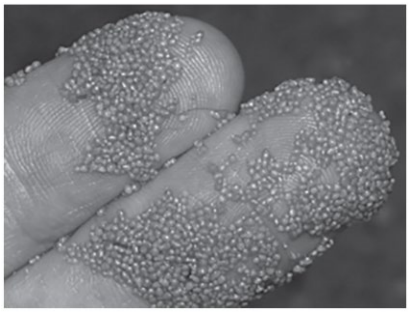
Transport in Plants

1. *Wolffia arrhiza* is one of the smallest flowering plants in the world.



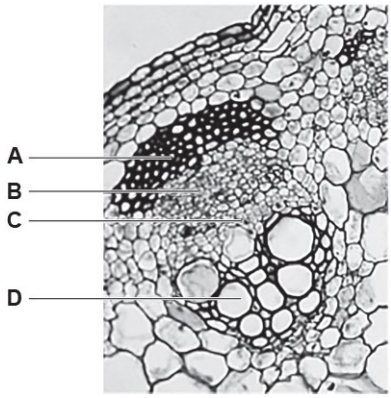
Which of the options, **A** to **D**, explains the absence of a transport system in *Wolffia arrhiza*?

A It has no cell differentiation.
B It has a small surface area to volume ratio.
C It has a large surface area to volume ratio.
D It has a high metabolic rate.

Your answer ☐ **[1]**

2. The image below shows a transverse section of a stem vascular bundle of a sunflower, *Helianthus annuus*.

Which of the options, **A** to **D**, labels the xylem vessels?



Your answer ☐

[1]

3. The rate of transpiration of water can be estimated by recording the rate of water uptake using a potometer.
Two potometers were set up, one with large leaves and one with small leaves.
A calibrated capillary tube that had a diameter of 1 mm was used to introduce the bubble.

Which of the options, **A** to **D**, shows the most appropriate units to compare the rate of transpiration of large leaves compared to small leaves?

A $mm^2\ cm^{-1}\ min^{-1}$
B $mm^3\ cm^{-1}\ min$
C $mm^2\ cm^{-2}\ min^{-1}$
D $mm^3\ cm^{-2}\ min^{-1}$

Your answer ☐ **[1]**

4. The following mechanisms are used to move water through plants:

i. diffusion
ii. osmosis
iii. mass flow.

Which row correctly identifies the mechanism used at each point of the transpiration stream?

	Into root cells	Across root via symplast pathway	Up the stem in the xylem	Across leaf via apoplast pathway	Out of leaf via stomata
A	osmosis	osmosis	mass flow	mass flow	diffusion
B	diffusion	osmosis	osmosis	mass flow	diffusion
C	diffusion	osmosis	osmosis	mass flow	osmosis
D	osmosis	osmosis	mass flow	mass flow	osmosis

Your answer ☐

[1]

5. The following passage has four key terms missing:

Meristem cells in plants are used to generate new plant tissues. When …… tissue is formed, …… impregnates the cell walls, making them impermeable to water. All cytoplasm is lost. When …… tissue is formed, cytoplasm remains, but the …… become elongated and lose most of their cytoplasm.

What is the correct order of missing terms?

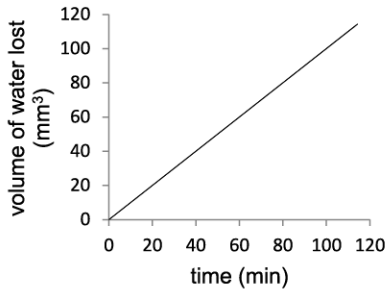
A sclerenchyma, phloem, lignin, xylem vessels
B xylem, lignin, parenchyma, phloem vessels
C phloem, collenchyma, xylem, sieve tube elements
D xylem, lignin, phloem, sieve tube elements

Your answer ☐

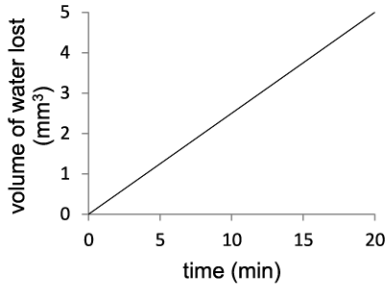
[1]

6. The following graphs show results from an experiment to investigate the rate of transpiration of the same plant in different environments.

