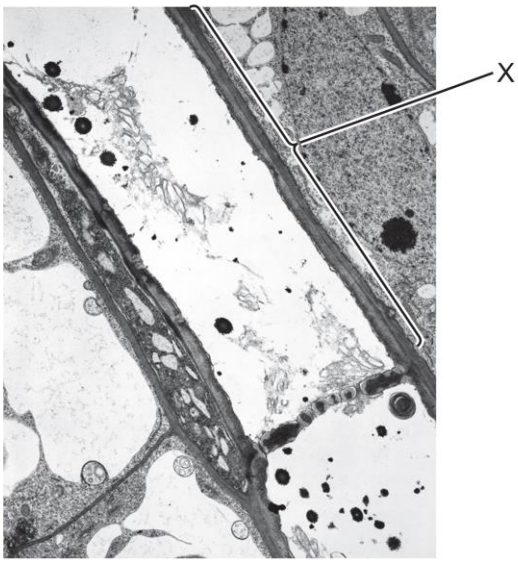
7. Transport in Plants

7.1 Structure of transport tissues

Paper 1

Question Paper

1 The electron micrograph shows a longitudinal section of part of the stem of a plant.



What is the name of the structure labelled X?

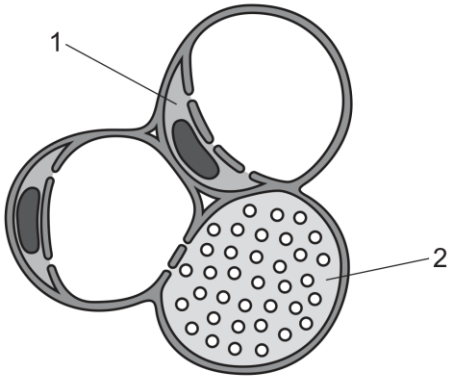
A companion cell

B Casparian strip

C phloem sieve tube element

D xylem vessel element

2 The diagram shows a transverse section through a transport tissue in a plant.



Which row correctly identifies cell 1 and cell 2?

	cell 1	cell 2
A	companion cell	phloem sieve tube element
B	companion cell	xylem vessel element
C	phloem sieve tube element	phloem sieve tube element
D	phloem sieve tube element	xylem vessel element

3 Xylem vessel elements are specialised cells that are adapted for the transport of water.

Which statement correctly matches an adaptation of a xylem vessel element to its function?

A Cytoplasm is only found in a thin layer next to the cell walls and does **not** contain any organelles. This reduces resistance to the flow of water in the xylem vessels.

B The end walls between xylem vessel elements have partially broken down, forming end plates. This reduces resistance to the flow of water in the xylem vessel.

C The walls of the xylem vessel elements contain cellulose that is hydrophilic and can form hydrogen bonds to water, allowing adhesion of water molecules to the vessel walls.

D Xylem vessel elements have plasmodesmata that connect them with companion cells. The companion cells provide ATP, which is needed for the transport of water.

4 A student makes an accurate labelled plan diagram of a section of a leaf containing a vascular bundle.

Which statement correctly describes part of their plan diagram?

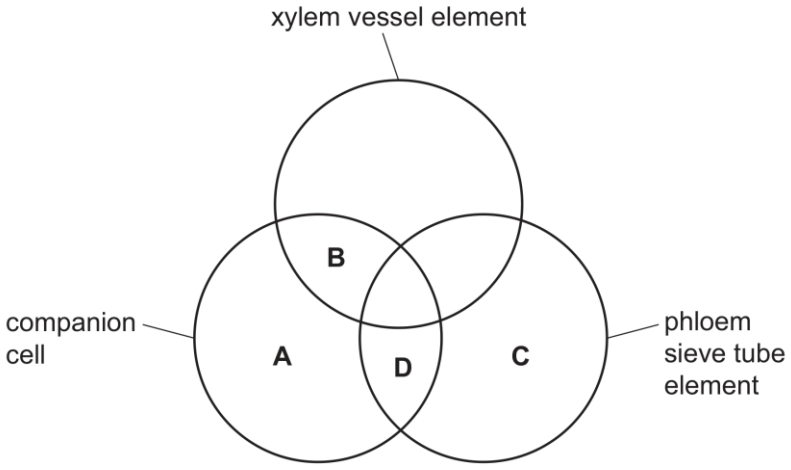
A The vascular bundle has labels for the xylem vessel elements, phloem sieve tube elements and companion cells.

