Transport in plants – AS 9700 Biology June 2022

1. June/2022/Paper_11/No.26

Which row is correct for the movement of water in a root?

	pathway	molecule present in Casparian strip
A	apoplast pathway through intercellular spaces	suberin
B	apoplast pathway through plasmodesmata	lignin
C	symplast pathway through plasmodesmata	lignin
D	symplast pathway through intercellular spaces	suberin

2. June/2022/Paper_11/No.27

The table contains some information about uptake and movement of water and of mineral ions in plants.

	water	mineral ions
mechanism for uptake	osmosis	diffusion, active transport
site of uptake	root hair cells	root hair cells
mechanism of release	evaporation, diffusion	diffusion, active transport
site of release	stomata	plant cells

Using the information provided, which factors will affect the uptake and movement of water or of mineral ions in plants?

1 humidity

2 surface area of root hair cell

3 oxygen concentration

4 temperature

A 1, 2, 3 and 4

B 1, 3 and 4 only

C 1 and 3 only

D 4 only

3. June/2022/Paper_11/No.28

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

	water potential in the phloem sieve tube becomes	volume of solution in the phloem sieve tube
A	higher	decreases
B	higher	increases
C	lower	decreases
D	lower	increases

4. June/2022/Paper_11/No.29

A student wrote the following statements about a possible mechanism for loading sucrose from a source.

1 When energy is released from ATP, the released energy is used to move sucrose through a co-transporter protein in the companion cell membrane.

2 As sucrose is moved into a companion cell the pH in the cell wall of the companion cell decreases.

3 Proton pumps in the cell membrane of a companion cell move sucrose into the phloem sieve tube element.

Which statements are correct?

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

5. June/2022/Paper_12/No.24

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

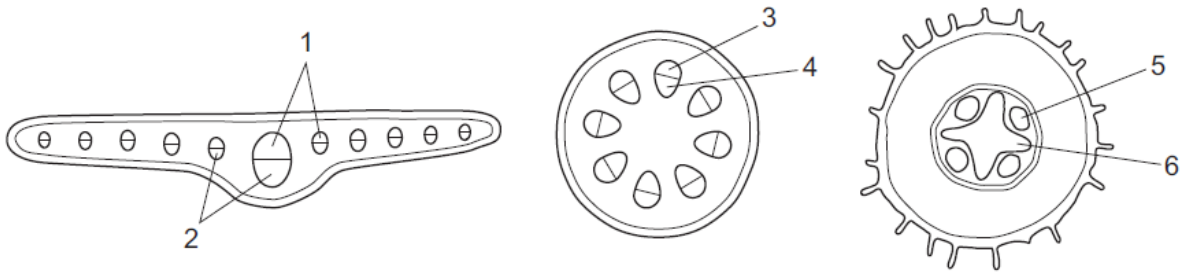
B 1, 4 and 5

C 1 and 4 only

D 2, 3 and 5

6. June/2022/Paper_12/No.25

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

7. June/2022/Paper_12/No.26

Which molecules form hydrogen bonds with water during transpiration?

1 cellulose in the xylem wall

2 suberin in the xylem wall

3 other water molecules in the xylem

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

8. June/2022/Paper_12/No.27

Some plant species can take up heavy metal contaminants that are dissolved in soil water and then transport them within the plant. Within plant cells, the heavy metals accumulate mainly in the vacuole.

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

1 After initial entry into the root, some of the heavy metals can pass through the tonoplast to be stored in the vacuole of cells in the cortex.

2 The heavy metals take an apoplastic pathway in the xylem but at the endodermis must take a symplastic pathway.

3 The rate of accumulation of the heavy metals in leaf cells will be faster at night, when photosynthesis is not occurring, than during the day.

4 The presence of heavy metals causes the transpiration stream to slow down and reduce the rate of transpiration.

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

9. June/2022/Paper_12/No.28

What is the correct route for the movement of water from cell to cell in the apoplast pathway?

