Chapter 11
Transport in Plants

FACT/DEFINITION TYPE QUESTIONS

1. In a fully turgid cell
(a) ψ_s will be negative and ψ_p will be positive.
(b) ψ_p will be negative and ψ_s will be positive.
(c) Both ψ_p and ψ_s will be positive.
(d) Both ψ_s and ψ_p will be negative.

2. Which of the following pairs of the cell structures are important for determining the movement of molecules in or out of the plant cell?
(a) Tonoplast + Vacuolar membrane
(b) Tonoplast + Cell membrane
(c) Cell wall + Cell membrane
(d) Cell wall + Tonoplasts

3. The process in which water moves out of the cell and the cell membrane of a plant cell shrinks away from its cell wall is known as
(a) diffusion (b) osmosis
(c) plasmolysis (d) bulk flow

4. Phenomenon of plasmolysis occurs when
(a) cells are kept in hypertonic solution.
(b) cells are kept in hypotonic solution.
(c) cells are kept in hypotonic solution.
(d) none of the above.

5. When a cell is plasmolysed, it becomes
(a) flaccid and its TP becomes zero.
(b) turgid and its TP becomes zero.
(c) turgid and TP becomes equal to OP.
(d) flaccid and DPD becomes zero.

6. Seed increase in its volume by the absorption of water through
(a) osmosis (b) diffusion
(c) imbibition (d) plasmolysis

7. The process by which water is absorbed by solids like colloids causing them to increase in volume is called _____.
(a) osmosis (b) plasmolysis
(c) imbibition (d) diffusion

8. A cell swells up when kept in
(a) hypotonic solution (b) hypertonic solution
(c) isotonic solution (d) any of the three

9. Bulk flow of substances over the longer distances through the vascular tissue is called
(a) simple diffusion (b) facilitated diffusion
(c) active transport (d) translocation

10. Movement that is aided by cytoplasmic streaming and occurs from cell to cell through plasmodesmata is called _____.
(a) apoplast (b) symplast
(c) active transport (d) translocation

11. Casparian strip is made up of
(a) lignin (b) pectin
(c) suberin (d) cellulose

12. At which cell layer, water movement through the apoplast pathway is restricted and is facilitated towards symplast pathway?
(a) Cortex (b) Pericycle
(c) Epidermis (d) Endodermis

13. Which of the following organism helps in the absorption of water and mineral ions from the soil?
(a) *Nostoc* (b) *Anabaena*
(c) Mycorrhiza (d) *Spirullina*

14. A pressure that is responsible for pushing up water to small height in the stem is called
(a) positive root pressure
(b) turgor pressure
(c) pressure gradient
(d) negative root pressure

15. Guttation is loss of impure water which is the result of
(a) osmosis (b) diffusion
(c) root pressure (d) transpiration

16. Which of the following is the most acceptable theory for movement of water through plants?
(a) Cohesion theory (b) Passive transport
(c) Root pressure (d) Capillarity

17. The force responsible for upward conduction of water against gravity comes from _____.

(a) transpiration (b) translocation
(c) respiration (d) photosynthesis

18. Guard cells help in
(a) protection against grazing
(b) transpiration
(c) guttation
(d) fighting against infection

19. Which of the following wall of guard cells is thick?
(a) Side wall (b) Middle wall
(c) Inner (d) Outer

20. When a root absorbes minerals from a region of lower concentration to a region of higher concentration, and need energy then this type of absorption is called
(a) passive absorption (b) facilitated diffusion
(c) active absorption (d) osmosis

21. In root endodermis there is one way active transport of ions because of presence of
(a) pericycle (b) suberin layer
(c) cortex (d) cellulosic layer

22. Sinks are related to
(a) transport of minerals (b) stomata
(c) hydathodes (d) phytochrome

23. Translocation of food in flowering plants occurs in the form of
(a) starch (b) glyceraldehyde
(c) glucose (d) sucrose

24. During fruit development, photosynthesizing leaves would be the _____ and the fruit would be _____
(a) sink, sink (b) source, source
(c) sink, source (d) source, sink

25. Bidirectional translocation of minerals takes place in
(a) xylem (b) phloem
(c) parenchyma (d) cambium

26. _____is mainly water and sucrose, but other sugars, hormones and amino acids are also _____ through phloem.
(a) xylem sap, loaded
(b) phloem sap, translocated
(c) xylem sap, translocated
(d) phloem sap, loaded