B The vascular bundle is divided into two sections, with the section closer to the upper epidermis labelled as xylem and the other section labelled as phloem.

C In the section of the vascular bundle positioned closer to the lower epidermis, each sieve tube element has an associated companion cell.

D The phloem sieve tube elements are drawn with thick cell walls to represent the lignin in the walls.

5 Which structures contain cytoplasm with mitochondria and a nucleus?



6 Which row identifies cells with plasmodesmata?

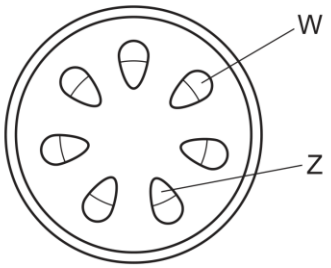
	phloem sieve tube element	companion cell	xylem vessel element
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key

✓ = plasmodesmata present

✗ = plasmodesmata not present

7 The plan diagram of a transverse section through a dicotyledonous plant stem was drawn by a student. They had stained the section with a chemical that stains lignin.



Which row is correct for tissues W and Z?

	W	Z	stained tissue
A	phloem	xylem	W
B	phloem	xylem	Z
C	xylem	phloem	W
D	xylem	phloem	Z

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

1 lignified walls

2 cytoplasm

3 mitochondria

4 pits

5 plasmodesmata

Which features are present in xylem vessel elements?

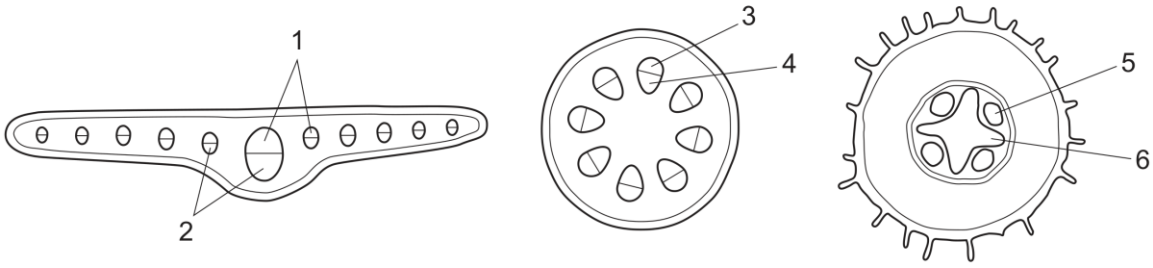
A 1, 2, 3 and 4

B 1, 4 and 5

C 1 and 4 only

D 2, 3 and 5

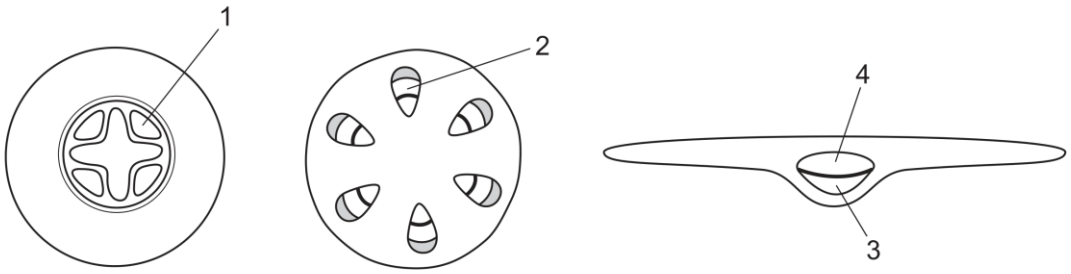
9 The diagrams show transverse sections through parts of plants.



