

## UNIT -1 PLANT PHYSIOLOGY

# 1. TRANSPORT IN PLANTS

(1 x 2) + (1 x 4) = 6 Marks

### ROOT POINTS

- Transport of Plants** consists of transport of water, solutes, food from one part to other parts.
- Plants have two types of transport tissues.
  - Xylem** vessels transport water and solute from the roots to the leaves via stems.
  - Phloem** transports food from leaves to the rest of the Plant.
- Translocation** is the transport of substances over longer distances through Xylem and Phloem.
- Passage of materials** into and out of cells is carried by (i) diffusion (ii) facilitated diffusion (iii) active transport.
- Diffusion** is movement of solute particles from a region of higher concentration into a region of lower concentration. It is passive (no energy is used) transport along concentration gradient.
- Facilitated diffusion** is the passive absorption of solute particles mediated by a membrane along concentration gradient. [IPE]
- Osmosis** is the movement of solvent molecules from a region of lower concentrated solution into a region of higher concentrated solution through a semipermeable membrane. [IPE]
- Plasmolysis** is the shrinkage of protoplast of cell due to loss of water and turgor. [IPE]
- Imbibition** is a special type of diffusion of water by seeds. [IPE]
- Water potential ( $\Psi_w$ )** is the measure of relative tendency of water to move from one part to another part. [IPE]
- Apoplast** is the path of transport of water in a plant without crossing any membrane. [IPE]
- Symplast** is the path of transport of water in a plant by crossing some membranes. [IPE]
- Transpiration** is the loss of water, from the aerial parts in living tissues of plant body, in the form of **water vapour**. It is a **necessary evil**. [IPE]
- Guttation** is removal of excess of water, from the tips of leaves, in the form of **droplets**. [IPE]
- Ascent of sap** occurs in tall trees due to **transpiration pull** against gravitational force. [IPE]

### FRUITY Qs OF IPE

(1 x 2) + (1 x 4) = 6 Marks

- Differentiate osmosis from diffusion.
- What are apoplast and symplast?
- How does guttation differ from transpiration?
- How does ABA bring about the closure of stomata under water stress conditions?
- Compare imbibing capacities of pea and wheat seeds.
- Define and explain water potential.
- What is meant by plasmolysis? How is it practically useful to us?
- How does ascent of sap occur in tall trees?
- "Transpiration is a necessary evil". Explain.

## SCENT BOXES- MEMORY HINTS

### FOR SELECTIVE QUESTIONS

#### 7. Define and explain water potential .

[TS 19][AP 18,19]

**A: Water potential ( $\psi_w$ ):** Water potential is the measure of movement of water from one part to the another part within the plant. It involves diffusion, osmosis.

It is expressed in Pascals(Pa).

Water potential of Pure water is taken as zero at standard temperature and pressure.

Water potential has two main components (i) Solute potential and (ii) Pressure potential.

**i) Solute potential ( $\psi_s$ ) :** When a solute is dissolved in pure water , the concentration of pure water decreases. Hence its water potential also decreases. This decrease in water potential is called solute potential. **It is always negative.**

**ii) Pressure potential ( $\psi_p$ ) :** When some water enters into a plant cell, the pressure against cell wall increases due to diffusion. This makes the cell turgid(swollen). This increase in water potential is called pressure potential. It is always positive. It is observed in the ascent of water through stem. Total water potential =Sum of solute & pressure potential.

$$\text{Total Water potential } \psi_w = \psi_s + \psi_p$$

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$(\psi_w), (\psi_p)$  are Best Friends  
They complement each other

$(\psi_w), (\psi_s)$  are Just Enemies  
They oppose each other

#### 8. What is meant by plasmolysis? How is it practically useful to us? [AP 16, 23]

**A: 1) Plasmolysis:**It is the shrinkage of protoplast of cell due to loss of water and turgor.

- 2) This happens when a plant cell is placed in hypertonic solution.
- 3) Water molecules inside the cell move out into the solution.
- 4) Then the cell membrane shrinks away from its cell wall.
- 5) This causes the protoplast to shrink away from the wall.
- 6) This leads to the separation of plasma membrane from the cell wall.
- 7) Then the cell is said to be plasmolysed.

**8) Practical applications:** Salting of pickles, preservation of fish, meat and prawns.

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**Fish, Meat, Prawns**

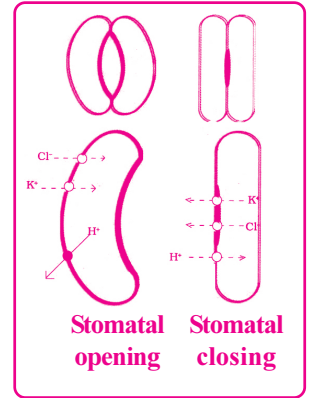
when dried  
go away from  
Water and Wall.