27. The hypothesis accepted for the translocation of sugar from source to sink is_____.
(a) pressure gradient
(b) pressure flow hypothesis
(c) mass flow hypothesis
(d) both (b) and (c)

28. The process of loading at the source produces a _____. condition in the phloem.
(a) hypertonic (b) isotonic
(c) hypotonic (d) hydroponic

29. Water in the adjacent xylem moves into the phloem by the process of
(a) facilitated diffusion (b) acute transport
(c) simple diffusion (d) osmosis

30. Phloem tissue is composed of sieve tube cells, which form long columns with holes in their end walls called _____.
(a) tracheids (b) sieve elements
(c) sieve plate (d) companion cell

STATEMENT TYPE QUESTIONS

31. Find out the incorrect statements.
(a) The process of plasmolysis is usually irreversible.
(b) The pressure exerted by the protoplasts due to entry of water against the rigid walls is called ψ_p.
(c) The T.P. is responsible for enlargement and extension growth of cells.
(d) Plant cells swell in hypotonic solutions.

32. Which of the following the statements regarding mycorrhizae is incorrect?
(a) Mycorrhizal fungi form a network around the young root and they penetrate the root cells.
(b) Mycorrhizae helps the plant to absorb water and minerals.
(c) Root provides sugar and nitrogenous organic compounds to the mycorrhizae.
(d) *Pinus* seed can germinate and establish without mycorrhizae.

33. Which of the following statement is incorrect regarding stomata?
(a) It helps in exchange of oxygen and carbon dioxide in the leaf.
(b) It is open in the day time and close during the night.
(c) Opening or closing of the stomata is a change in the turgidity of the guard cells.
(d) The inner wall of each guard cell, towards the stomatal aperture is thin and rigid.

34. Which of the following statement is correct?
(a) Unlike water, all minerals cannot be passively absorbed by roots.
(b) Most of the minerals enter the root by active transport.
(c) Ions are absorbed from soil by both passive and active transport.
(d) All of the above

35. Which of the following statements is/are not incorrect?
(i) Water and minerals, and food are generally moved by a mass or bulk flow system.
(ii) Bulk flow can be achieved either through a positive hydrostatic pressure gradient or a negative hydrostatic pressure gradient.
(iii) The bulk movement of substances through the conducting tissues of plants is called translocation.

(iv) Xylem translocates organic and inorganic solutes, mainly from roots to the aerial parts of the plants.

(v) Phloem translocates water, mineral salts, some organic nitrogen and hormones, from the leaves to other parts of the plants.

(a) (ii), (iii) and (v) (b) (ii), (iii) and (iv)
(c) (iv) and (v) (d) (ii) and (v)

36. Which of the following statements is/are correct?

(i) The apoplastic movement of water occurs exclusively through the cell wall without crossing any membranes.

(ii) The apoplastic movement occurs from cell to cell through the plasmodesmata.

(iii) Endodermis is impervious to water because of a band of suberised matrix.

(iv) Symplastic movement may be aided by cytoplasmic streaming which occurs in *Hydrilla* leaf and chloroplast.

(a) (i) and (ii) (b) (ii) and (iv)
(c) (i), (iii) and (iv) (d) (i), (ii) and (iv)

37. Which of the following factors affect transpiration?

(i) Number and distribution of stomata.

(ii) Percent of open stomata.

(iii) Water status of the plant.

(iv) Canopy structure.

(a) (i) and (ii) (b) (i), (ii) and (iii)
(c) (ii) and (iv) (d) (i), (ii), (iii) and (iv)

38. Which of the following statements, (i -v) regarding transpiration is/are correct?

(i) It creates transpiration pull for absorption and transport of plants.

(ii) It supplies water for photosynthesis.

(iii) It transports minerals from the soil to all parts of the plants.

(iv) It heats leaf surfaces, sometimes 10 to 15 degrees.

(v) It maintains the shape and structure of the plants by keeping cells turgid.

(a) Only (ii) (b) Only (iii)
(c) (i), (ii), (iii) and (v) (d) All

39. The following statements are associated with translocation of mineral ions.

(i) Mineral ions are slowly remobilised.

