1. Phloem sap is made up of
(a) water and minerals (b) water and sucrose
(c) water and glucose (d) Both (b) and (c)

2. In plants, which of the following are translocated through phloem?
(a) Hormones (b) Amino acids
(c) Sugars (d) All of these

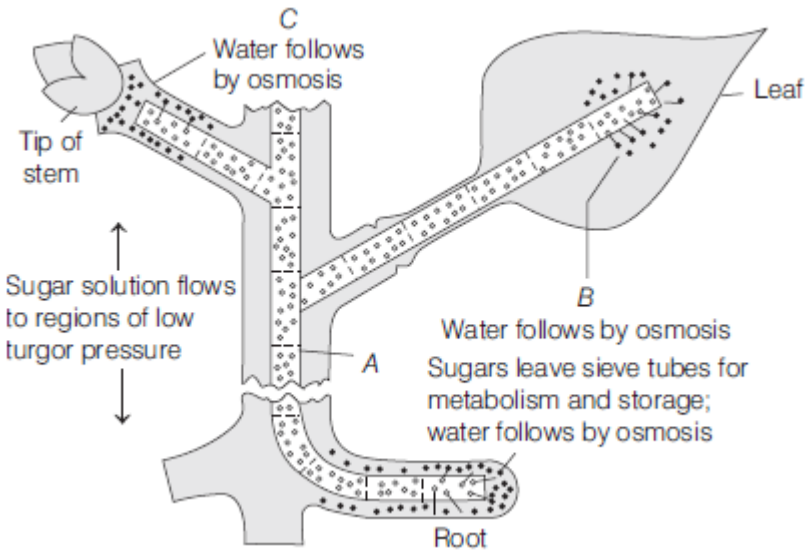
3. Pressure flow hypothesis is for
(a) translocation of sugars
(b) translocation of water
(c) translocation of minerals
(d) None of these

4. The accepted mechanism used for the translocation of sugars from source to sink is
(a) root flow hypothesis (b) pressure flow hypothesis
(c) transpirational pull (d) stem flow hypothesis

5. Loading of phloem sets up a ..... that facilitates mass movement in phloem.
(a) concentration gradient
(b) pressure gradient
(c) water potential gradient
(d) Both (a) and (b)

6. When sugars enter sieve tubes, water flows by osmosis, resulting in
(a) water potential (b) osmotic gradient
(c) turgor pressure (d) DPD

7. In the given diagram, identify the marked phenomenon/part and choose the correct option.



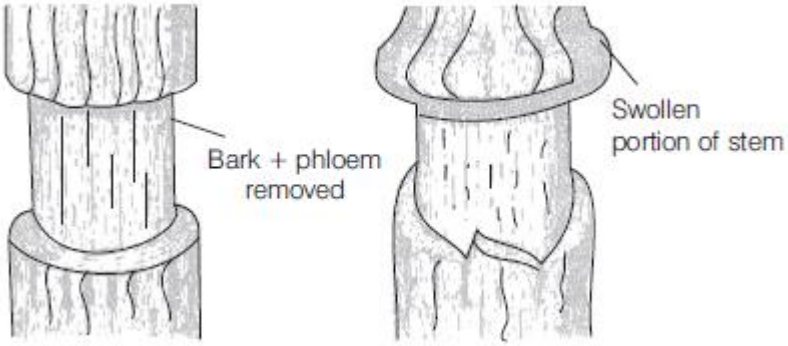
(a) A–Phloem, B–Sugar leaves sieve tube, C–Sugar enters sieve tube
(b) A–Xylem, B–Sugar leaves sieve tube, C–Sugar enters sieve tube
(c) A–Phloem, B–Sugar enters sieve tube, C–Sugars leave sieve tubes
(d) A–Xylem, B–Sugar enters sieve tube, C–Sugars leave sieve tubes

8. Sugar is loaded into sieve tube by
(a) simple diffusion (b) active transport
(c) facilitated transport (d) passive transport

9. If you are given a task to analyse phloem sap chemical, which of the following will be present in least concentration?
(a) Water (b) Sugar
(c) Minerals and nitrogen (d) Hormones

10. Why the transport of organic food through phloem is bidirectional?
(a) Roots serve as source, while leaves are the sink region
(b) Source and sink regions are irreversible
(c) The relationship between the two regions (source and sink) is variable
(d) Translocation of organic solute is regulated by energy

11. The diagram given below represents the simple ringing or girdling experiment. Bark containing phloem is removed. This experiment proves and justify that phloem is the path for translocation of food. In the given diagram, swollen part of stem has been indicated. Choose the correct option for the formation of the swollen part of stem.



