

# Transport in Plants

## Question Paper

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Transport in plants
Sub Topic	
Booklet	Multiple Choice
Paper Type	Question Paper

Time Allowed : 63 minutes

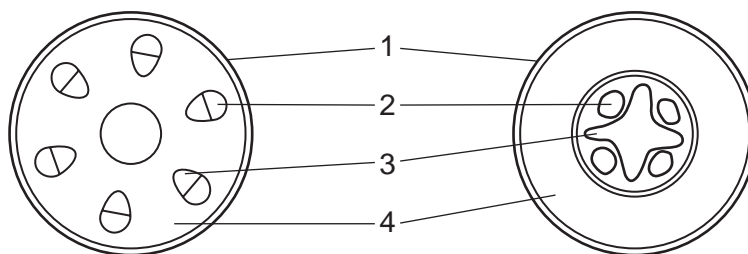
Score : / 52

Percentage : /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

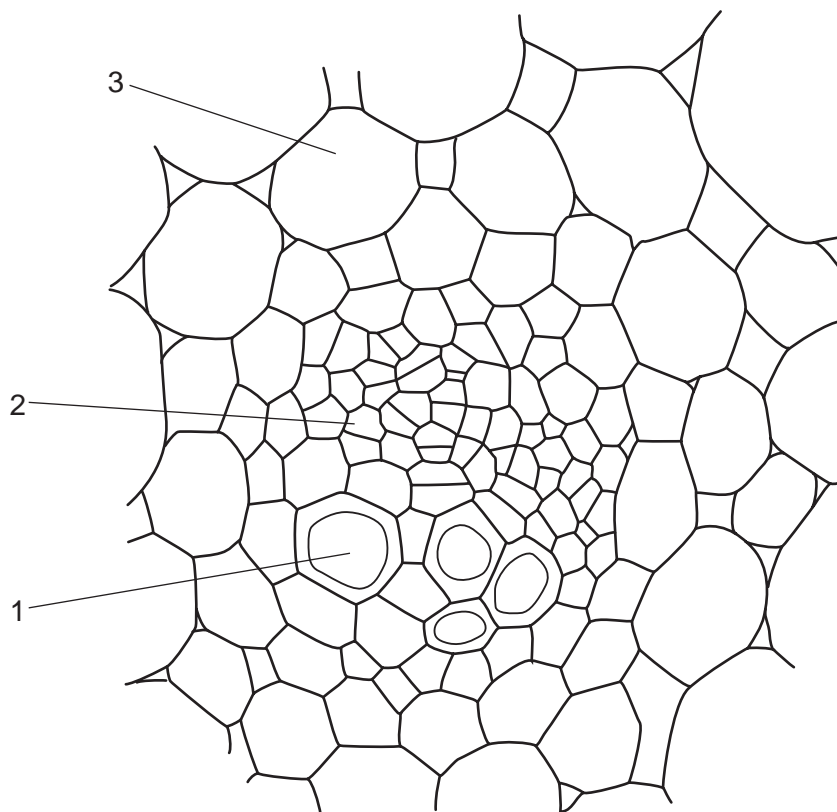
1 The diagram shows transverse sections of two plant structures.



Which row shows the correct labels?

	1	2	3	4
<b>A</b>	cuticle	phloem	xylem	pith
<b>B</b>	cuticle	xylem	phloem	cortex
<b>C</b>	epidermis	phloem	xylem	cortex
<b>D</b>	epidermis	xylem	phloem	pith

2 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
<b>A</b>	1	2	3
<b>B</b>	2	1	3
<b>C</b>	2	3	1
<b>D</b>	3	1	2

- 3 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
<b>A</b>	higher	dec
<b>B</b>	higher	inc
<b>C</b>	lower	decr
<b>D</b>	lower	incr

- 4 What is the function of plasmodesmata in plant cells?

- A** to act as a barrier to water soluble substances
- B** to allow active transport of ions and sucrose between cells
- C** to allow the symplastic movement of substances between cells
- D** to enable cells to recognise each other

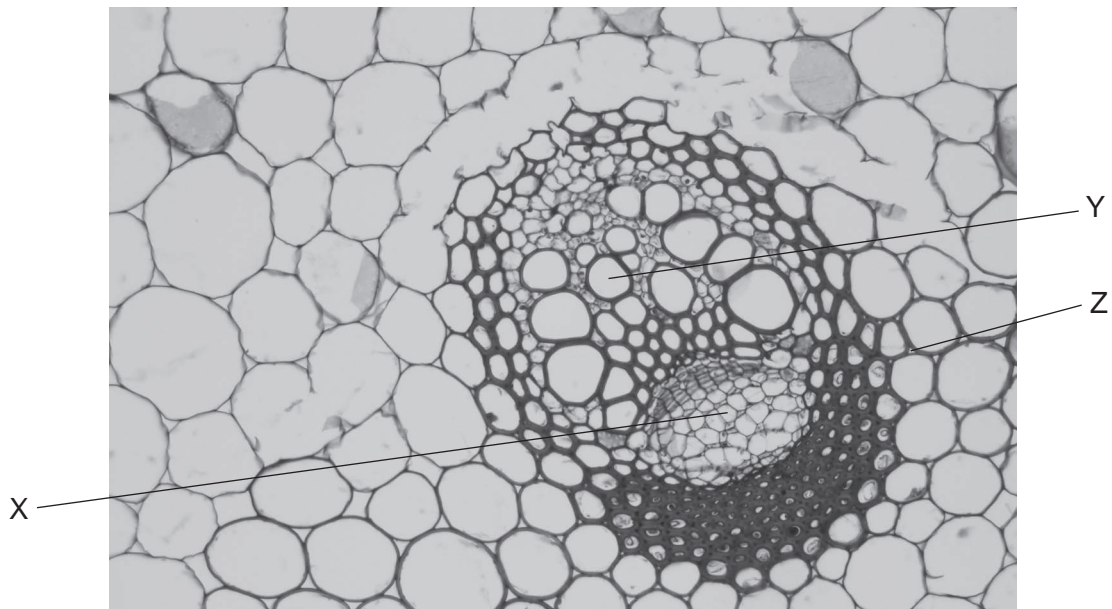
- 5 Which features of these cells make them suitable for their function?

