

# Chapter - 11 Transport in Plants

## Question-1

Define water potential?

### Solution:

Water potential is the potential energy of water.

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## Question-2

what are the factors affecting the rate of diffusion?

### Solution:

The main factors that affect the rate of diffusion are,

**(i) Temperature:** The rate of diffusion increases with rise in temperature. This is because a rise in temperature increases the kinetic energy of the diffusing particles.

**(ii) Density of diffusing substance:** The rate of diffusion of a substance is inversely proportional to the square root of its density (i.e.) heavier the molecule, slower is the rate of diffusion.

**(iii) Density of the medium:** The rate of diffusion is slower, if the medium is concentrated. Thus, a gas would diffuse more rapidly in vacuum than in air.

**(iv) Diffusion pressure gradient:** The rate of diffusion is directly proportional to the difference of diffusion pressure at the two ends of a system and inversely proportional to the distance between the two.

### **Question-3**

**What will happen to water potential when solutes are added?**

**Solution:**

Water potential is lowered when solutes are added.

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### **Question-4**

**Write the significance of plasmolysis.**

**Solution:**

Plasmolysis is a vital phenomenon and has the following importance:

- (i) The osmotic pressure of a cell can be measured by plasmolysis. The osmotic pressure of a cell is roughly equal to the osmotic pressure of a solution that causes incipient plasmolysis in the cell.
- (ii) Salting of pickles, meat, fishes, etc. and addition of sugar to jams, jellies, cut fruits, etc., prevent their decay by microbes, as the latter get killed due to plasmolysis.
- (iii) Plasmolysis is helpful in determining whether a particular cell is living or dead as plasmolysis does not occur in a dead or non-living cell.

### **Question-5**

**Which fractions of soil water are readily available to plants for absorption?**

**Solution:**

Capillary water is the fractions of soil water are readily available to plants for absorption.

### Question-6

**Distinguish between active and passive absorption of water.**

**Solution:**

Active absorption	Passive absorption
(i) Active absorption of water occurs due to the activity of root and root hairs.	(i) Passive absorption occurs due to the activity of the upper part of the plant such as shoot and leaves.
(ii) Water is absorbed by the osmotic or non-osmotic processes along or against DPD gradient.	(ii) Water is absorbed as a result of tension created by transpiration pull.
(iii) It involves symplast movement of water.	(iii) It involves apoplast movement of water (i.e.) through cell walls and intercellular spaces.
(iv) It utilizes metabolic energy.	(iv) It utilizes solar energy for transpiration.
(v) During active absorption of water, the root cells play an active role.	(v) During passive absorption of water, the root cells play a passive role.
(vi) It is independent of transpiration.	(vi) It takes place when transpiration is fast.
(vii) It creates a positive pressure in xylem channels.	(vii) It produces a negative pressure in xylem channels.

### Question-7

**Distinguish between transpiration and evaporation.**

**Solution:**

Transpiration	Evaporation
(i) This is a physiological process that occurs in plants.	(i) This is a physical process that occurs from any free surface.
(ii) It involves living tissues.	(ii) It may involve both living and non-living surfaces.
(iii) It is controlled by environmental factors as well as by plant factors such as osmotic pressure of the cells, thickness of cuticle, number and position of stomata, etc.	(iii) It is influenced only by environmental factors.
(iv) It moistens the surface of leaves and young stems and protects them from the burning Sun.	(iv) It causes dryness of free surfaces.
(v) It is comparatively a slow process.	(v) It is comparatively a faster process.

### Question-8

**Mention two ways of absorption of water in plants?**

**Solution:**

Two ways of absorption of water in plants are, (i) apoplast pathway and (ii) symplast.

## Question-9

**What are the factors affecting water absorption?**

### **Solution:**

The absorption of water is affected by a number of factors. They are

**(i) Availability of soil water:** Water uptake is directly affected by the amount of water available to the roots for absorption. The water content between field capacity and permanent wilting percentage is often termed as readily available water, because it can be absorbed readily by plants. If water is present in the soil below the permanent wilting percentage or beyond field capacity, the rate of water absorption will be reduced.

### **(ii) Concentration of soil**

**Solution:** The amount of soluble salts in the soil also affects water uptake by the roots. If the concentration of soil solution is more than that of the cell sap of root cells, water will tend to move out due to exosmosis. It is due to this reason that a field is irrigated properly after addition of fertilizers.

**(iii) Soil temperature:** Most plants require temperatures ranging from 20-35°C for optimum water absorption. A temperature above 35°C reduces water uptake by reducing the permeability of the plasma membrane. Low temperature of the soil reduces absorption of water.

**(iv) Aeration of soil:** The roots of plants absorb water more efficiently in well aerated soils than in poorly aerated soils. In poorly aerated soils, the growth and metabolic activities of the roots are slowed down. Accumulation of CO<sub>2</sub> in soil air increases the viscosity of the protoplasm and decreases its permeability. This decreases the rate of water absorption.

### **Question-10**

**Define wall pressure?**

#### **Solution:**

The pressure extended by the rigid cell wall on the protoplasm of cell opposite to the turgor pressure is called wall pressure.