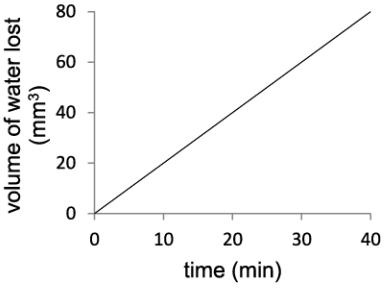
A



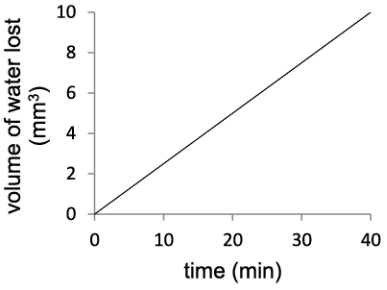
B



C



D

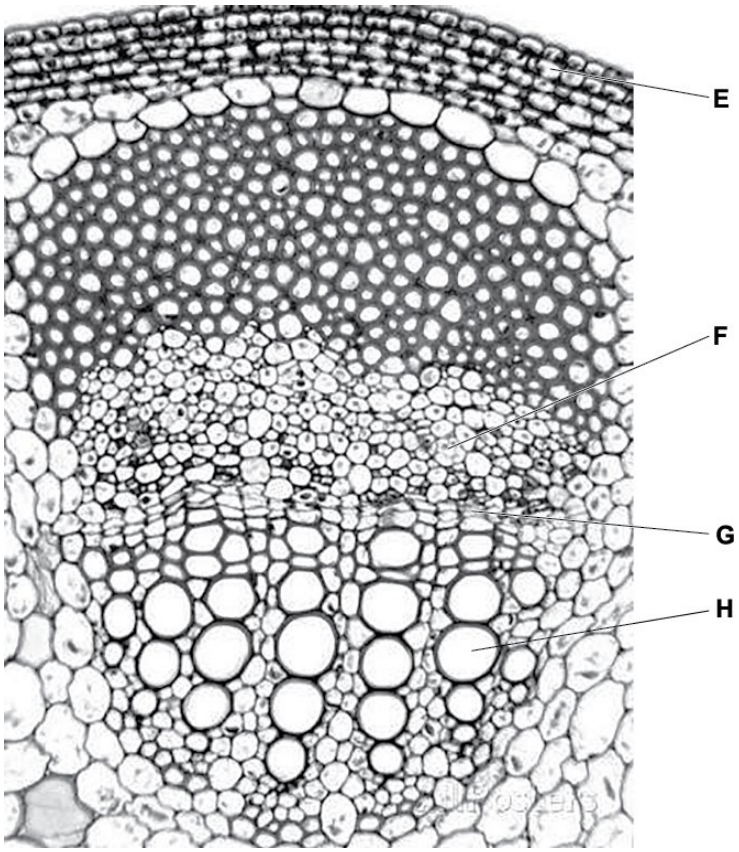


Which graph, **A** to **D**, shows the results for when the plant is being grown in the least humid environment?

Your answer ☐

[1]

7. Below is a light microscope image of a transverse section of part of a plant stem.



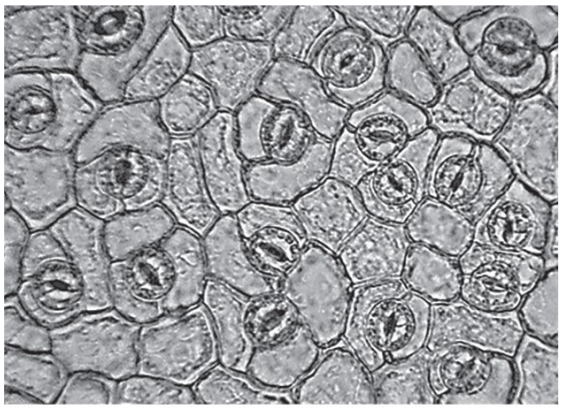
Which row, **A** to **D**, lists the correct labels for this image?