Which row is correct?

	contains lignin	transports organic solutes
A	1, 4, 5	2, 3, 6
B	1, 4, 6	2, 3, 5
C	2, 3, 5	1, 4, 6
D	2, 4, 6	1, 3, 5

10 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

11 Which description of xylem vessel elements is correct?

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 leaves

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

12 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.

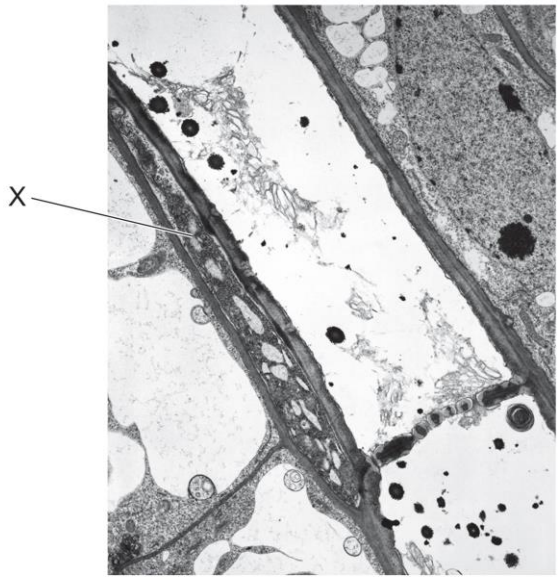
2 It is not permeable to water.

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

13 The electron micrograph shows a longitudinal section through part of a plant stem.



What is X?

A xylem vessel element

B stem cell

C phloem sieve tube element

D companion cell

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

A providing cytoplasmic contact with the sieve tube element for loading

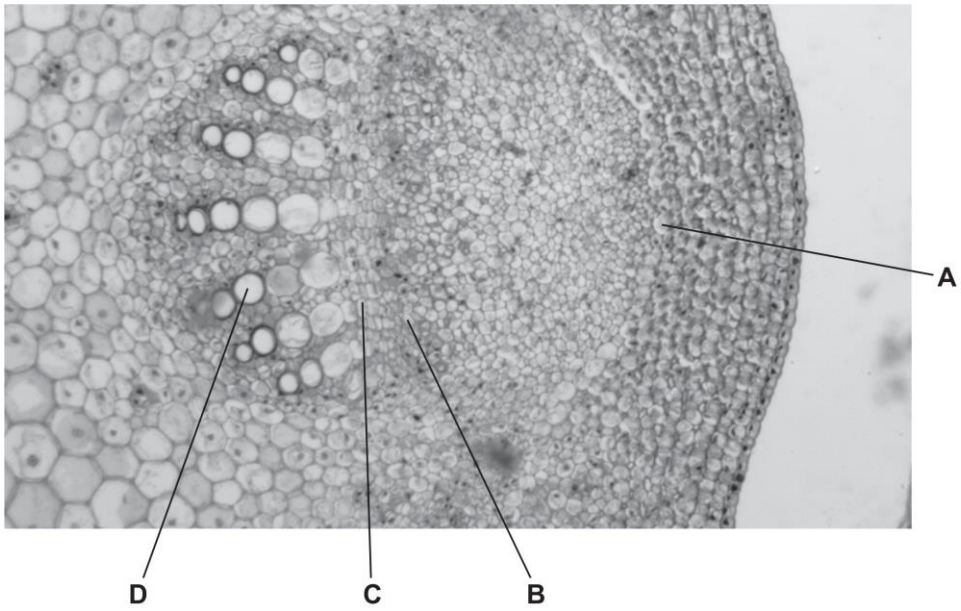
B providing structural support for the sieve tube element

C providing the nucleus for cell division in the phloem

D providing the source of assimilates for storage

15 The diagram shows a transverse section of a stem.

Which area is the phloem?



