

Transport in Plants
I PUC – Biology
Chapter - 11

One mark

1. What is transport over long distances through xylem and phloem called as?
Ans: Translocation.
2. Why is diffusion considered to be a passive process?
Ans: Because it does not require energy.
3. Gaseous movement within the plants takes place through which process?
Ans: Diffusion
4. What is facilitated diffusion?
Ans: It is the diffusion of water or water soluble substances from a region of its higher concentration to the region of its lower concentration with the help of carrier molecules in the membrane.
5. When is the rate of transport across the membrane maximum during facilitated diffusion?
Ans: The rate of transport across the membrane reaches maximum, when all the protein transporters are being used (saturation)
6. Name the proteins that help in facilitated diffusion by forming pores on the membrane.
Ans: Transport protein.
7. What is meant by uphill transport?
Ans: Transport against concentration gradient using energy i.e in active transport.
8. What is solute potential?
Ans: Decline in the amount of free energy of water molecule due to the presence of solute molecules.
9. When can water potential be equal to solute potential?
Ans: Solution at atmospheric pressure $\Psi_w = \Psi_s$
10. Give an expression to show the relationship between Ψ_w , Ψ_s & Ψ_p .
Ans: $\Psi_w = \Psi_s + \Psi_p$.
11. What happens to a cell whose Ψ_p increases?
Ans: Cell becomes turgid.
12. The contents of which cell component decides the solute potential of the cell?
Ans: Cell Sap
13. In plant cells which are the 2 membrane determinants for movement of molecules in or out of the cell?
Ans: Cell Membrane & Tonoplast.
14. Define Osmosis.
Ans: Movement of water molecules from a region of its higher concentration to a region of its lower concentration through semi-permeable membrane is called Osmosis.
15. What is meant by isotonic solution?
Ans: If the external solution balances OP of the cytoplasm, the solution is said to be Isotonic.
16. A cell is placed in a solution. There is no net flow of water inside or outside the cell. What does this indicate?

Ans: It indicates that OP of cytoplasm & external solution are same. / Isotonic solution.

17. When is a cell said to be flaccid?

Ans: The cell is said to be flaccid when water flows into the cell & out of cell and are in equilibrium.

18. How can plasmolysis be reversed?

Ans: Plasmolysis can be reversed by placing freshly plasmolysed cell in hypotonic solution.

19. Mention the role played by root hair.

Ans: Absorption of water & minerals by diffusion.

20. Name the 2 pathways of movement of water into the deeper layers of the root.

Ans: Apoplast, Symplast.

21. Mention 2 factors that help in symplastic movement.

Ans: Plasmodesmata, cytoplasmic streaming.

22. What is root pressure?

Ans: Root pressure is the hydrostatic pressure developed in the xylem elements as a result of metabolic activities of the root.

23. Name the experiment used to identify the tissues through which food is transported.

Ans: Girdling experiment.

24. Which element that forms structural component in plants, is not remobilised?

Ans: Calcium.

25. Name 2 elements that are readily mobilized in plants.

Ans: Phosphorus, Sulphur, Nitrogen, Potassium.

26. Name the process involved in unloading of mineral ions at the vein endings.

Ans: Active process.

27. Explain why pure water has the maximum water potential.

Ans: Because it has no solute molecules in it.

28. What happens when a pressure greater than the atmospheric pressure is applied to pure water or a solution?

Ans: Ψ_w increases.

Analogy

1. Xylem : Water : :: Organic substances

Ans: Phloem.

2. Dicot : Dorsiventral : : Monocot :

Ans: Isobilateral.

Give the scientific terms for the following.

1. Diffusion across membrane with the help of proteins

Ans: Facilitated diffusion

2. Movement of molecules across a membrane independent of other molecules.

- Ans: Uniport.
- Evaporation of water from the surface of leaves.
Ans: Transpiration.
 - Cell to cell movement of water through intercellular spaces and cell walls.
Ans: Apoplast.
 - Cell to cell movement of water through interconnected protoplast.
Ans: Symplast.
 - Symbiotic association of fungi with root system.
Ans: Mycorrhiza.
 - Water loss in liquid form from special openings of veins in leaves.
Ans: Guttation.
 - Pores on leaves through which transpiration takes place.
Ans: Stomata.