(ii) Younger leaves export most of their minerals content to older leaves.

(iii) Elements most readily mobilised are P, S, N and K.

(iv) Some elements that are structural components like calcium are not remobilised.

Which of the above statements are correct?

(a) (i) and (iii) (b) (i) and (ii)
(c) (iii) and (iv) (d) (ii) and (iii)

ASSERTION/REASON TYPE QUESTIONS

In the following questions, a statement of Assertion is followed by a statement of Reason.

(a) If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.
(b) If both Assertion and Reason are true but the Reason is not the correct explanation of the Assertion.
(c) If Assertion is true but Reason is false.
(d) If both Assertion and Reason are false.

40. **Assertion** : In symport both molecules cross the membrane in the same direction at the same time.

Reason : In antiport both molecules move in the opposite direction.

41. **Assertion** : More is the number of solute molecules, the lower is ψ_w.

Reason : Presence of solute particles reduces the free energy of water and decreases the water potential.

42. **Assertion** : Osmosis is a special type of diffusion through a semipermeable membrane.

Reason : The net rate and direction of osmosis depends upon the pressure gradient.

43. **Assertion** : Stomata are usually open in the day time and close during the night.

Reason : The opening or closing of stomata is due to the change in the turgidity of the guard cells.

44. **Assertion** : Cohesion, adhesion and surface tension give high tensile strength to water.

Reason : Capillarity is aided by small diameter of the tracheary elements.

45. **Assertion**: Ions are absorbed from the soil only by active transport.

Reason : The proteins present in the membranes of root hair cells passively pump ions from the soil into the cytoplasm of the epidermal cells.

MATCHING TYPE QUESTIONS

46. Match column-I with column-II and find out the correct option from the codes given below.

	Column - I		**Column - II**
A.	Isotonic	I.	External solution is more concentrated
B.	Hypotonic	II.	Shrinkage of protoplasm
C.	Hypertonic	III.	Solution is more dilute than the cytoplasm
D.	Plasmolysis	IV	Two solutions have the same osmolarity

(a) A – II; B – I; C – IV; D – III
(b) A – IV; B – III; C – I; D – II
(c) A – III; B – I; C – IV; D – II
(d) A – II; B – III; C – IV; D – I

47. Match the name of the activities given under column-I with the description of activity given under column-II and choose the correct option.

	Column-I		Column-II
A.	Cohesion	I.	The ability to rise in their tubes.
B.	Adhesion	II.	Loss of water vapour from plant parts.
C.	Tensile strength	III.	Mutual attraction between water molecules
D.	Capillarity	IV.	Attraction of water molecules to polar surfaces
		V.	An ability to resist a pulling force.

(a) A – I; B – II; C – III; D – V
(b) A – II; B – I; C – IV; D – III
(c) A – III; B – IV; C – V; D – I
(d) A – IV; B – V; C – II; D – III

48. Match the name of the activities given under column-I with the description of activity given under column-II and choose the correct option.

	Column-I		Column-II
A.	Transpiration	I.	Anaerobic respiration in yeast
B.	Guttation	II.	Active absorption of water
C.	Exudation	III.	Loss of water vapour from plant parts
D.	Fermentation	IV.	Loss of liquid water from leaves
		V.	Loss of water from injured plant parts

(a) A – I; B – II; C – III; D – V
(b) A – II; B – I; C – IV; D – III
(c) A – III; B – IV; C – V; D – I
(d) A – IV; B – V; C – II; D – III

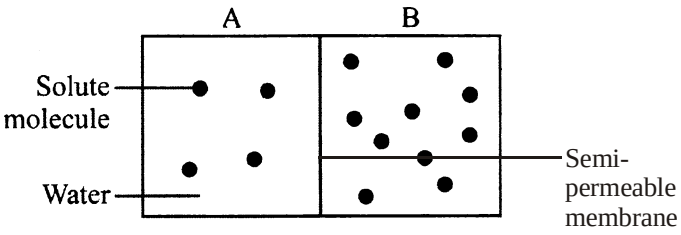
49. Match column-I with column-II and find out the correct answer from the code given below.