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

- 6 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
<b>A</b>	higher	dec
<b>B</b>	higher	inc
<b>C</b>	lower	decr
<b>D</b>	lower	incr

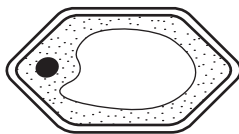
- 7 The photomicrograph shows a vascular bundle from the stem of a plant.



What are the correct labels for structures X, Y and Z?

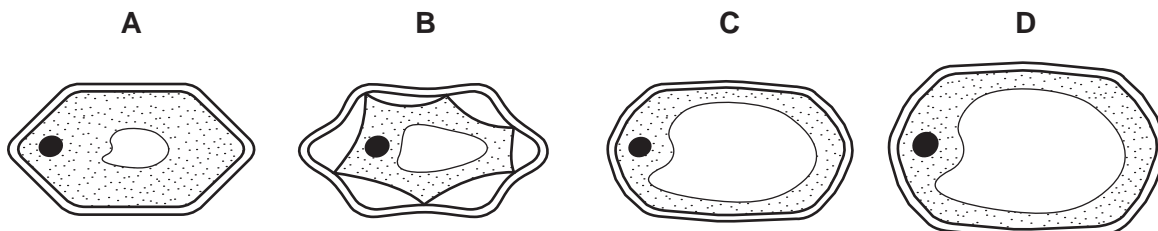
	X	Y	Z
<b>A</b>	companion cell	sieve tube element	air space
<b>B</b>	sieve tube element	xylem vessel element	air space
<b>C</b>	xylem vessel element	companion cell	sieve tube element
<b>D</b>	xylem vessel element	sieve tube element	companion cell

8 The diagram shows a plant cell.



The plant cell is put into a solution with a water potential less negative than the cell contents.

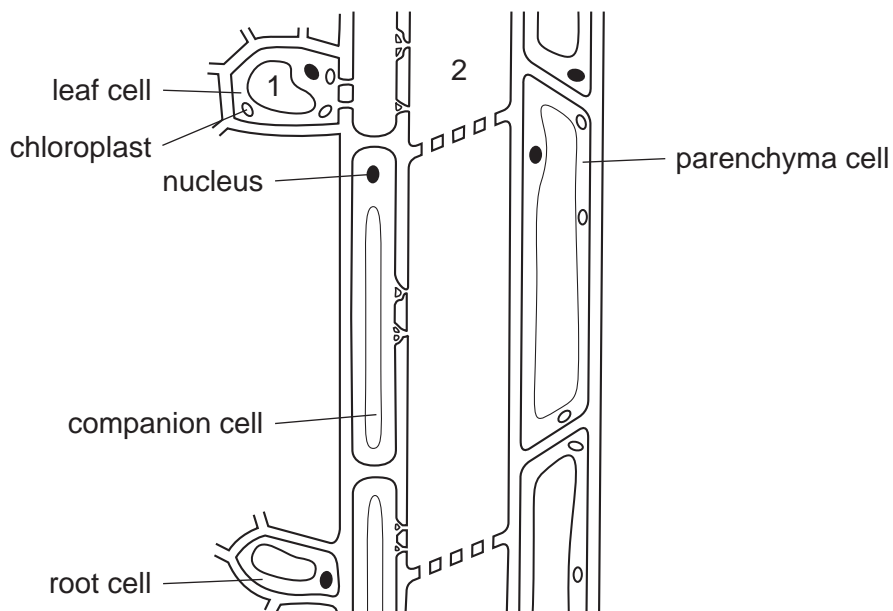
What will happen to the appearance of the cell?



9 Which feature of xylem vessel elements helps adhesion during transpiration?

- A lignin forms an incomplete secondary wall
- B new vessels carry extra water as the plants grow
- C there are no cross walls between vessel elements
- D the vessel elements form a narrow tube

- 10 The diagram represents part of the phloem pathway, with adjacent cells, from leaf to root in a plant.



Which process is occurring between 1 to 2 and what is the effect on the water potential at 2?