A through adjacent cell surface membranes

B through intercellular spaces

C through plasmodesmata

D through the Casparian strip

10. June/2022/Paper_12/No.29

Which row shows the correct sequence for the movement of sucrose into phloem sieve tubes?

	first	second	third
A	diffusion of sucrose into the companion cell cytoplasm	active transport of protons into the companion cell cytoplasm	cotransport of protons and sucrose into the sieve tubes
B	cotransport of protons and sucrose into the companion cell cytoplasm	active transport of protons out of the companion cell cytoplasm	diffusion of sucrose into the sieve tubes
C	active transport of protons into the companion cell cytoplasm	diffusion of sucrose into the companion cell cytoplasm	cotransport of protons and sucrose into the sieve tubes
D	active transport of protons out of the companion cell cytoplasm	cotransport of protons and sucrose into the companion cell cytoplasm	diffusion of sucrose into the sieve tubes

11. June/2022/Paper_12/No.39

A person's blood group is determined by antigens present on the red blood cells. The table shows the antigens and antibodies in the blood of people with different blood groups.

blood group	presence of A or B antigens on red blood cells	presence of antibodies to A or B in plasma
A	A only	anti-B only
B	B only	anti-A only
AB	A and B	neither
O	neither	anti-A and anti-B

During a blood transfusion, it is essential that the person who receives the blood does **not** have antibodies to the donor's blood.

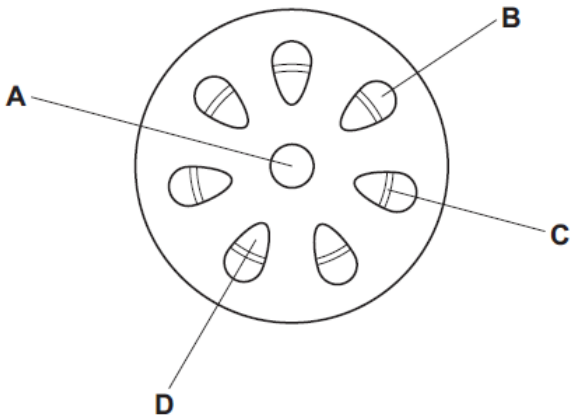
Which blood groups can be given to a person with blood group B?

A A and B **B** AB and B **C** AB and O **D** B and O

12. June/2022/Paper_13/No.26

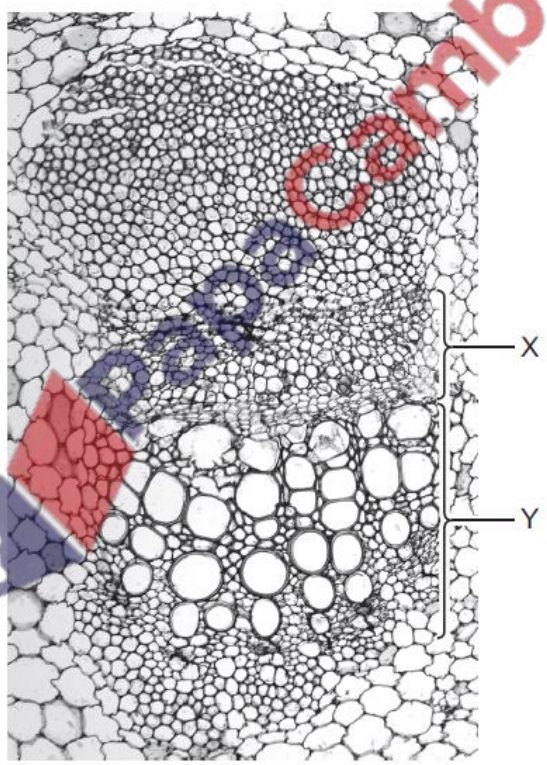
The diagram shows a plant organ.

Which letter correctly labels the xylem?



13. June/2022/Paper_13/No.27

The photomicrograph shows a vascular bundle found in a plant organ.



Which statements about this vascular bundle are correct?

1 The vascular bundle is part of the structure of a root.

2 Some of the cells in region X have very large numbers of mitochondria.

3 Region Y is made up of a number of different cell types.

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

14. June/2022/Paper_13/No.28

Which changes to the water potential and the volume of solution 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 becomes	volume of solution in phloem sieve tube element
A	higher	decreases
B	higher	increases
C	lower	decreases
D	lower	increases

15. June/2022/Paper_13/No.29

Which processes occur during the loading of sucrose into phloem sieve tubes?

1 Protons are pumped out of the cytoplasm of the companion cell into its cell wall.

2 There is a higher concentration of protons in the symplastic pathway outside the companion cell.

3 Protons are unable to move back into the companion cell.

4 A co-transporter molecule acts as a carrier for protons and sucrose.

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

16. June/2022/Paper_22/No.6

The transport tissues of plants are phloem and xylem.