	Column-I		Column -II
A.	Diffusion	I.	Hydrophilic substances
B.	Osmosis	II.	Shrinkage of protoplasm
C.	Imbibition	III.	Semipermeable membrane
D.	Plasmolysis	IV.	Free movement of ions and gases

(a) A – II; B – I; C –IV; D – III
(b) A – IV; B – III; C – I; D – II
(c) A – III; B – I; C – IV; D – II
(d) A – II; B – III; C – IV; D – I

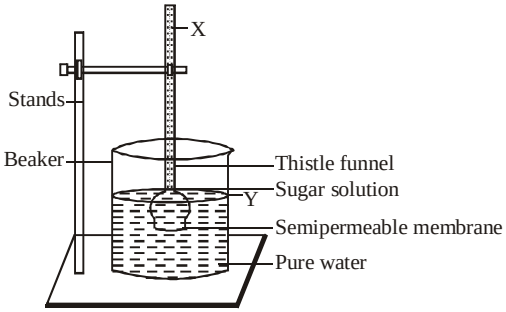
DIAGRAM TYPE QUESTIONS

50. In the given figure, chamber A and B are separated by a semipermeable membrane. Study the given figure and choose the right option.



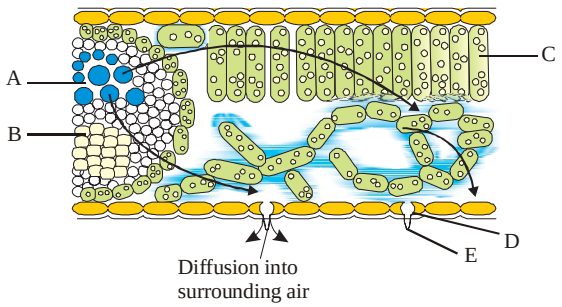
(a) Chamber A has higher water potential and water will move from A to B.
(b) Chamber B has lower solute potential and water will move from A to B.
(c) Chamber A has higher solute potential and water will move from B to A.
(d) Chamber B has lower water potential and water will move from B to A.

51. Study the experiment shown below :



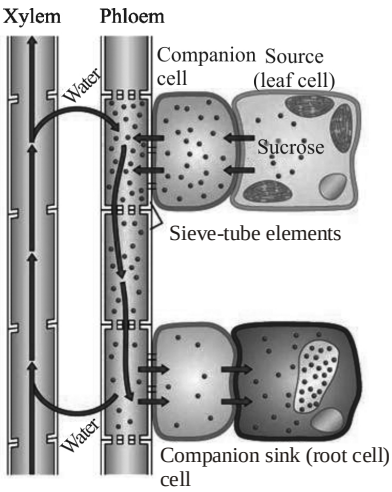
After a few days, which of the following will have occured ?
(a) A rise in level X and Y
(b) A drop in level X and level Y
(c) A rise in level X and a drop in level Y
(d) A drop in level X and a rise in level Y

52. Choose the option which shows the correct labelling of the parts marked as A, B, C, D and E in the given figure of water movement in the leaf.



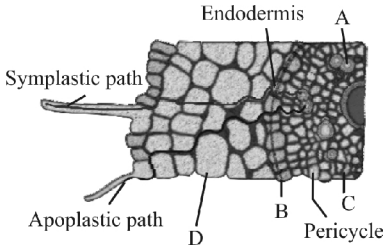
(a) A - Tracheids, B - Phloem, C - Mesophyll, D - Stomatal pore, E - Guard cell
(b) A - Phloem, B - Xylem, C - Palisade, D - Guard Cell, E - Water pore
(c) A - Xylem, B - Phloem, C - Palisade, D - Guard cell, E - Stomatal pore
(d) A - Phloem, B - Xylem, C - Mesophyll cell, D - guard cell, E - Water pore

53. Based on Munch's pressure-flow hypothesis shown in the given figure which of the following conditions would increase the rate of translocation?



(a) An increase in the humidity in the outside air.
(b) A decrease in phloem unloading at the sink.
(c) An increase in sucrose production at the source.
(d) A decrease in photosynthesis.

54. The given figure represents symplastic and apoplastic pathways of water & ion absorption & movement in roots. Few parts are marked as A, B, C & D. At the endodermis, water movement through the apoplast pathway is obstructed by which part (marked as A, B, C & D)?