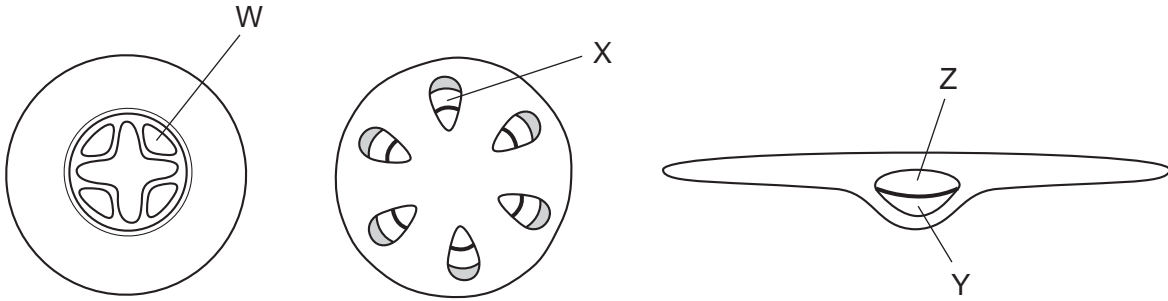
	process from 1 to 2	water potential at 2
<b>A</b>	active transport of sucrose	becomes less negative
<b>B</b>	active transport of sucrose	becomes more negative
<b>C</b>	diffusion of sucrose	becomes less negative
<b>D</b>	diffusion of sucrose	becomes more negative

- 11 Which xerophytic adaptations reduce the water potential gradient?

- 1 rolled leaves
- 2 hairy leaves
- 3 sunken stomata
- 4 fewer stomata
- 5 fleshy leaves

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

12 The diagrams show some tissue types, in plant organs.



Which row identifies the tissue types?

	W	X	Y	Z
A	phloem	phloem	phloem	xylem
B	phloem	xylem	phloem	xylem
C	xylem	phloem	xylem	phloem
D	xylem	xylem	phloem	xylem

13 Which features apply to **both** sieve tube elements and 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



- 14 What changes occur to the water potential and the volume of liquid in the **phloem** when carbohydrate is moved into a sink?

	water potential	volume of liquid
<b>A</b>	lowers	decreases
<b>B</b>	lowers	increases
<b>C</b>	raises	decreases
<b>D</b>	raises	increases

- 15 Which statement explains how mass flow arises in sieve tube elements?

- A** Sucrose actively loaded into sieve tube elements decreases the water potential causing the hydrostatic pressure to increase.
- B** Sucrose actively loaded into sieve tube elements increases the water potential causing the hydrostatic pressure to decrease.
- C** Sucrose diffused into sieve tube elements decreases the water potential causing the hydrostatic pressure to increase.
- D** Sucrose diffused into sieve tube elements increases the water potential causing the hydrostatic pressure to decrease.

- 16 Which statement explains why the circumference (girth) of a tree is less in the middle of the day than at night?

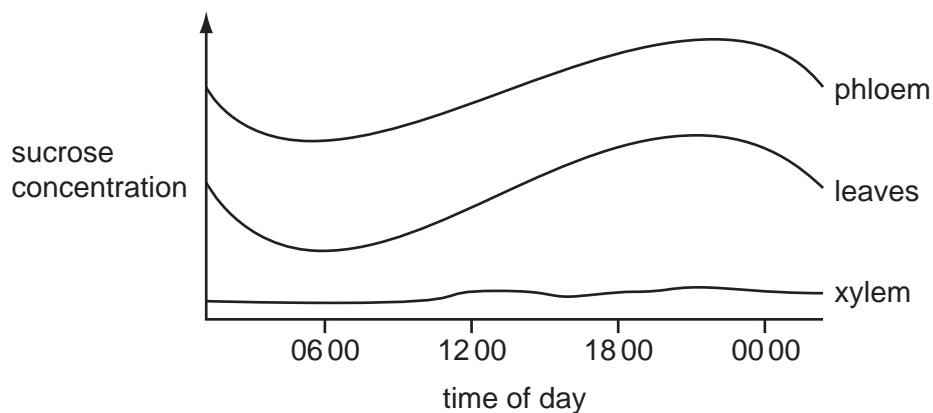
- A** Mineral uptake by the root hair cells decreases during the night because root pressure has decreased.
- B** Stomata close during the night and there is a build-up of water in the vascular tissue within the stem.
- C** The phloem sieve tubes fill with dissolved solutes because the translocation rate is reduced at night.
- D** There is less tension in the xylem vessels at night because the rate of transpiration is at a minimum.

17 Which xerophytic adaptations reduce the water potential gradient?

- 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, 4 and 5 only

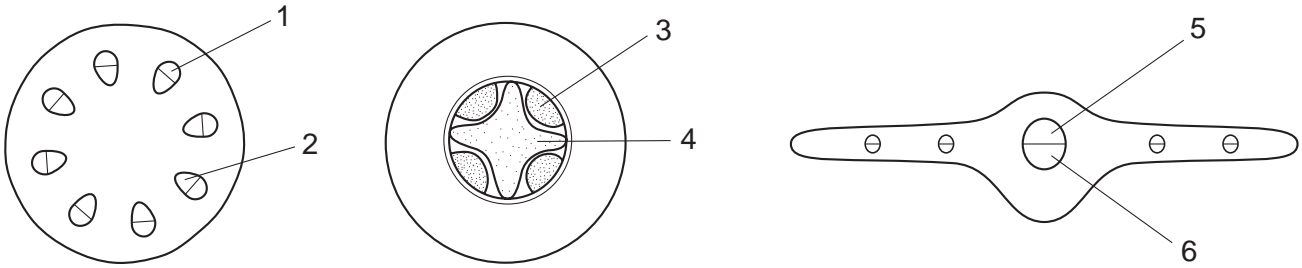
18 The graph shows the results of measuring the concentration of sucrose in the xylem, phloem and leaves of a plant during 24 hours.



Which conclusion can be drawn from these results?