	E	**F**	**G**	**H**
A	xylem	meristem	epidermis	phloem
B	epidermis	phloem	cambium	xylem
C	meristem	phloem	xylem	root hair
D	xylem	cambium	phloem	meristem

Your answer ☐

[1]

8. A student counted stomata on a leaf using a light microscope. The image below shows the stomata that were visible.



The image magnification is ×60.

Which of the options, **A** to **D**, is the correct stomatal density of this leaf?

A 7.50 stomata mm^{-2}
B 0.13 stomata mm^{-2}
C 2428 stomata mm^{-2}
D 0.21 stomata mm^{-2}

Your answer ☐ **[1]**

9. Which of the statements, **A** to **D**, correctly describes the process of adhesion?

A attraction of water molecules to the impermeable walls of xylem tissue
B attraction of water molecules to other water molecules in the xylem tissue
C active transport of water molecules into phloem tissue
D attraction of water molecules to other water molecules in the phloem tissue

Your answer ☐ **[1]**

10. Mistletoe is a plant parasite that lives on the stems of other plants. It survives by removing water and assimilates from the host plant.

The mistletoe binds to the stem of the host plant and grows a specialised root-like tissue called a haustorium that attaches to different tissues in the stem.

One species of mistletoe, *Viscum minimum*, contains no chloroplasts.

Which of the options, **A** to **D**, explains why *V. minimum* does not need chloroplasts?

A the haustorium of *V. minimum* attaches to sieve tube elements
B the haustorium of *V. minimum* attaches to xylem vessels
C the haustorium of *V. minimum* attaches to meristem cells
D the haustorium of *V. minimum* attaches to cambium tissue

Your answer ☐ **[1]**

11. Which of the statements, **A** to **D**, applies to transpiration **and** evaporation?

A It occurs at a faster rate at higher humidity.
B It occurs at a slower rate at greater wind speed.
C It occurs at a slower rate at higher temperature.
D It occurs at the surface of leaves.

Your answer ☐ **[1]**

12. A scientist tested a plant suffering from water stress. The plant was found to have high levels of abscisic acid (ABA) in its tissues.

Which of the following statements, **A** to **D**, explains this observation?

A ABA causes fruit ripening
B ABA prevents leaf drop
C ABA causes phototropism
D ABA stimulates stomatal closing

Your answer ☐ **[1]**

13. Which of the following statements about water transport in plants is/are correct?

1 Transpiration happens as a consequence of the need for gas exchange.

2 There are cohesive forces between water molecules because they form hydrogen bonds with one another.

3 Water is drawn up the stem due to adhesive forces between water molecules.

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

Your answer ☐ **[1]**

14. Which of the following statements, **A** to **D**, describes the movement of water across plant roots?

A The Casparian strip blocks movement by the symplast pathway.
B The symplast pathway requires water to cross partially permeable membranes.
C Water moves from the soil to the root hair cells up a water potential gradient.
D Water moves through the leaves only by the symplast pathway and across the roots only by the apoplast pathway.

Your answer ☐ **[1]**

15. Large multicellular animals need a transport system for oxygen and carbon dioxide.

Large multicellular plants do not need a transport system for oxygen and carbon dioxide.

Which of the following statements, **A** to **D**, correctly explains these observations?

A Large plants have a low surface area to volume ratio.
B Plant cells have a low metabolic rate.
C Plants generate ATP during photosynthesis, so they do not need to respire.
D Plants generate oxygen during photosynthesis.

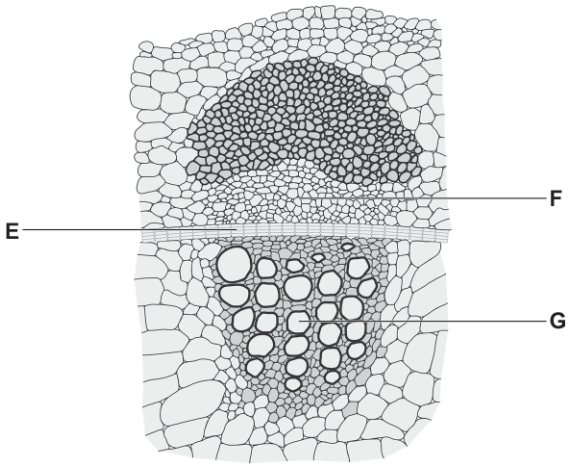
Your answer ☐ **[1]**

16. Which of the following statements, **A** to **D**, does **not** correctly describe the structure or formation of plant vascular tissues?