The role of xylem is the transport of water and mineral ions from the soil solution to the different parts of the plant body.

The role of phloem is the translocation of assimilates and other substances from sources to sinks.

(a) The source of mineral ions for the plant is the soil solution. These mineral ions are transported from the roots in the xylem. Mineral ions are also found in the phloem sap within phloem sieve tubes.

Suggest why mineral ions are found within phloem sieve tubes **and** state how they are transported within phloem sieve tubes.

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(b) Phloem tissue consists of different cell types.

Complete the passage using the most appropriate terms to summarise some of the features of phloem tissue.

The end walls of sieve tube elements are modified to allow efficient flow of phloem sap by the formation of ..... . These structures also prevent the cells from bursting under pressure. The cytoplasm of sieve tube elements is very much reduced and is found at the ..... of the cells. Most of the organelles in the cell are absent. Adjacent to sieve tube elements are ..... cells that carry out the metabolic processes of the missing organelles, allowing the sieve tube elements to function. [3]

[Total: 6]

Hakea spp. are xerophytic plants native to Australia. The leaves of *Hakea* have adaptations for a xerophytic mode of life.

(a) Fig. 3.1 is a photomicrograph of a transverse section of part of a leaf of *H. laurina*.

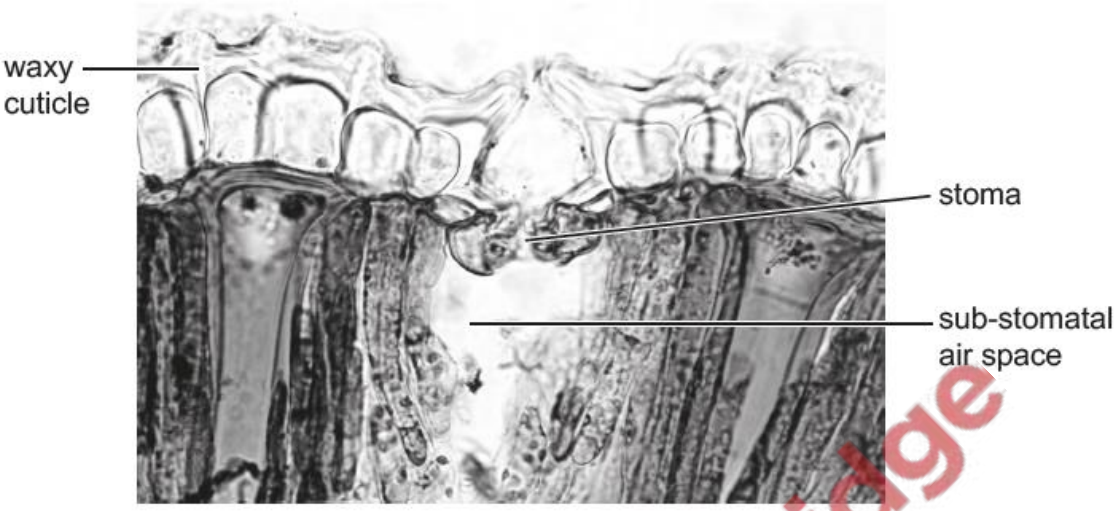

Fig. 3.1

Describe the xerophytic features of the waxy cuticle and the stoma shown in Fig. 3.1 **and** explain how these features adapt the plant to a xerophytic mode of life.

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(b) When the availability of phosphate ions and other soil nutrients is limited, a number of changes occur in the roots of *Hakea* spp.:

- Regions of meristematic tissue are active for a few days.
- Root clusters are formed. A root cluster is a dense arrangement of tiny side roots known as rootlets.
- Most of the epidermal cells of the rootlets are root hair cells.
- Rootlets release compounds into the soil that make phosphates and other mineral ions more soluble for uptake.
- Uptake of phosphate ions and the absorption of water from the soil increases.

(i) Meristem cells have a similar role to stem cells in animals.

Suggest how meristematic tissue activity leads to the formation of root clusters.

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(ii) Organic anions (negatively charged organic compounds) are released into the soil by rootlets. The concentration of these organic anions can become higher in the soil solution than in the rootlet cells.

Suggest **and** explain how the concentration of organic anions in the soil solution can become higher than in the rootlet cells.

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(iii) Explain how the formation of root clusters can lead to an increase in the uptake of phosphate ions and absorption of water from the soil solution.

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[Total: 11]