16 Which descriptions of the adaptations of xylem vessel elements to their function are correct?

1 They have pits between vessels allowing water to pass from one vessel to another.

2 They are thickened with lignin to stop them collapsing when the column of water is under tension.

3 They form a continuous hollow tube through the plant providing little resistance to water movement.

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

17 The table shows the observations made by a student about three different cell types, P, Q and R, seen in a transverse section of a plant stem, using a light microscope.

	ratio of cell wall width to whole cell width	structures observed in cell contents
P	1 : 10	none
Q	1 : 20	regular pattern of circles in some cells
R	1 : 20	granular appearance of all cells

What type of cells are P, Q and R?

	P	Q	R
A	companion cell	phloem sieve tube element	xylem vessel element
B	companion cell	xylem vessel element	phloem sieve tube element
C	xylem vessel element	companion cell	phloem sieve tube element
D	xylem vessel element	phloem sieve tube element	companion cell

18 Which features of companion cells are essential to their function?

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

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

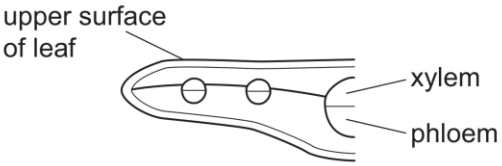
3 They contain a nucleus and mitochondria.

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

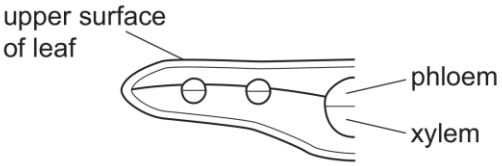
19 A dicotyledonous leaf has a palisade mesophyll layer that is approximately twice as thick as the spongy mesophyll layer.

Which plan diagram is correct?