(a) A (b) B
(c) C (d) D

CRITICAL THINKING TYPE QUESTIONS

55. Cell A and cell B are adjacent plant cells. In cell A, $\psi_s = -20$ bars and $\psi_p = 8$ bars. In cell B, $\psi_s = -12$ bars and $\psi_p = 2$ bars. Then

(a) water moves from cell A to cell B.
(b) there is no movement of water between cell A and cell B.
(c) water moves from cell B to cell A.
(d) equal amount of water is simultaneously exchanged between cell A and cell B.

56 . A plant cell placed in pure water will

(a) expand until the osmotic potential or solute potential reaches that of water.
(b) becomes more turgid until the pressure potential of cell reaches its osmotic potential.
(c) become more turgid until osmotic potential reaches that of pure water.
(d) becomes less turgid until the osmotic potential reaches that of pure water.

57. A boy is studying transport of a certain type of molecules into cell. He finds that transport slows down when the cells are poisoned with a chemical that inhibits energy production. Under normal circumstances the molecules studied by the boy is probably transported by

(a) simple diffusion (b) osmosis
(c) active transport (d) facilitated diffusion

58. Osmosis is a form of diffusion in which

(a) the solvent moves through a semipermeable membrane from its region of higher chemical potential to its region of lower chemical potential.
(b) the solvent moves through a semipermeable membrane from its region of lower chemical potential to its region of higher chemical potential.
(c) the solute moves through a semipermeable membrane from a region of higher concentration to lower concentration.
(d) the solute moves through a semipermeable membrane from a region of lower concentration to higher concentration.

59. Water will move from its region of higher chemical potential to its region of lower chemical potential until

(a) equilibrium is reached.
(b) amount of both solvent and solute in both regions become equal.
(c) solvent amount in both regions become equal.
(d) solute amount in both regions become equal.

60. Read the given statement and answer the question :
"Osmosis is the diffusion of a solution of a weaker concentration when both are separated by semipermeable membrane".
What is the error in the statement ?

(a) The movement of solvent molecule is not specified.
(b) There is no mention of DPD.
(c) Behaviour of semipermeable membrane is not specified.
(d) The exact concentration of solutions are not indicated.

61. The net direction and rate of osmosis depends on both the 'X' and 'Y'. Identify 'X' and 'Y'.
(a) X - Solute; Y - Solvent
(b) X - Pressure potential; Y - Solute potential
(c) X - Water potential; Y - Pressure gradient
(d) X - Pressure gradient; Y - Concentration gradient

62. Bacteria cannot survive in a highly salted pickle because
(a) salt inhibits reproduction of bacteria.
(b) they become plasmolysed and death occurs.
(c) nutrients in pickle cannot support life.
(d) enough light is not available for photosynthesis.

63. A cell is said to be flaccid when
(a) there is no net flow of water towards the inside or outside.
(b) the external solution balances the osmotic pressure of the cytoplasm.
(c) water flows into the cell and out of the cell and are in equilibrium.
(d) the external solution is more dilute than the cytoplasm.

64. Process of imbibition results in
(a) increase in the volume of imbibant but without development of pressure.
(b) decrease in the volume of imbibant and development of pressure.
(c) no change in volume of imbibant but pressure develops.
(d) increases in volume of imbibant and development of pressure.

65. Seeds when soaked in water, they imbibe because of
(a) OP inside the seed is low.
(b) OP of water is high.
(c) DPD of seed is very much low.
(d) water potential gradient between the seed coat and water.

66. A bottle filled with previously moistened mustard seeds and water was screw capped tightly and kept in a corner. It blew up suddenly after about half an hour. The phenomenon involved in this is
(a) diffusion (b) imbibition
(c) osmosis (d) D.P.D.

67. Dry wooden stakes, if driven into a small crack in a rock and then soaked, can develop enough pressure to split the rock. Such a pressure is built up through the phenomenon of
(a) imbibition (b) transpiration
(c) turgor pressure (d) plasmolysis

68. A boy has taken fresh twig from a tree and then he placed it into a coloured water. After a few hours he cut the surface of the twig and examine it with a magnifying glass to study the path of water movement. This experiment demonstrates that movement of water occurs through
(a) xylem (b) phloem
(c) sieve tube (d) casparian strip

69. The movement of water from one cell of the cortex to the adjacent one in roots is due to
(a) water potential gradient.
(b) chemical potential gradient.
(c) turgor pressure.
(d) mass flow.