(a) Accumulation of food material just above the ringing space
(b) Accumulation of minerals and water just above the ringing space
(c) Due to a repairing mechanism
(d) Injured part undergoes turgor change

12. Stomata open at night and close during day in

(a) Xerophytes (b) Gametophytes
(c) Mesophytes (d) Hydrophytes

13. Stomata in angiosperms does not open during
(a) Noon (b) Twilight
(c) 11 O'clock (d) At midnight

14. Lenticular transpiration takes place in
(a) Fruits (b) Woody stems
(c) Leaves (d) All the above

15. If the rates of transpiration and water absorption of a flowering plant are measured over a period of twenty four hours, it is found that the rate of transpiration reaches its peak at about mid-day and then declines, whereas the peak for water absorption is reached approximately two hours later. Which one the following statements provides the best explanation of these results
(a) There is a temporary reduction of light intensity at mid-day, which reduces the rate of transpiration
(b) Water absorption is mainly due to root respiration and this is affected by soil temperature, which does not reach a maximum for some hours after the maximum air temperature has been reached
(c) The high rate of transpiration causes a water deficit which results in stomatal closure and an increased concentration of leaf cell sap, which in turn causes continued water uptake
(d) The high light intensity results in high internal oxygen concentrations and so increase water uptake

16. By which process atmospheric temperature is maintained

(a) Transpiration (b) Respiration
(c) Photosynthesis (d) Phosphorylation
(e) None of these

17. Path of greater resistance in transpiration is
(a) Stomatal (b) Cuticular
(c) Pectin (d) All equally

18. In plants, movement of water against gravitational force is due to
(a) Biostatic theory
(b) Transpiration pull
(c) Water cohesion
(d) Transpiration pull and water cohesion theory

19. Cohesion–tension theory is directly related with
(a) Absorption (b) Transpiration
(c) Evaporation (d) Guttation

20. Stomata of CAM plants
(a) Never open
(b) Are always open
(c) Open during the day and close at night
(d) Open during the night and close during the day

21. Ultrafiltration theory for permeability of cell membrane was put forth by
(a) Traube (b) Ruhland
(c) Sachs (d) None of these

22. Who explained the scotoactive opening of stomata
(a) Nishida (b) Palls
(c) Ehrler (d) None of the above

23. The scientist, who proposed that production of glycolic acid in guard cells is an important factor in stomatal opening, is
(a) Kumar (b) Steward
(c) Zelitch (d) Lewitt

24. Which of the following method is adopted by plant for the absorption of water when a cut shoot is fitted in a potometer
(a) Active (b) Passive
(c) Partly both (d) None of these

25. Osmoscope is used for
(a) Measuring OP
(b) Measuring TP
(c) Measuring psi
(d) Demonstration of osmosis

26. Potometer and clinostat are used to study
(a) Photosynthesis and respiration
(b) Transpiration and growth
(c) Phototropism and geotropism
(d) Transpiration and geotropism

27. Root pressure in a plant is measured by
(a) Potometer (b) Manometer
(c) Thermometer (d) Barometer

28. Who studied the effect of light on translocation
(a) De Vries (b) Blackman
(c) Williams (d) Hart

29. Marshall and Wardlaw proposed the theory of
(a) Solution flow (b) Volume flow
(c) Active mass flow (d) None of these

30. Mass flow hypothesis was first described by
(a) Swanson (b) Buchnan
(c) Kursanov (d) Munch

1. (b)
2. (d)
3. (a)
4. (b)
5. (*c*) The movement of sugars in the phloem begins at the source, where sugars are loaded (actively transported) into a sieve tube. Loading of the phloem sets up a water potential gradient that facilitates mass movement in the phloem.
6. (a)
7. (c)
8. (b)
9. (c)
10. (*c*) Long distance transport of the substances takes place through bulk flow system. Organic nutrients are supplied over long distance transport by phloem tissue from source to sink region. The direction of transport of these organic nutrients can be upward or downward, i.e. bidirectional. This is due to the variable relationship between synthesis region or source site and sink or utilisation region.

11. (*a*) Option (a) is correct. In girdling or ringing experiment, the path of organic nutrients in the stem of plant is represented, which is carried out by phloem. In the experiment, a ring of bark along with phloem is cut from the stem. Due to the absence of phloem in the ringing part, translocation of food does not take place and gets accumulated above the ring. Bark also swells up and may rise to adventitious roots. Ascent of sap in plants can be demonstrated by girdling experiment.

12. (a) Such stomata are known as scotoactive stomata. This is a mechanism to reduce water loss due to transpiration. These are found in plants like *Opuntia*, *Aloe*, *Bryophyllum* etc.

13. (d)
14. (b) Lenticels are the areas in the bark of woody plants which are filled with loosely arranged cells known as complementary cells. Loss of water vapour through lenticels is called lenticular transpiration.
15. (c) Maximum opening of stomata occurs at about 10 : 00 AM and 3 : 00 PM (At 12 : 00 noon, partial closure of stomata occurs).

16. (a) Because water is removed in the form of vapours during transpiration.
17. (b) Because cuticle is a thick layer of plant parts.

18. (d) The column of xylem resists breaking due to forces of cohesion (between water-water) and adhesion (between wall and water). Thus water is pulled from roots as a result of transpiration pull.
19. (b) Due to transpiration a tension or pull generated in xylem hence it is also called transpiration pull theory.
20. (d) CAM plants possess scotoactive stomata
21. (b) W. Ruhland (1912) and Hoffman (1925) described that, small pores are found on membranes the molecules which are small in size than pores of membrane are only passed through these membranes.

22. (a) Some stomata open during night and remain closed during the day time and found in lower surface. This type of stomatal opening is called scotoactive type. This mechanism was explained by Nishida (1963).

23. (c) Zelitch (1963) proposed that stomata open due to production of glycolic acid by photorespiration in guard cells under low concentration of CO_2.

24. (b)
25. (d)
26. (d) Potometer used for transpiration and clinostat used for geotropism.

27. (b) Manometer (Gk. manos – thin, metron – measure). An instrument for measuring pressure of tension (such as root pressure) in gases and liquids.

28. (d)
29. (a)

30. (d)