- A Osmosis moves water from the xylem to the phloem.
- B Sucrose is actively transported into the phloem from the leaves.
- C Sucrose is moved in both directions in the phloem.
- D Xylem tissue uses sucrose as a source of energy.

19 The diagrams represent the cross section of the stem, root and leaf of a non-woody dicotyledonous plant. In each section the distribution of the tissues is shown.



Which sequence of numbers correctly identifies the distribution of xylem and phloem in the stem, root and leaf?

	xylem			phloem		
<b>A</b>	1	3	5	2	4	6
<b>B</b>	1	4	6	2	4	5
<b>C</b>	2	3	6	1	3	5
<b>D</b>	2	4	5	1	3	6

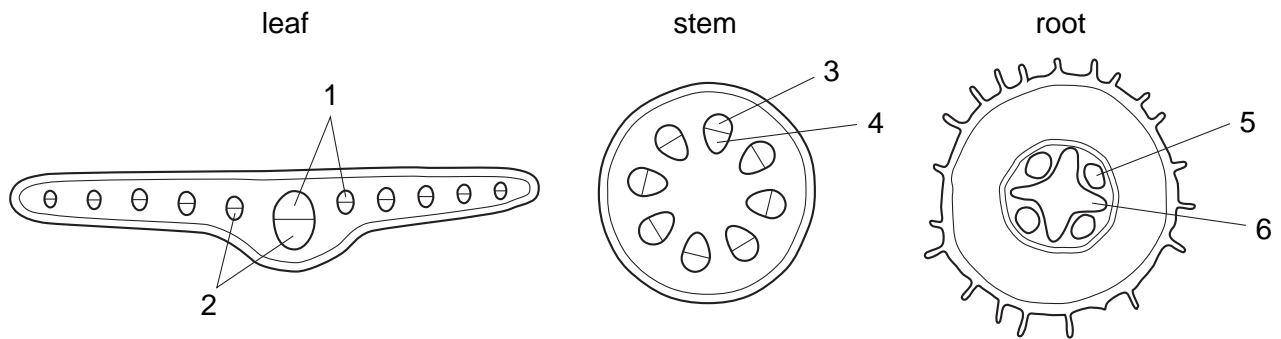
20 What occurs in the sieve tube elements of a photosynthesising leaf and an actively growing root?

	sieve tube elements in leaf	sieve tube elements in root
<b>A</b>	water potential decreases	sugars are moved in
<b>B</b>	water potential decreases	sugars are moved out
<b>C</b>	water potential increases	sugars are moved in
<b>D</b>	water potential increases	sugars are moved out

21 In constructing a plan diagram of a transverse section of a dicotyledonous leaf, which feature should **not** be included?

- A chloroplasts in the palisade mesophyll layer
- B cuticle on the upper epidermis
- C vascular bundles in the leaf lamina
- D xylem in the vascular bundles

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

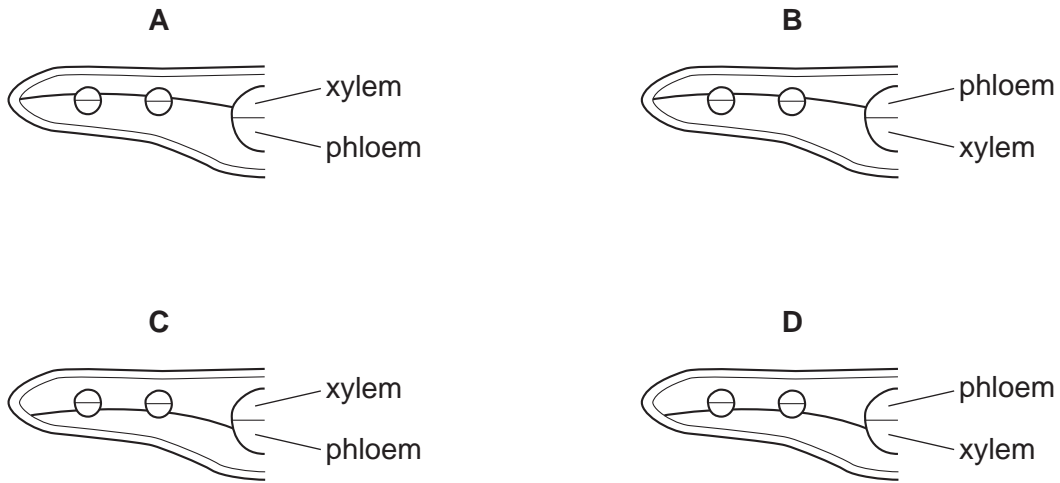


In the cross sections, what do 1, 2, 3, 4, 5 and 6 represent?

	leaf		stem		root	
	phloem	xylem	phloem	xylem	phloem	xylem
<b>A</b>	1	2	3	4	5	6
<b>B</b>	1	2	4	3	6	5
<b>C</b>	2	1	3	4	5	6
<b>D</b>	2	1	4	3	6	5

- 23 What is the main function of a companion cell in mature phloem tissue?
- A** providing cytoplasmic contact with the sieve tube 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
- 24 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
- 25 How does sucrose move from chloroplasts to the phloem?
- 1 mass flow
  - 2 apoplast pathway
  - 3 symplast pathway
- A** 1, 2 and 3      **B** 1 and 2 only      **C** 1 and 3 only      **D** 2 and 3 only

- 26 Which plan diagram of a transverse section of a dicotyledonous leaf correctly shows the position of xylem and phloem in a palisade mesophyll layer that is twice as thick as the spongy mesophyll layer?