Give reasons why

- Smaller substances diffuse faster.
Ans: The rate of diffusion depends on the size of the particle.
- Lipid soluble substances diffuse through the cell membrane faster.
Ans: Since the cell membrane has bilipid layer.
- Facilitated diffusion is a passive process.
Ans: FD does not require energy.
- Water potential of a solution is always less than 0.
Ans: Ψ_w of pure water is zero. Presence of solute molecule decreases water potential.
- Most of the water flow in the roots occurs via the apoplast.
Ans: It occurs through cell wall & intercellular spaces with out osmosis.
- Endodermis in roots is impervious to water.
Ans: Endodermis shows the presence of casparian thickening (suberin) on the radial & inner tangential walls.
- Humidity of rainforests is very high.
Ans: Since rainforests have thick vegetation with a canopy and more transpiration results in enriched humidity.
- Active mineral uptake promotes absorption of water.
Ans: Since it creates a concentration gradient between the root cell sap and surrounding soil medium enhancing the absorption of water.
- Flow of nutrients in phloem is bidirectional.
Ans: Since phloem translocates food to all the parts of the plant body like upper and aerial apicies, downward root system, storing and growing regions.

Two marks

- Name the substances that would need to be transported in flowering plants.
Ans: a) water b) mineral salts c) organic solutes d) ions e) hormones
- List the factors that affect the rate of diffusion.
Ans: a) size of the particles b) temperature c) pressure
d) lipid solubility e) type of diffusing particle [liquid & gas- faster, solids – slower]
- Mention the 2 properties of facilitated diffusion.
Ans: a) FD is a passive process occurring across a concentration gradient.
a) It's highly specific
b) It's sensitive to inhibitors

4. Draw a labelled diagram to show facilitated diffusion across the membrane.(with the help of aquaporins) - diagram from text book

5. Differentiate between symport & antiport.

Symport

Both the molecules cross the membrane in the same direction.

Antiport

Both the molecules cross the membrane in different [opposite] direction.

6. What is active transport? How is it carried out?

Ans: Active transport is a type of transport which takes place against the concentration gradient and with the help of energy in the form of ATP.

7. Define waterpotential. What are its 2 main components?

Ans: The magnitude with which the free energy of water molecule drops down due to the addition of solute particles is called water potential. It's two main components are solute potential (Ψ_s) and pressure potential (Ψ_p)

8. Mention the a) symbol for water potential b) unit for expressing water potential
c) water potential of pure water.

Ans: a) Ψ - Psi b) Pa - Pascals c) Ψ_w

9. What are the 2 factors on which osmosis depends?

Ans: a) pressure gradient b) concentration gradient.

10. What is meant by osmotic pressure & osmotic potential?

Ans: Osmotic pressure: It's the positive pressure that is required to stop the process of endosmosis. It is the function of solute concentration.

Osmotic potential: It is equal and opposite to osmotic pressure.

11. What happens when a) raisins are placed in hypotonic solution b) grapes are placed in hypertonic solution.

Ans: a) endosmosis takes place from surrounding hypotonic medium to the raisins across the cell membranes of the raisins. It results in building up of turgidity in the raisins and it swells up.

b) Exosmosis takes place from cell sap of grapes into the surrounding hypertonic medium across the cell membrane of the grape cells leading to the shrinking of grapes.

12. What is plasmolysis? When does it occur?

Ans: It is the process of shrinkage of protoplasm away from the cell wall, when a turgid cell is placed in a hypertonic medium.

13. What is turgor pressure? How does it help the cell?

Ans: It is the pressure that is built inside a cell due to endosmosis against it's cell wall. It helps in maintaining, the turgidity of the cell.

14. What is imbibition? Give 2 examples.

Ans: It is a special type of diffusion during which water is adsorbed onto a hydrophilic colloid and later absorbed into it through diffusion.

Example: a) absorption of water by seeds b) absorption of water by dry wood.

15. What is mass flow? How is it achieved?

Ans: It is the movement of substances in bulk or en masse from one point to another due to pressure difference.

16. Differentiate between apoplast & symplast pathway.

Apoplast

- a) It's a type of water transport across the cell walls of the cell.
- b) Large amount of water is transported through apoplast.

Symplast

- a) It's a type of water transport through the cytoplasm.
- b) It only acts as a supplementary method.

17. Write a note on mycorrhiza.

Ans: It's a symbiotic association of a fungus with root system. The fungal partner helps in the maximum absorption of water and mineral salts due to intricate network of hyphae. The root partner helps in donating organic and nitrogen content to the hyphae.

18. What is root pressure? How can you prove that root pressure exists?

Ans: The positive pressure that is built in the xylem elements due to active absorption of ions is called root pressure. The exudation from the cut end of the stem on a humid day demonstrates root pressure.

19. What are the effects of root pressure?

Ans: The effects of root pressure are

- i. It helps in the initial short distance transport of materials (water & salts) from the root end.
- ii. It reestablishes the continuity of water column if broken due to extra transpiration pull.

20. Draw a labelled diagram of a stomata. - diagram from text book

21. Mention the external factors that affect transpiration.

Ans: The external factors that affect the rate of transpiration. a) temperature b) light c) humidity. D) wind speed.

