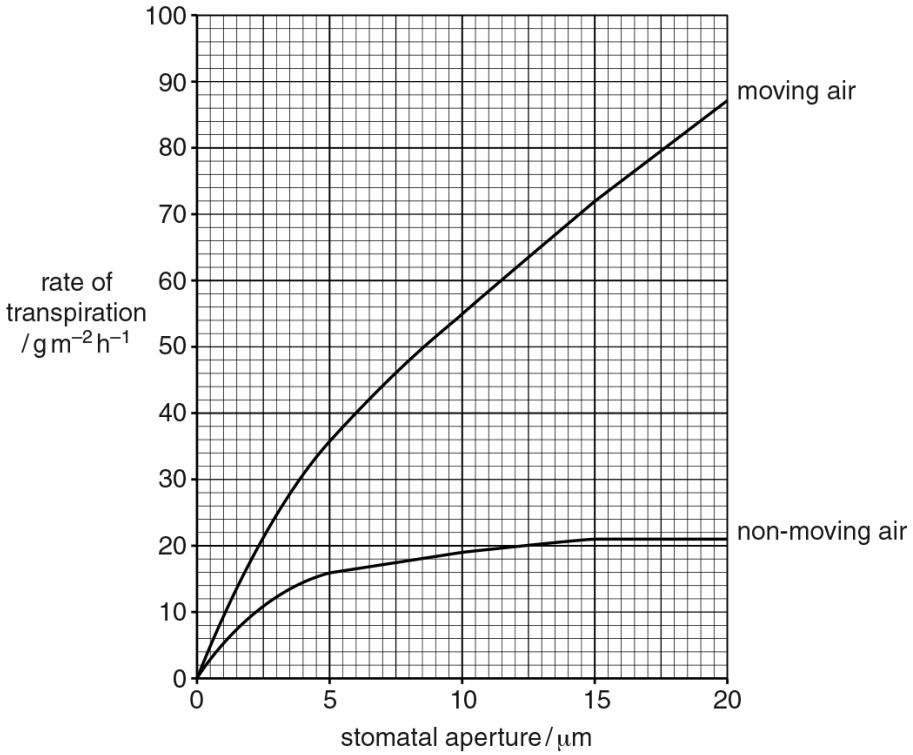


Fig. 2.2

(a) (i) Compare the effect of stomatal aperture on the rate of transpiration in *T. zebrina* in the two conditions.

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..... [3]

(ii) Explain the effect of stomatal aperture on rates of transpiration in non-moving and moving air.

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..... [3]