- 27 A short piece of DNA 15 base pairs long was analysed to find the number of nucleotide bases in each of the polynucleotide strands. Some of the results are shown below.

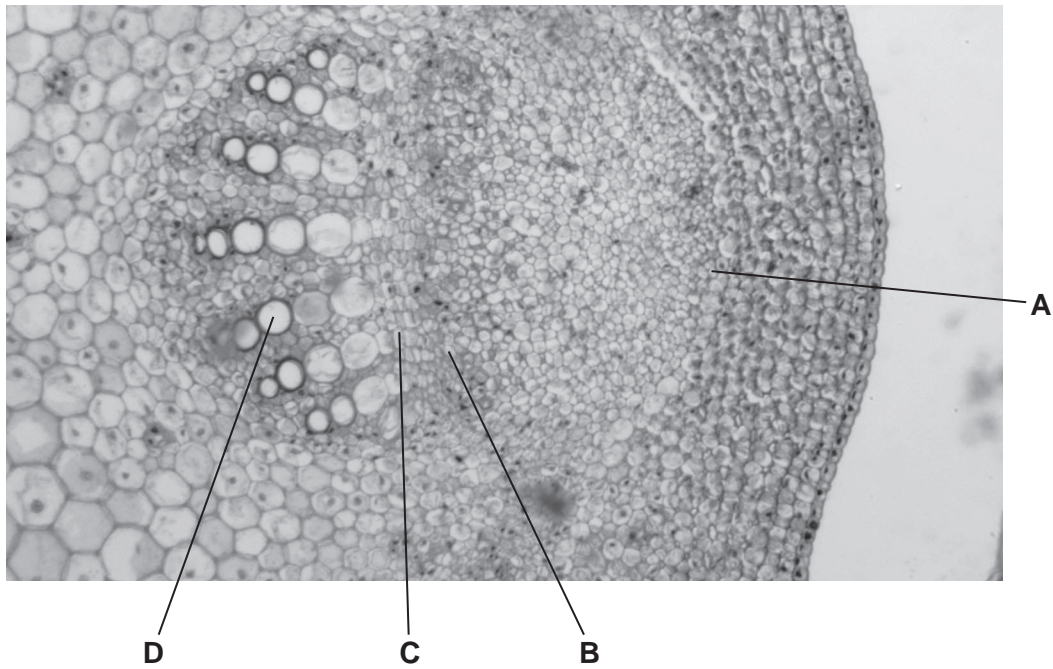
	number of nucleotide bases			
	A	C	G	T
strand 1		6		3
strand 2				4

How many nucleotides containing guanine were present in strand 1?

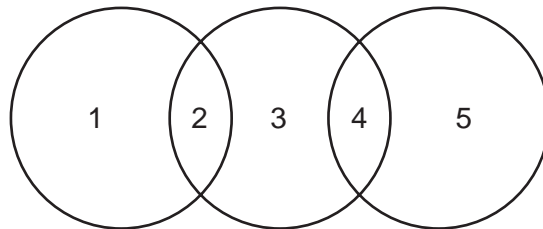
- A** 2                      **B** 3                      **C** 4                      **D** 6

28 The diagram shows a transverse section of a stem.

Which area is the phloem?



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



Which is correct?

	1	2	3	4	5
A	companion cells	endoplasmic reticulum	phloem sieve tube elements	nucleus absent	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	cytoplasm absent	phloem sieve tube elements	vacuole	companion cells

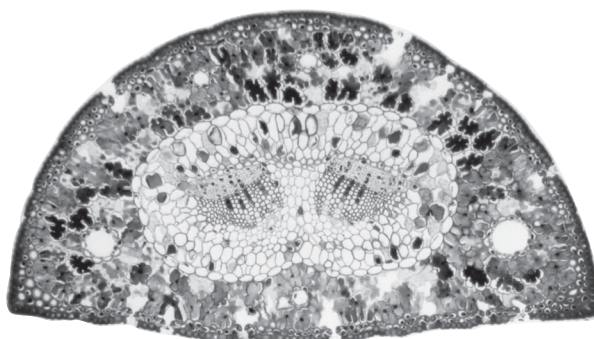
30 Which processes occur in the vascular tissue in leaves and in roots?

	in leaves	in roots
<b>A</b>	sucrose enters phloem and is polymerised to starch	water passes from phloem to xylem by osmosis
<b>B</b>	sucrose enters phloem by active transport and the water potential becomes more negative	sucrose is used or polymerised and the water potential becomes less negative
<b>C</b>	water passes from phloem to xylem by osmosis, making the phloem water potential less negative	active transport of water into the xylem makes the water potential more negative
<b>D</b>	water passes out of xylem and phloem and is lost through transpiration	active transport of ions into the xylem makes the water potential less negative

31 Which feature of xylem vessel elements helps the cohesion of water?

- A** lignin forms an incomplete secondary wall
- B** new vessels carry extra water as a plant grows
- C** there are no cross walls between the vessel elements
- D** the vessel elements form narrow tubes

32 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 and 2 only
- B** 1 and 3 only
- C** 3 and 4 only
- D** 1, 2, 3 and 4



33 What occurs in the sieve tube elements of a photosynthesising leaf and an actively growing root?

	sieve tube elements in leaf	sieve tube elements in root
<b>A</b>	water potential decreases	sugars are moved in
<b>B</b>	water potential decreases	sugars are moved out
<b>C</b>	water potential increases	sugars are moved in
<b>D</b>	water potential increases	sugars are moved out

34 Some fungi cause wilting in crop plants by growing within the xylem vessels.

Which process will be directly affected by these fungi?