22. What are the plant factors that affect transpiration?

Ans: The plant factors that affect the rate of transpiration are

- a) number of stomata
- b) distribution of stomata
- c) percent of stomata open
- d) canopy structure

23. How is a C_4 photosynthetic system advantage with respect to actively transpiring plants?

Ans: The C_4 plants loses only half as much water as a C_3 plant for the same amount of CO_2 fixed.

24. Mention the 2 factors why mineral absorption by roots has to be an active process.

Ans: a) Minerals are present on the soil as charged particles (ions) which cannot move across cell membranes.

b) The concentration of minerals in the soil is generally lower than the concentration of minerals in the root.

25. State the role played by transport proteins in mineral ion absorption.

Ans: The special proteins in the membrane of root hair cells actively pump the ions from soil into the cytoplasm. These are specific proteins called transport proteins.

26. List the chief sinks for mineral elements.

Ans: The chief sinks of mineral absorption are

- a) growing regions of the plant like the apical and lateral meristems.
- b) Young leaves
- c) Developing flowers
- d) Developing fruits and seeds
- e) Storage organs.

27. Give 2 reasons for remobilization of mineral ions in the plants.

Ans: Mineral ions are remobilized from older senescing parts to younger leaves and from the withering leaves in the deciduous plants. This is mainly to conserve the precious minerals, diverting it to the much needed areas from the least used areas.

28. What does phloem sap contain?

Ans: Phloem sap contains mainly water and sucrose. Along with it are also present other sugars, hormones and amino acids.

29. Describe the girdling experiment.

Ans: A ring of bark is removed from the trunk of a tree up to a depth of phloem layer. After a while it's observed that bark above the ring on the stem swells up. This is due to absence of conducting tissue to conduct food. Since the girdled portion has no phloem, it implies that phloem is the pathway for food conduction.

30. Differentiate between guttation and transpiration.

Guttation	Transpiration
a) loss of liquid droplets	a) loss of water vapour
b) takes place during early morning or night times.	b) takes place during day time
c) droplet contains xylem sap	c) diffused vapours have only water
d) It takes place from margins of the xylem elements (Hydathode)	d) It takes place from stomata.

31. C_4 plants are twice as efficient as C_3 plants. Why?

Ans: C_4 plants lose half the amount of water as compared to C_3 plants but fix the same amount of CO_2 per unit time. Thus C_4 plants are much more effective compared to C_3 plants.

32. What are porins? What role do they play in diffusion?

Ans: Porins are proteins that form huge pores in the outer membrane of plastids, mitochondria and few bacteria. It allows molecules of a specific size of a protein to pass through.

33. Briefly describe water potential. What are the factors affecting it?

Ans: The magnitude with which the kinetic or free energy of the pure water molecules are decreased due to the addition of solute particles is called water potential.

It depends upon the solute and pressure potential. The relationship between the components are $\psi_w = \psi_p + \psi_s$ – (where ψ_w water potential of pure water, ψ_s – solute potential, ψ_p – pressure potential)

34. How is mycorrhizal association helpful in absorption of water and minerals in plants?

Ans: Refer 17th answer

35. What role does root pressure play in water movement in plants?

Ans: Refer 19th answer

36. What essential role does the root endodermis play during mineral absorption in plants?

Ans: The root endodermis possess casparian thickenings made up of suberin. Thus it has the ability to actively transport ions in one direction only.

37. Explain why xylem transport is unidirectional and phloem transport bi-directional.

Ans: In the case of xylem transport the movement of water is unidirectional because of the orientation of source (root) and sink (leaf) is unidirectional

In the case of phloem transport, the movement of food is bidirectional since source (leaf) sink (root, growing regions, & storage region) direction is not in one direction.

Four marks

1. What is root pressure? How is it demonstrated experimentally?
2. Diagrammatically show the movement of water in a leaf during transpiration.
3. i) In which chamber water potential is more.
ii) In which chamber solute potential is more negative.
iii) In which direction osmosis will occur?
iv) What happens if you apply osmotic pressure on Solution B.

- diagram from text book

4. How do roots absorb water and how does water got transported form root hair to primary root?
5. Describe an experiment to demonstrate osmosis.
6. Describe the structures of a stomata. How is opening and closing of stomata regulated?

Five marks

1. With a neat labeled diagram, explain how water absorbed by root hair reach deeper into root layers.
2. Explain the process of transpiration driven ascent of xylem sap.
3. List the advantages of transpiration.
4. a) With the help of well-labelled diagrams, describe the process of plasmolysis in plants, giving appropriate examples.
b) Explain what will happen to a plant cell if it is kept in a solution having higher water potential.
5. Explain the pressure flow hypothesis for translocation of sugar.
6. Describe transpiration pull model of water transport in plants. What are the factors influencing transpiration? How is it useful to plants?