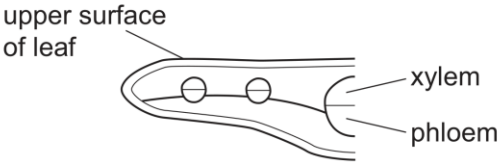
A



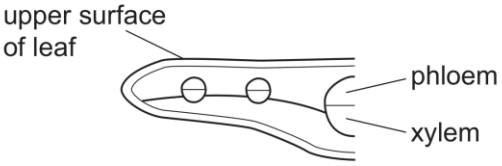
B



C

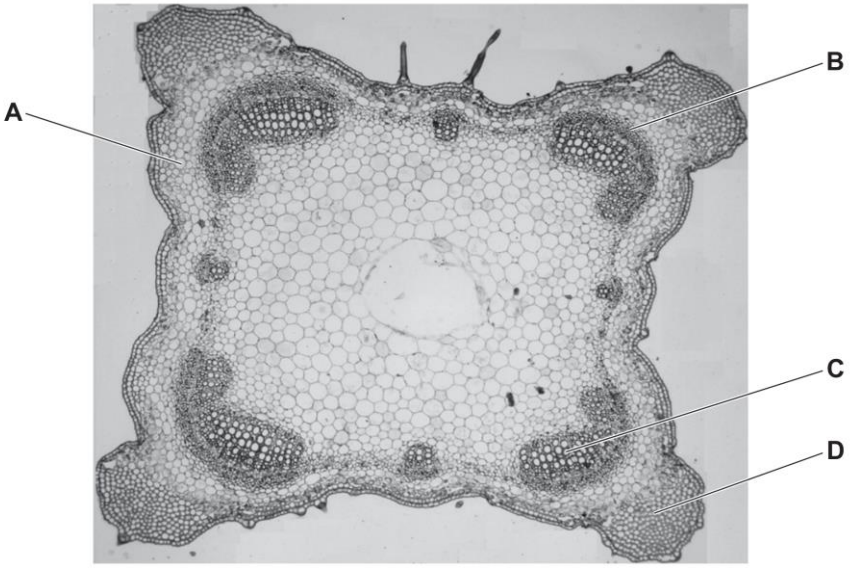


D

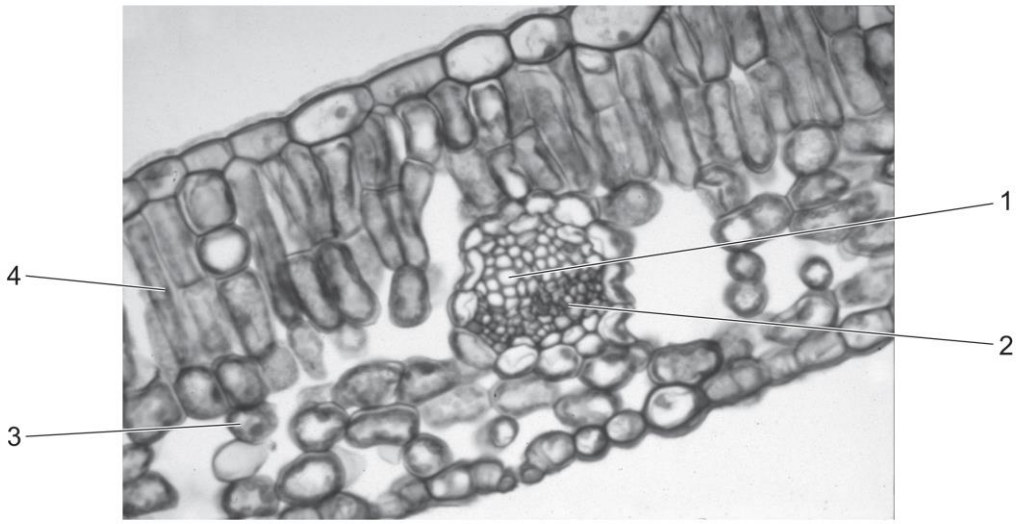


20 The photograph shows a section of a stem.

Which labelled part is the xylem?



21 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

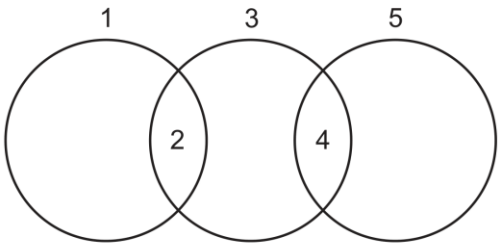
22 Some of the features present in transport tissues in plants are listed.

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

23 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

24 What is correct for phloem sieve tube elements?

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

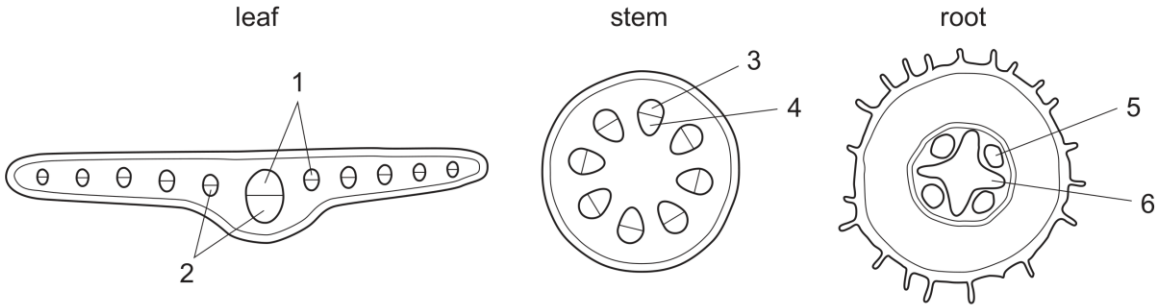
B Lignified walls of phloem sieve tube elements prevent transport of mineral salts by mass flow.

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.