- A** cohesion between water molecules
- B** development of root pressure
- C** mass flow during translocation
- D** uptake of water by root hair cells

35 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.

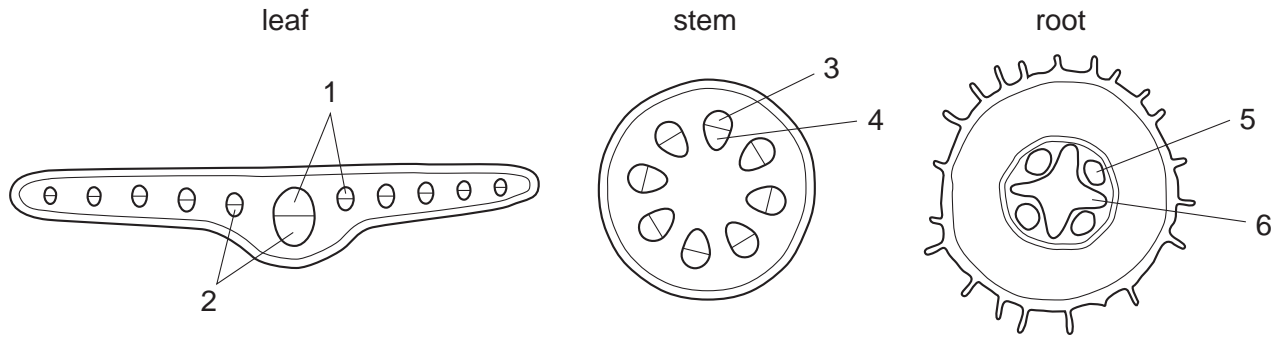
Which student, **A**, **B**, **C** or **D**, suggested a correct set of labels?

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

36 Which row correctly identifies xylem vessel elements and sieve tube elements?

	xylem vessel element		sieve tube element		
	cytoplasm	nucleus	cytoplasm	nucleus	
<b>A</b>	✓	✓	x	x	key ✓ = present x = absent
<b>B</b>	x	✓	x	x	
<b>C</b>	x	x	✓	✓	
<b>D</b>	x	x	✓	x	

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



In the transverse sections, what do 1, 2, 3, 4, 5 and 6 represent?

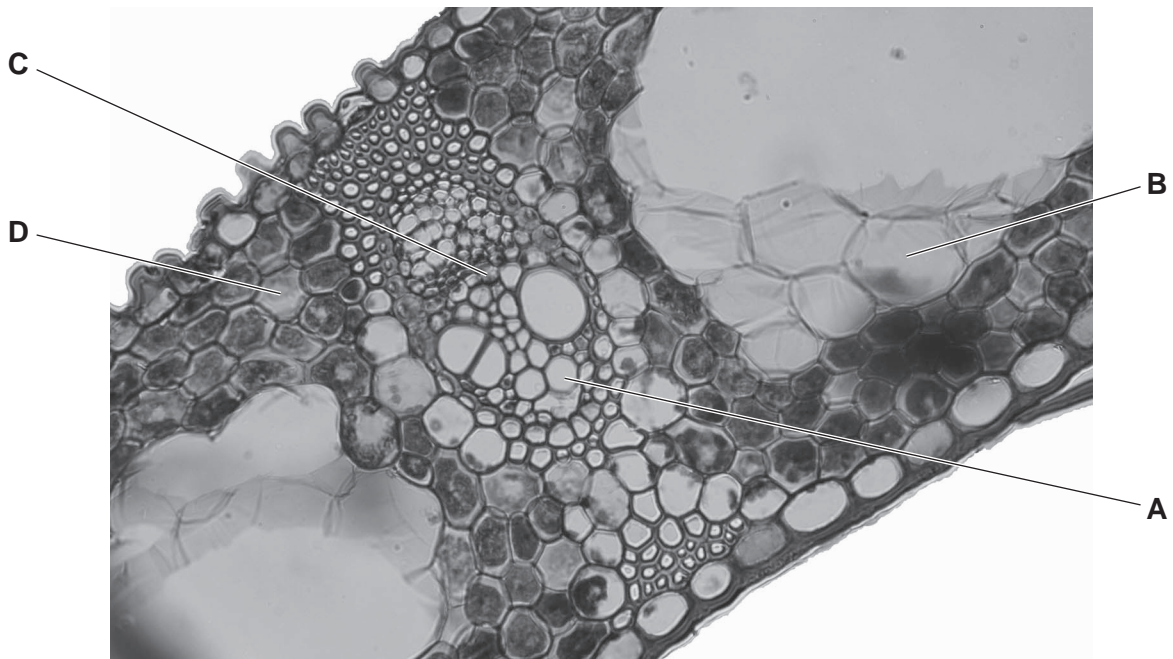
	leaf		stem		root	
	phloem	xylem	phloem	xylem	phloem	xylem
<b>A</b>	1	2	3	4	5	6
<b>B</b>	1	2	4	3	6	5
<b>C</b>	2	1	3	4	5	6
<b>D</b>	2	1	4	3	6	5

38 When drawing a plan diagram of a transverse section of a dicotyledonous leaf, which feature should **not** be included?