### **Question-11**

**Write the importance of diffusion in plants.**

#### **Solution:**

- (i) Exchange of gases ( $\text{CO}_2$  and  $\text{O}_2$ ) through stomata takes place by diffusion.
- (ii) Transpiration or loss of water from the aerial parts of the plant involves the process of diffusion.
- (iii) Diffusion is involved in the passive uptake of mineral salts.
- (iv) Fragrance from the flowers, to attract the pollinating animals, spreads in the air by diffusion.
- (v) Diffusion plays an important role in imbibition and osmosis.

### **Question-12**

**Name the pores through which guttation occur?**

#### **Solution:**

Hydathodes are the pores through which guttation occur.

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### Question-13

What is the value of water potential of pure water at normal temperature and pressure?

#### Solution:

The value of water potential of pure water at normal temperature and pressure is zero.

### Question-14

What is transmembrane pathway?

#### Solution:

Transmembrane is the movement through the cell membrane.

### Question-15

Mention two factors that affect water potential.

#### Solution:

The two factors that affect water potential are, (i) the amount of solute and (ii) the external pressure.

### Question-16

Mention two external factors, which affect transpiration.

#### Solution:

The two external factors, which affect the rate of transpiration, are atmospheric humidity and light.

**(i) Atmospheric humidity:** The diffusion of water vapour from the intercellular spaces of leaves to the outside atmosphere depends on the moisture content of the atmosphere. If the moisture content of the atmosphere is high, the rate of transpiration is relatively low but as the moisture in the air decreases, the rate of transpiration increases rapidly.

**(ii) Light:** Light indirectly affects the rate of transpiration by regulating (a) the opening of stomata and (b) increasing the leaf temperature. In most plants, stomata open in the presence of light and close in darkness. Thus, the rate of transpiration increases in light and decreases in the dark.

### **Question-17**

**Define wilting.**

#### **Solution:**

Wilting is the loss of turgidity of leaves and other soft aerial parts of a plant, thereby causing them to droop.

### **Question-18**

**Mention any two uses of transpiration of plants.**

#### **Solution:**

The two uses of transpiration to plants,

- (i) It maintains the turgidity of cells.
- (ii) It reduces negative tension downwards to the roots and this help in the ascent of sap.

### **Question-19**

**Which part of root is related with the absorption of water?**

#### **Solution:**

Root hairs are the part of root which is related with the absorption of water.

### **Question-20**

**What is wall pressure?**

#### **Solution:**

In plants, due to turgor pressure, the protoplast of a plant cell presses the cell outwards. The cell wall being elastic, pushes the protoplast back with a pressure equal in magnitude but opposite in direction. This pressure is called wall pressure.

### **Question-21**

**Describe the thistle funnel experiment to demonstrate osmosis.**

#### **Solution:**

The phenomenon of osmosis can be demonstrated by a thistle funnel experiment. Take a long stemmed thistle funnel. Fill it with 10% sugar solution by closing the opening of the stem with finger. Close the mouth of the funnel tightly with semi permeable animal membrane by means of a waxed thread. Scissor the free edges of the membrane. Invert the funnel in a beaker containing water so that the membrane is completely immersed. Mark the level of the solution as A by means of glass marking pencil. After a couple of hours, the level of water falls down in the beaker. The water in the beaker does not taste sweet. The rise in the level of the sugar solution in the stem of the thistle funnel is due to osmosis. The concentration of water molecules in the beaker is more than their concentration inside the thistle funnel. Therefore, water molecules move from the region of their higher concentration to the region of their lower concentration.

### **Question-22**

**Name the forces involved in absorption of water by roots?**

#### **Solution:**

Osmotic pressure and transpiration pull are the forces involved in absorption of water by roots.

### **Question-23**

**Name the two factors that affect water potential.**

#### **Solution:**

The two factors that affect the water potential are, (i) amount of solute and (ii) transpiration pull.



### Question-24

Define diffusion pressure.

#### Solution:

The pressure exerted by the tendency of molecules of gases, liquids or solids to diffuse from the area of their higher concentration to the area of lower concentration is called diffusion pressure.

### Question-25

Write the types of osmosis.

#### Solution:

The osmosis is of two different types. They are

(i) Endosmosis and

(ii) Exosmosis

**(i) Endosmosis:** The osmotic inflow of water into a cell, when it is placed in a solution, whose solute concentration is less than the cell sap, is called endosmosis.

**(ii) Exosmosis:** The osmotic outflow of water from a cell, when it is placed in a solution, whose solute concentration is more than the cell sap is called exosmosis.

### Question-26

Mention the osmotic relationship of cell when it is put in.

- (i) hypotonic solution
- (ii) hypertonic solution
- (iii) an isotonic solution.

#### Solution:

- (i) Endosmosis,
- (ii) Exosmosis,
- (iii) No net movement.

### Question-27

Write the different types of osmotic concentration.

#### Solution:

A solution can be termed as hypotonic and hypertonic or isotonic depending upon its osmotic concentration, with respect to another solution or cell sap.