Shrinkage - Loss of water

## 12. Explain the structure and mechanism of opening and closing of stomata. [TS 15]

### A: Levitt's $K^+$ ion pump theory:

- 1) According to this theory,  $K^+$  ions accumulate in the guard cells from the subsidiary cells in the presence of light.
- 2) This is coupled with efflux of protons which leads to an increase in the pH of guard cells.
- 3) This is also associated with passive influx of  $Cl^-$  ions, thereby decreasing the water potential of guard cells.
- 4) Water enters into guard cells, making them turgid.
- 5) The outer walls of guard cells are thin and expand outwardly, leaving a minute pore in the centre to open.
- 6) At night, in the absence of light,  $K^+$  and  $Cl^-$  ions move out of guard cells, due to which the water potential of guard cells increases. Hence, water moves out and stomata closes.
- 7) Under water stress conditions Abscisic acid (ABA), drives the  $K^+$  ions out of guard cells making them close.
- 8) In succulent plants, the water potential gradient is established. Accumulation of organic acids at night makes the guard cells turgid, hence stomata opens at night.



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Levitt's  $K^+$ ,  $Cl^-$   
in Guard cells open stomata.

**49. What are porins? What role do they play in diffusion?**

[AP 19]

- A:**
- 1) **Porins** are a kind of **protein channels**.
  - 2) They form **huge pores** on the outer membranes of Plastids, Mitochondria and some Bacteria.
  - 3) They allow small sized protein molecules to diffuse through them.
  - 4) Thus, porins cause **facilitated diffusion**.

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Porin is a pro channel  
watched by  
PMB- Prince Mahesh Babu

**50. Define water potential. What is the value of water potential of pure water? [TS 20]**

- A:**
- 1) **Water potential ( $\psi_w$ )**: Water potential is the measure of movement of water from one part to the another part within the plant. It involves diffusion, osmosis.
  - 2) The value of water potential of pure water is taken as zero.

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Pure Water has not taste.  
So I gave it zero marks.

**51. Differentiate osmosis from diffusion.**

[AP 17,17]

Osmosis	Diffusion
<p><b>A:</b></p> <ol style="list-style-type: none"> <li>1) Osmosis is the movement of solvent (water) molecules from a <b>lower</b> concentrated solution <b>to a higher</b> concentrated solution.</li> <li>2) It requires a <b>semipermeable membrane</b>.</li> <li>3) It occurs in <b>liquid medium</b> only.</li> <li>4) <b>Ex:</b> Osmosis of water across Plant cells.</li> </ol>	<ol style="list-style-type: none"> <li>1) Diffusion is the movement of solute molecules from a <b>higher</b> concentrated solution <b>to a lower</b> concentrated solution.</li> <li>2) It need not require a membrane.</li> <li>3) It occurs mostly in gases and liquids.</li> <li>4) <b>Ex:</b> Diffusion of gases (<math>\text{CO}_2</math> and <math>\text{O}_2</math>) during photosynthesis.</li> </ol>

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Osemli is a girl who grew up from lower to higher position in plant cell company

**52. What are apoplast and symplast?**

[TS 15,17] [AP 19,22]

Apoplast	Symplast
<p><b>A:</b></p> <ol style="list-style-type: none"> <li>1) <b>Apoplast</b> is the path of transport of water in a plant without crossing any membrane.</li> <li>2) It is a <b>fast process</b>.</li> </ol>	<ol style="list-style-type: none"> <li>1) <b>Symplast</b> is the path of transport of water in a plant by crossing <b>some membranes</b>.</li> <li>2) It is a <b>slow process</b></li> </ol>

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Apoplast is a village with 'no check posts', so I reached there fast.

## 53. How does guttation differ from transpiration?

[TS 15]

A:	Guttation	Transpiration
	1) During guttation, water is lost from the leaves of plants in the form of <b>water droplets</b> . 2) It occurs usually at <b>night</b> . 3) It is an uncontrolled process.	1) During transpiration, water is lost from the leaves of plants in the form of <b>water vapour</b> . 2) It occurs usually at <b>day time</b> . 3) It is a controlled process.

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Last night Sri Drank Water droplets uncontrollably when she ate a Chilly.

## 54. What are the physical factors responsible for the ascent of sap through xylem in plants?

## A: Physical factors responsible for the ascent of sap:

[TS 17, 23]

- 1) **Cohesion**: It is due to mutual attraction among water molecules.
- 2) **Adhesion**: It is due to attraction between water molecules and the surface of tracheal elements.
- 3) **Transpiration pull**: It is due to driving force for upward movement of water.

## 😊 SCENT BOX 😊

Co- among  
Ad- Between  
Pull- Upward

## 56. With reference to transportation of food within a plant, what are source and sink? [TS 19]

- A: 1) **Source**: It is a place in the plant body where food material is prepared. **Ex**: leaf.
- 2) **Sink**: It is a place in the plant body where food material is stored. **Ex**: fruits, buds.

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Source is my  
Mother's Kitchen  
while Sink is  
my Friend's Stomach.

## 62. Compare transpiration and evaporation.

A:	Transpiration	Evaporation
	1) <b>Transpiration</b> is the loss of water from the <b>living tissues</b> of aerial parts of the plants. 2) It happens within the plant. 3) It is a physiological process. 4) It is a slow process.	1) <b>Evaporation</b> is the loss of water from any free surface i.e., either <b>living or non-living</b> 2) It is a surface level process. 3) It is a physical process. 4) It is comparatively a fast process.

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Evaporation can solve Physics Problems so faster sitting at any free surface