- A cuticle on the upper epidermis
- B palisade mesophyll layer
- C vascular bundles in the leaf lamina
- D xylem vessel elements

39 The photomicrograph shows a transverse section of a leaf.

Which cell has the least negative water potential?

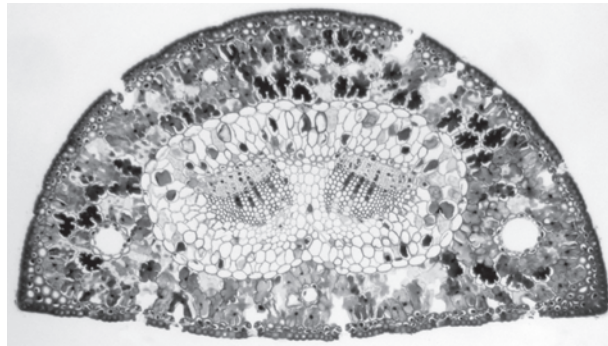


40 Which shows the correct structure of mature xylem vessel elements and phloem sieve tube elements?

		cytoplasm	nucleus	end wall
<b>A</b>	phloem	✓	✓	✓
	xylem	✓	x	x
<b>B</b>	phloem	✓	x	✓
	xylem	x	✓	✓
<b>C</b>	phloem	✓	x	✓
	xylem	x	x	x
<b>D</b>	phloem	x	✓	✓
	xylem	x	x	✓

key  
 ✓ = present  
 x = absent

41 The photomicrograph shows a transverse section through a leaf.



x50

- 1 sunken stomata
- 2 two layers of epithelium
- 3 thick cuticle
- 4 small surface area to volume

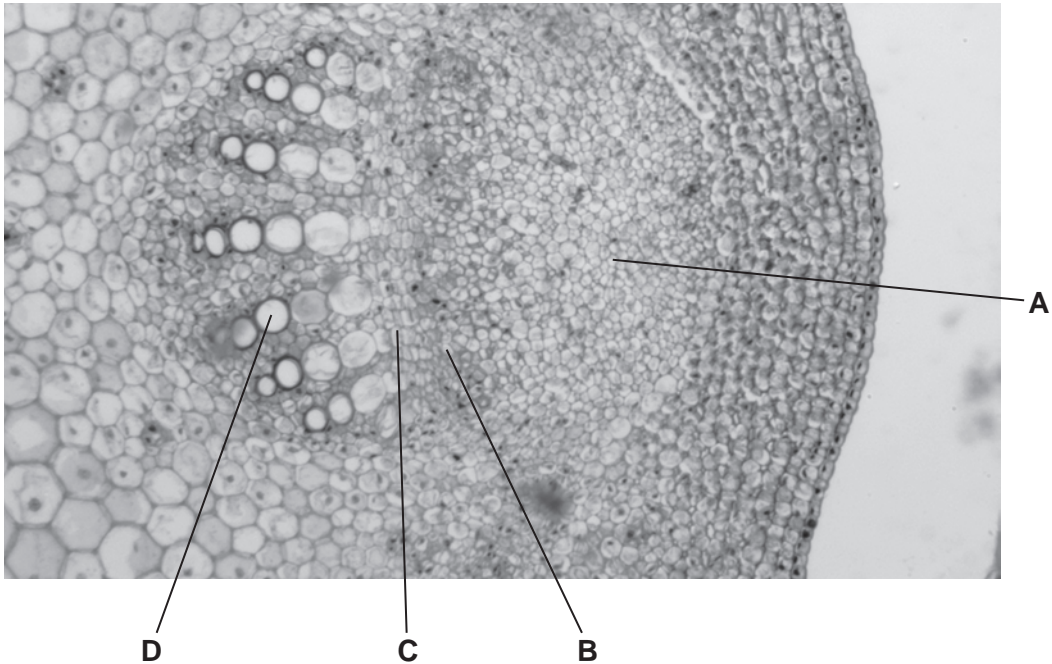
Which features of a xerophytic leaf are visible in this section?

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

- 42 What is the main function of a companion cell in mature 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

43 The diagram shows a transverse section of a stem.

Which area is the phloem?

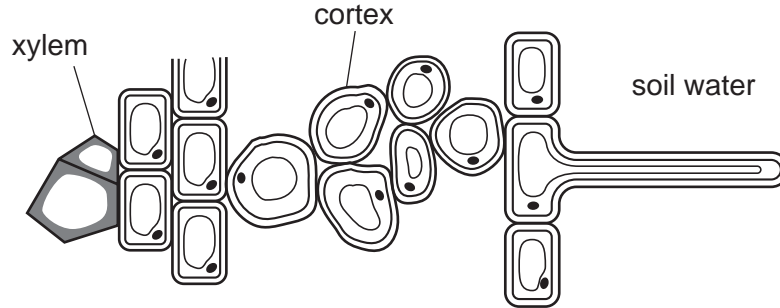


- 44 Which description states some of the features of xylem vessels?
- A** cells joined to form a tube, pits at intervals, sieve plates between cells, surrounded by the endodermis in roots
  - B** contains cells joined end to end, containing peripheral cytoplasm, cell walls with secondary thickening of 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
- 45 When stained, which features, visible under the light microscope, are part of the cells of the plant tissues listed in the table?

	xylem elements	sieve tube elements	companion cells
<b>A</b>	cytoplasm	lignin	nuclei
<b>B</b>	lignin	cytoplasm	nuclei
<b>C</b>	lignin	nuclei	cytoplasm
<b>D</b>	nuclei	cytoplasm	lignin