25 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

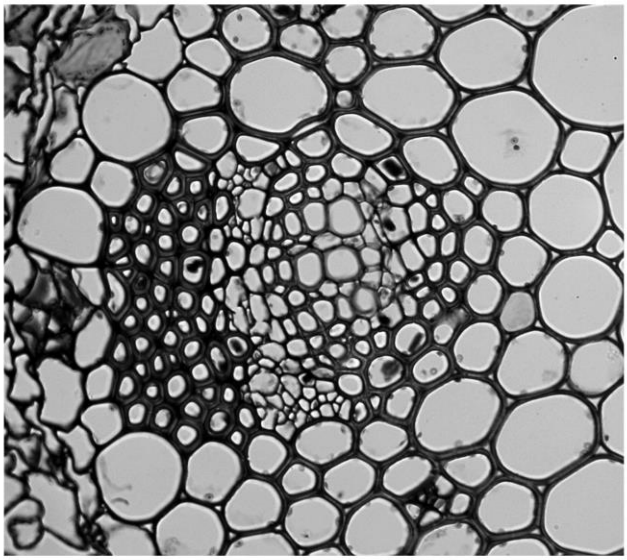
✓ = transporting water is a main function

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

26 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

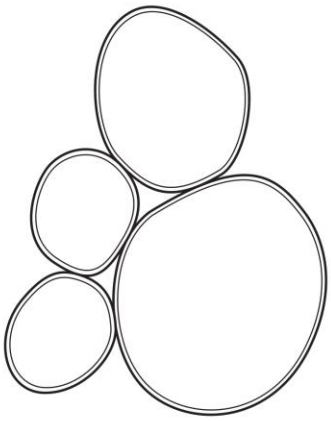
27 The photomicrograph shows tissues in a stained transverse section of a plant stem.



Students are asked to draw four adjacent xylem vessel elements.

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

A



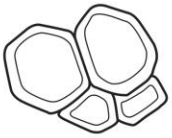
B



C



D



28 Which features of companion cells are essential to their function?

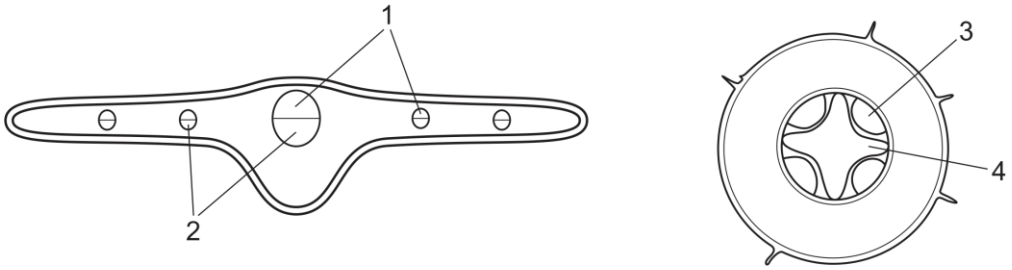
1 They are connected by plasmadesmata to the sieve tube elements.

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

29 The diagrams show transverse sections of parts of a plant.



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

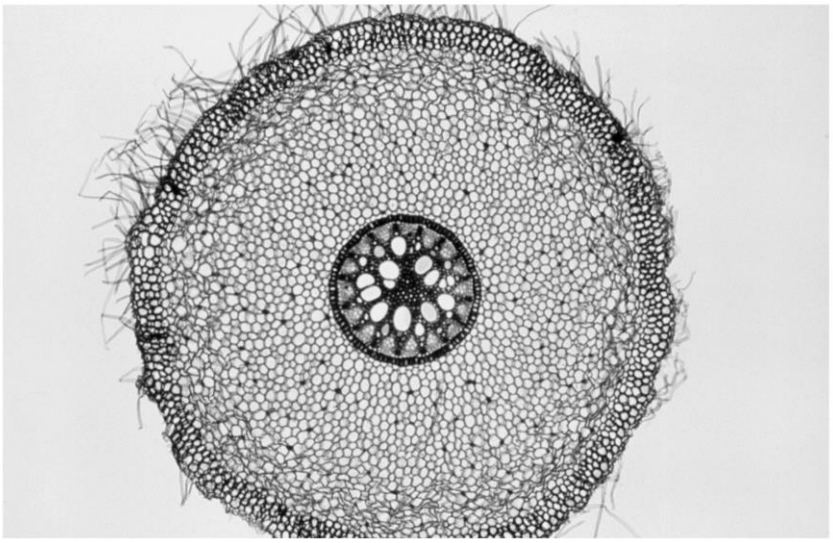
	1	2	3	4
A	✓	✗	✓	✗
B	✓	✗	✗	✓
C	✗	✓	✓	✗
D	✗	✓	✗	✓