70. 'X' breaks the continuity of the 'Y' pathway and forces water and solutes to cross the endodermis by passing through the plasma membrane. Identify 'X' and 'Y'.
(a) X - Suberin; Y - Tonoplast
(b) X - Suberin; Y - Symplast
(c) X - Casparian strip ; Y - Tonoplast
(d) X - Casparian strip ; Y - Apoplast

71. The path of water from soil upto secondary xylem is
(a) Soil → Root hair cell wall → Cortex → Endodermis → Pericycle → Protoxylem → Metaxylem
(b) Metaxylem → Protoxylem → Cortex → Soil → Root hair
(c) Cortex → Root hair → Endodermis → Pericycle → Protoxylem → Metaxylem
(d) Pericycle → Soil → Root hair → Cortex → Endodermis → Protoxylem → Metaxylem

72. A Botanist discovered a mutant plant that was unable to produce materials that form casparian strip. This plant would
(a) unable to transport water or solutes to the leaves.
(b) unable to use its sugar as a sugar sink.
(c) able to exert greater root pressure than the normal plant.
(d) unable to control amounts of water and solutes it absorbs.

73. Which of the following is correct regarding guttation?
(a) It occurs through stomata.
(b) It occurs through hydathodes.
(c) It occurs mostly during night and early morning.
(d) Both (b) and (c)

74. Which one of the following is not related to guttation?
(a) Water is given out in the form of droplets.
(b) Water given out is impure.
(c) Water is given out during daytime.
(d) Guttation is a process of universal occurrence.

75. Which of the following compound is used to study water loss from a leaf and turns colour on absorbing water?
(a) Calcium chloride (b) Magnesium chloride
(c) Cobalt chloride (d) Sodium chloride

76. Stomata in angiosperms open and close due to
(a) their genetic constitution.
(b) effect of hormone.
(c) changes of turgor pressure in guard cells.
(d) pressure of gases inside the leaves.

77. Stomata closes because
(a) guard cells lose turgidity and becomes flaccid
(b) of increased turgidity of the guard cells brought about by exposure to light.
(c) O.P. of the guard cell increases
(d) of the movement of water from neighbouring cells into guard cells.

78. Arrange the following events in a correct order that explains the mass flow of materials in the phloem?
(i) Water diffuses into the sieve tube elements.
(ii) Leaf cells produce sugar by photosynthesis.
(iii) Solutes are actively transported into the sieve elements.
(iv) Sugar is transported from cell to cell in the leaf.
(v) Sugar moves down the stem.
(a) (ii) – (iv) – (iii) – (i) – (v)
(b) (ii) – (iv) – (i) – (iii) – (v)
(c) (i) – (ii) – (iii) – (iv) – (v)
(d) (iv) – (ii) – (i) – (iii) – (v)

79. If a stem is girdled,
(a) root dies first.
(b) shoot dies first.
(c) both die together.
(d) none of the above.

80. Stomata opens when
(a) guard cells swell due to a decrease in their water potential.
(b) guard cells swell up due to an increase in their water potential.
(c) guard cells swell by endosmosis due to efflux of potassium ions.
(d) guard cells swell by endosmosis due to influx of hydrogen ions (protons).

81. Transpiration facilitates
(a) electrolyte balance
(b) absorption of water by roots
(c) opening of stomata
(d) excretion of minerals.

82. Which of the following will affect the active uptake of water?
(a) Transpirational power of the root hairs.
(b) Typical tissue organization.
(c) Tension due to transpiration.
(d) Osmotic concentration of the cell sap of the leaves.

83. In part A of a plant, sugars are actively transported into the phloem tissue. In part B, sugars are actively transported out of the phloem. Which way will the phloem sap move under these conditions?
(a) From A to B.
(b) From B to A.
(c) First from A to B; then, once the pressure builds up, from B to A.
(d) First from B to A; then, once the pressure builds up, from A to B.

84. If the external solutions balance the osmotic pressure of cytoplasm, it is said to be
(a) isotonic (b) hypotonic
(c) atomic (d) hypertonic