#### (i) Hypotonic

**Solution:** A solution, whose osmotic concentration is less than that of another solution or cell sap is called hypotonic solution.

#### (ii) Hypertonic

**Solution:** A solution, whose osmotic concentration is more than that of another solution or cell sap is called hypertonic solution.

#### (iii) Isotonic

**Solution:** A solution, whose osmotic concentration is equal to that of another solution or cell sap, is called isotonic solution.

### **Question-28**

Which molecules can move freely across the semi permeable membrane of plant cell.?

#### **Solution:**

Water molecules can move freely across the semi permeable membrane of plant cell.

### **Question-29**

What is turgor pressure?

#### **Solution:**

Turgor pressure is the pressure, which develops in a confined part of an osmotic system due to the osmotic entry into it.

### **Question-30**

Name the tissue through which ascent of sap takes place.

#### **Solution:**

Xylem tissue is the tissue through which ascent of sap takes place.

### **Question-31**

State any two significance of turgidity.

#### **Solution:**

- (i) Turgidity keeps the cell and their organelles fully distended. This is essential for plants to live and grow normally.
- (ii) The opening and closing of stomata are regulated by the turgidity of the guard cells.

### Question-32

Name two antitranspirants.

#### Solution:

The two antitranspirants are, phenyl mercuric acetate, and abscisic acid.

### Question-33

Describe pressure potential.

#### Solution:

The positive pressure operating in the plant cell is termed as pressure potential. It is usually positive and increases the water potential in the system. The water potential ( $\Psi$ ) in a plant cell can be written as sum of the solute potential ( $\Psi_s$ ), the matric potential ( $\Psi_m$ ) and the pressure potential ( $\Psi_p$ ).

$$\Psi = (\Psi_s) + (-\Psi_m) + (\Psi_p)$$

$$= \Psi_s + \Psi_m + \Psi_p$$

Since, matric potential is often discarded because it is not significant in osmosis, the above relationship can be simplified as

$$\Psi = \Psi_s + \Psi_p$$

### Question-34

What determines the direction of flow of water from one cell to another cell?

#### Solution:

Water potential of the cells which is represented by Greek letter psi ( $\psi$ ), determines the direction of flow of water from one cell to another cell.

### **Question-35**

**What is the water potential of pure water?**

#### **Solution:**

Zero bar is the water potential of pure water.

### **Question-36**

**What is holard?**

#### **Solution:**

The total amount of water present in the soil is called holard.

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### **Question-37**

**What are anti-transpirants?**

#### **Solution:**

The chemical substances, which reduce transpiration without affecting gaseous exchange, are called anti-transpirants.

### **Question-38**

**What is turgor pressure?**

#### **Solution:**

Turgor pressure is the pressure responsible for pushing the cell membrane against the cell wall due to the entry of water by osmosis.

### **Question-39**

**What is wall pressure?**

#### **Solution:**

The pressure extended by the turgid cell wall on the protoplasm of cell opposite to the turgor pressure is called wall pressure.

### **Question-40**

**Demonstrate an experiment to show how the root pressure exists.**

#### **Solution:**

Root pressure can be demonstrated experimentally by cutting the stem of a well-watered herbaceous plant, near its base. The xylem sap is seen to flow out through the cut end with a pressure. The pressure of exudation can be noted by fixing a vertical glass tube half filled with water, with the help of a rubber tuber to the cut end of the stem. A column of sap is seen to rise in the tube. If a manometer is fixed to the cut end of the stem, the rise in the level of the mercury of the manometer will be a measure of the root pressure.

### **Question-41**

**Which of the following has the highest water potential.**

- (a) IM salt solution
- (b) IM sugar solution
- (c) Distilled water
- (d) IM sugar solution with 2.3 bars pressure applied to it.?

#### **Solution:**

- (d) IM sugar solution with 2.3 bars pressure applied to it.

### **Question-42**

**Name the force of attraction which keeps the water molecules united in the plants.**

#### **Solution:**

Cohesive force is the force of attraction, which keeps the water molecules united in the plants.

### **Question-43**

Name the part of root concerned mainly with absorption of water.

#### **Solution:**

Root hair.

### **Question-44**

What is hygroscopic water ?

#### **Solution:**

The thin film of water, which covers the soil particles, is called hygroscopic water.

### **Question-45**

What will happen to a plant cell when it is kept in a higher water potential ?

#### **Solution:**

In a plant cell when it is kept in higher water potential, water will move from higher potential to lower potential.

### **Question-46**

What happens to a plant cell if it is put in a hypertonic solution ?

#### **Solution:**

Plant cell if it is put in a hypertonic solution, water moves out causing shrinkage of a cell.

### **Question-47**

Name the structure through which water is lost from the plants ?

#### **Solution:**

Stomata.

### **Question-48**

**Define permeability**

#### **Solution:**

Permeability is the extent to which the membrane allows or restricts the movement of a substance.

### **Question-49**

**Name the theory proposed by Dixon for ascent of sap.**

#### **Solution:**

Transpiration pull theory

### **Question-50**

**Expand DPD.**

#### **Solution:**

Diffusion Pressure Deficit