



## **PLANT PHYSIOLOGY**

**Q1:**

Define the following:-

a- Photoperiodism

c- Vernalization

b- Auxin precursors

d- plant development.

**Q2:**

Explain the actual mechanism of active absorption (Non-osmotic theories).

**Q3:**

Explain the mechanism for opening of stomata.

**Q4:**

Write short notes on gibberellins and auxin interactions.

*GOOD LUCK*

## Answer the Exam.

**Q1:**

### **Photoperiodism:-**

Photoperiodism is defined as the response of a plant to the relative lengths of light and dark periods.

### **Auxin precursors:-**

Are compounds that in the plant can be converted into auxins.

### **Vernalization:-**

Is the acquisition of a plant ability to flower the spring by exposure to the prolonged cold of winter. After vernalization, plants have acquired the ability to flower.

### **Plant development:-**

Development means changing in shape, form, degree of differentiation and state of complexity.

**Q2:**

**Explain the actual mechanism of active absorption (Non-osmotic theories).**

### **Active absorption of water:**

Two types of theories such as osmotic theory and non Osmotic theory have been proposed to explain active absorption of water by plants.

### **(ii) Non osmotic theory:**

The non-osmotic theory assumes that when the driving forces are zero, water absorption takes place at the expenditure of metabolic energy released in **respiration**. Thus this theory explains the absorption of water by roots when the osmotic potential of soil water is greater than that of the root hair cell sap.

The non-osmotic active water uptake can also be **supported** by the following facts:

- (i) There is a correlation between the rate of water absorption and respiration,
- (ii) Auxin-induced water uptake
- (iii) The factors such as low temperature, oxygen tension and respiratory inhibitors which affect respiratory rate and in turn the absorption rate.

The serious drawback of the above theory is that it fails to explain the exact manner of utilization of metabolic energy in the process of water uptake.

**Q3:**

**Explain the mechanism for opening of stomata.**

**Stomatal mechanisms:**

**Opening:** *Triggered by sunlight or low CO<sub>2</sub> within the plant cell.*

1. It is initiated by a proton pumping ATPase pumping H<sup>+</sup> out of the guard cell plasma membrane.

2a. This pumping hyperpolarises the guard cells causing voltage gated influx channels to opening, allowing K<sup>+</sup> and Cl<sup>-</sup> to move into the guard cells.

2b. Phosphoenol pyruvate is carboxylated to form malic acid

3. The solute potential of the guard cells decreases because of the K<sup>+</sup> Cl<sup>-</sup> and Malic acid accumulation.

4. Water then flows into the guard cells down a water potential gradient which then increases the turgor of the cell ( $\psi_w = \psi_p - \psi_s$ )

5. Increased turgor pushes the guard cells apart opening the stomata pore.

**Closing:** *Triggered by darkness, water stress, abscisic acid (ABA) and high CO<sub>2</sub> within the plant cell.*

1: Proton pumping ATPase stops pumping H<sup>+</sup>. H<sup>+</sup> is now accumulated within the guard cells again.

2: The voltage gated influx channels on the guard cells close stopping the movement

of  $K^+$  and  $Cl^-$  into the guard cells. Malic acid is also no longer made.

3: The solute potential of the guard cells increases as the left over  $K^+$   $Cl^-$  and malic acid is used up.

4: Water flows out of the guard cells along the reversed water potential gradient and the turgor of the guard cells decrease.

5: Due to the decreased turgor the guard cells become flaccid and the stomata pores close.

**Q4:**

**Write short notes on gibberellins and auxin interactions.**

Gibberellins	Auxin	Response activity
No effect	Promote	1. Apical dominance
No effect	Promote	2. Avena coleoptiles elongation
Promote	No effect	3. Bolting and flowering
No effect	Promote	4. Callus formation
Promote	No effect	5. Chlorophyll retention of detached leaves
Promote	Promote	6. Growth of intact cucumber hypocotyls
No effect	Promote	7. Growth of dwarf pea stem sections
Promote	No effect	8. Growth on intact dwarf pea stem
No effect	Promote	9. Epinastic responses.
No effect	Promote	10. leaf abscission
Promote	Promote	11. Parthenocarpic fruit growth
No (sometimes)	Yes (stem) no effect (root)	12. polar transport
No effect	Promote	13. Root initiation
No effect	Promote	14. Root growth
Promote	No effect	15. Seed germination and breaking of dormancy.