A Companion cells are linked to xylem vessels by plasmodesmata.
B Mature sieve tube elements do not contain nuclei.
C Phloem and xylem are formed by differentiation of vascular meristems.
D Xylem vessels have non-lignified pits to allow movement in and out.

Your answer ☐ **[1]**

17. The figure below shows a drawing of a light microscope image. The image is a cross-section taken from the stem of a dicotyledonous plant.



Which of the rows, **A** to **D**, correctly identifies the name of the tissue labelled **E** and the functions of tissue **F** and tissue **G**?

	Name of tissue E	Function of tissue F	Function of tissue G
A	cambium	transport of assimilates	transport of water
B	cambium	transport of water	transport of assimilates
C	palisade cells	transport of assimilates	transport of water
D	palisade cells	transport of water	transport of assimilates

Your answer ☐ **[1]**

18. During translocation of photosynthetic products in the phloem sieve tube, hydrogen ions are moved out of companion cells, then sucrose enters the companion cells and moves through plasmodesmata into the sieve tube.

Which of the rows, **A** to **D**, correctly identifies how these substances enter or leave companion cells?

	hydrogen ions out of companion cell	**sucrose into companion cell**	**sucrose out of companion cell**
A	diffusion	facilitated diffusion	diffusion
B	diffusion	active transport	active transport
C	active transport	facilitated diffusion	diffusion
D	active transport	active transport	facilitated diffusion

Your answer ☐ **[1]**

19. Which of the following, **A** to **D**, is **not** an adaptation to reduce water loss in plants?

A an extensive root system that extends far from the plant
B leaves that are reduced to spines that prevent damage from animals
C the ability to store carbon dioxide so stomata only need to open at night
D the surface covered in reflective hairs

Your answer ☐ **[1]**

20. A student designed an investigation into the rate of transpiration in plants. They used eight leaves of the same size, age and species. They kept environmental conditions such as wind speed, temperature and humidity constant.

Why did the student take readings from eight different leaves?

A to make their investigation valid
B to increase the accuracy of their readings
C to assess the repeatability of their data
D to improve the precision of their results

Your answer ☐ **[1]**

21. Many plants are adapted to the availability of water in their environment; one group of these plants is the xerophytes.

Which one of the following statements correctly describes a xerophyte?

A Smooth cordgrass grows in highly saline marine estuary environments.
B The water lily has aerenchyma tissue to allow the movement of gases to submerged roots.
C The poison tree has leafless branches covered in thorns to reduce water loss.
D Water lobelia completes its entire life cycle submerged in shallow ponds.

Your answer ☐ **[1]**

22. Which of the options, **A to D**, is a reason why plants require specialised transport tissue?

A to allow osmosis to take place
B because they all have a large surface area to volume ratio
C to carry sucrose to their leaves
D to overcome the limitations of diffusion over large distances

Your answer ☐ **[1]**

23. The following statements refer to the movement of water from the cortex of the root into the xylem.

Which of the following statements is / are true?

Statement 1: Most of the water moves across the root cortex by the apoplast pathway.
Statement 2: At the endodermis water has to enter the symplast pathway.
Statement 3: Casparian strips in the endodermis contain the chemical lignin.

A. 1, 2 and 3
B. Only 1 and 2
C. Only 1 and 3
D. Only 1

Your answer ☐ **[1]**

24. Translocation occurs through the sieve elements by **……1……** . Sucrose is loaded into the phloem at regions of the plant known as **……2……** . This mechanism is **……3……** . The addition of sucrose **……4……** the water potential of the sieve element sap. This causes water to enter from surrounding tissues by **……5……** which in turn increases the **……6……** of the sap.

Which words correctly complete the numbered gaps **1–6**?

	1	2	3	4	5	6
A	active transport	sources	active	raises	osmosis	concentration
B	mass flow	sources	active	lowers	active transport	pressure
C	mass flow	sinks	passive	raises	diffusion	concentration
D	mass flow	sources	active	lowers	osmosis	pressure

Your answer ☐ **[1]**