key

✓ = correct

✗ = incorrect

30 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?

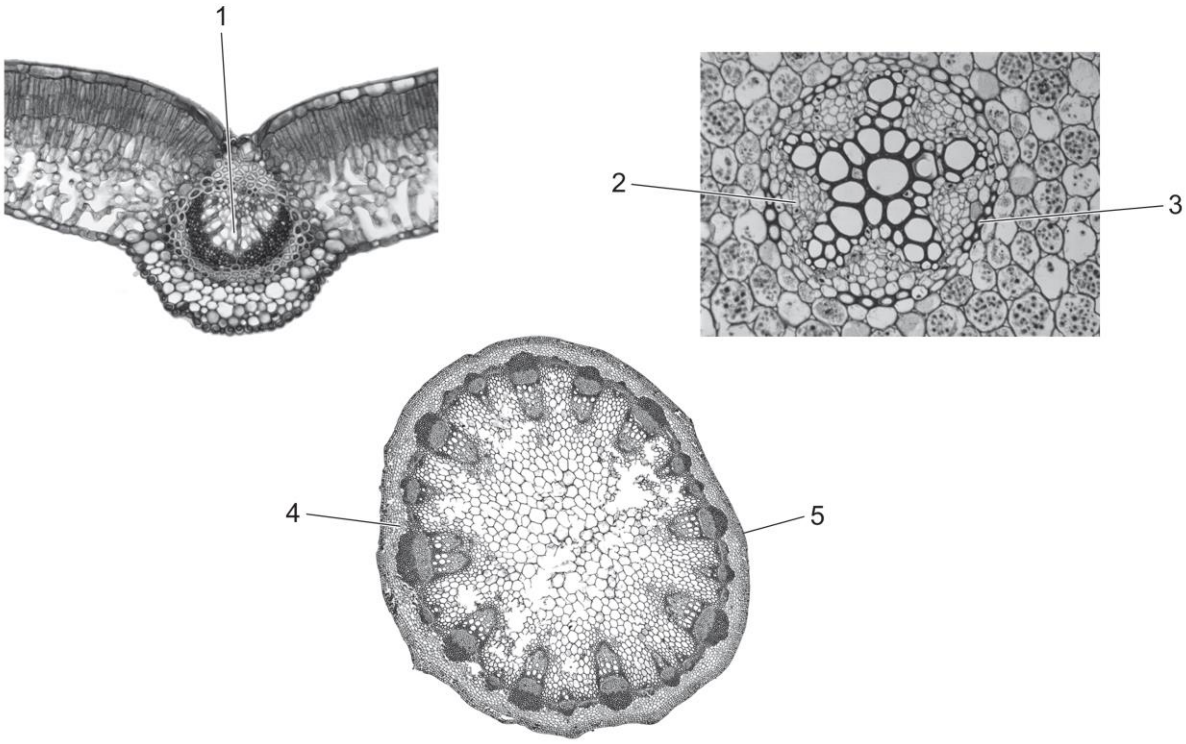
A 40 mm : 11 mm

B 40 : 11

C 8 cm : 2.2 cm

D 80 : 22

31 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

32 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