- 46 Which feature of a root hair cell is **not** an adaptation for water uptake from the soil solution?
- A** lack of a waxy cuticle
  - B** large numbers of mitochondria
  - C** long, thin extension to the cell
  - D** thin cellulose cell wall

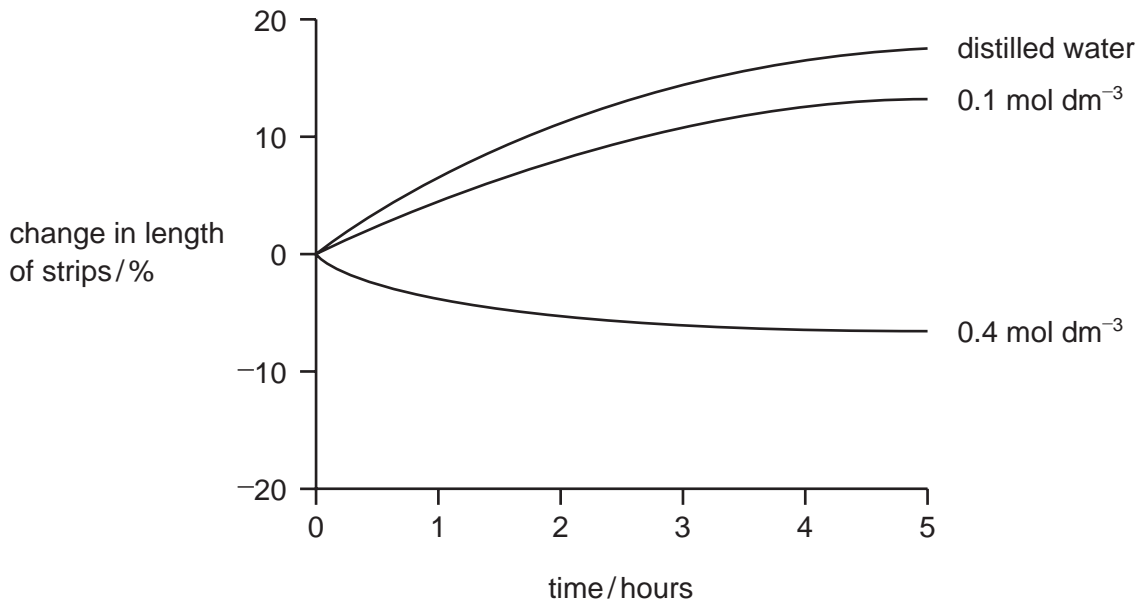
47 The diagram represents a transverse section through a part of the root of a plant.



Which values of water potential (kPa) in the xylem and soil water help to explain why water passes from the soil into the xylem across the cortex?

	xylem	soil water
<b>A</b>	-700 kPa	0 kPa
<b>B</b>	-1800 kPa	-700 kPa
<b>C</b>	0 kPa	-1800 kPa
<b>D</b>	-700 kPa	-1800 kPa

- 48 Strips of potato tuber tissue were immersed in distilled water or in sucrose solutions of different concentrations. The graph shows the percentage change in length of the strips.



Which statement explains the change that occurred in the potato strips immersed in 0.1 mol dm<sup>-3</sup> sucrose solution?

- A Sucrose molecules diffused into the potato cells.
  - B Sucrose molecules were actively transported into the potato cells.
  - C The water potential of the sucrose solution was less negative than the water potential inside the cells.
  - D The water potential of the sucrose solution was more negative than the water potential inside the cells.
- 49 Which organelles occur in large numbers in companion cells in phloem?
- A chloroplasts
  - B lysosomes
  - C mitochondria
  - D starch grains



50 A region of a stem of a plant is heated to kill the cells in the living vascular tissues.

How will this treatment affect the transport between roots and leaves via xylem and phloem?

	xylem	phloem
<b>A</b>	✓	✓
<b>B</b>	✓	x
<b>C</b>	x	✓
<b>D</b>	x	x

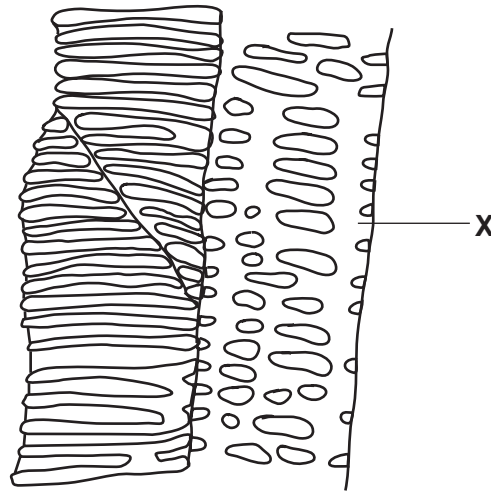
✓ transport continues  
x transport stops

51 Some soil-borne fungi cause wilting in crop plants by growing within the xylem vessels.

Which process will be directly affected by these fungi?

- A** conduction in the apoplast
- B** development of root pressure
- C** stomatal movement
- D** uptake of water by root hairs

52 The diagram shows a longitudinal section through transport tissue in a plant stem.



What are the names of the structure labelled **X** and the tissue in which it is found?

	structure <b>X</b>	tissue
<b>A</b>	sieve tube	phloem
<b>B</b>	sieve tube	xylem
<b>C</b>	vessel	phloem
<b>D</b>	vessel	xylem