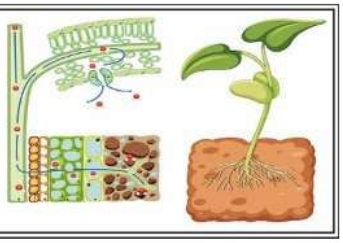
9 CHAPTER

PLANT PHYSIOLOGY



9.1 NUTRITION IN PLANTS

LONG ANSWER QUESTIONS

Q.3 Define macro and micro-nutrients. Give their role in plants. (K.B)

Ans:

NUTRIENTS IN PLANTS

Macronutrients:

The minerals which are required in **larger quantities** are called macronutrients.

Example:

Carbon, hydrogen, oxygen, phosphorus, potassium, nitrogen, sulphur, calcium, and magnesium.

Micronutrients:

The minerals which are required in **lower quantities** are called micronutrients.

Example:

Iron, molybdenum, boron, copper, manganese, zinc, chlorine, and nickel.

Role of Macronutrients in Plants:

Macronutrients	Role in Plant Life
Carbon	Major component of all **biomolecules**
Hydrogen	Major component of all **biomolecules**
Oxygen	Major component of biomolecules, necessary for **cellular respiration**
Phosphorus	Component of **ATP**, nucleic acids, and coenzymes, necessary for seed germination, photosynthesis etc.
Potassium	Regulates the opening and closing of the **stoma**
Nitrogen	Component of **proteins**, chlorophyll and enzymes
Sulphur	Component of proteins, vitamins and enzymes
Calcium	Activates **enzymes**, is a structural component of cell walls, influences water movement in cells
Magnesium	Component of **chlorophyll**, activates many enzymes

Role of Micronutrients in Plants:

Micronutrients	Role in Plant Life
Iron	Necessary for **photosynthesis**, activates many enzymes
Molybdenum	Component of the enzyme that coverts **nitrates** to ammonia
Boron	For sugar transport, cell division, and certain enzymes
Copper	Component of several enzymes
Manganese	Involved in the activities of enzymes of **photosynthesis** and respiration
Zinc	Required in a large number of **enzymes**
Chlorine	Involved in **osmosis** of water
Nickel	Required in a **nitrogen metabolism**

Q.4 Explain the role of nitrogen and magnesium for plants. (K.B)

Ans:

ROLE OF NITROGEN AND MAGNESIUM

Role of Nitrogen in Plants:

- Nitrogen is a necessary part of all **proteins**, **enzymes** and **nucleic acids**.
- It is also a part of **chlorophyll**.
- Nitrogen helps plants for **rapid growth**, increasing seed and fruit production and improving the quality of leaf.

Source of Nitrogen for Plants:

- Plant roots absorb nitrogen in the form of **nitrates**.
- **Carnivorous plants** trap and digest small animals. Such plants fulfil their needs of nitrogen from the prey animals.

Nitrogen Deficiency:

- Nitrogen deficiency **slows down** the growth of plant.
- It also results in insufficient production of chlorophyll and so leaves begin to turn **yellow**.

Role of Magnesium in Plants:

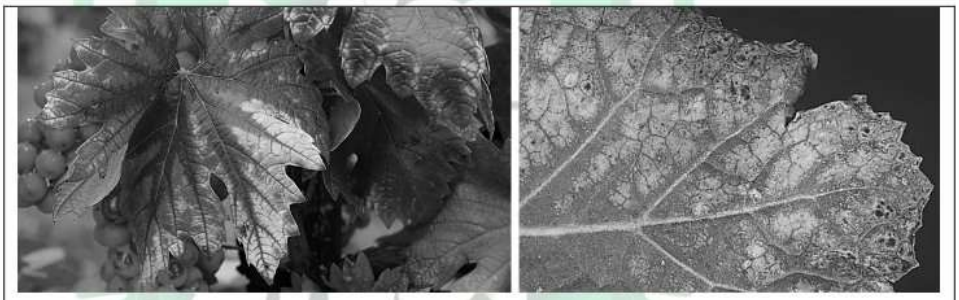
- Magnesium is part of the **chlorophyll**.
- It also activates many plant enzymes needed for growth.
- It also helps in **fruit formation** and **germination of seeds**.

Source of Magnesium:

Plant roots absorb Magnesium in **ionic form** (Mg^{2+}).

Deficiency of Magnesium:

- If sufficient amounts of magnesium are not available, plants begin to **break the chlorophyll** in leaves.
- This causes the **yellowing of leaves**.
- After prolonged magnesium deficiency leaves may also **drop**.



(a) (b)

Figure: (a) Chlorosis due to Nitrogen deficiency, (b) Chlorosis due to magnesium deficiency

SHORT ANSWER QUESTIONS

Q.1 What are nutrients? (K.B)

Ans:

NUTRIENTS

Definition:

Nutrients are the substances required by organism for energy, growth, repair, and maintenance.

Types:

There are two types of nutrients.

- Macronutrients
- Micronutrients

Q.2 What is the difference between macronutrients and micronutrients? (K.B)

Ans:

DIFFERENTIATION

The differences between macronutrients and micronutrients is as follows:

Micronutrients	Macronutrients
Definition	
The nutrients which are required by plants in small quantities are called micronutrients.	The nutrients which are required by plants in large quantities are called macronutrients.

Examples	
• Iron • Molybdenum • Boron	• Carbon • Hydrogen • Oxygen

Q.3 What is the role of iron and boron in plant life? (A.B)

Ans: **ROLE OF IRON AND BORON IN PLANT LIFE**

Iron:

It is necessary for:

- Necessary for photosynthesis
- Activates many enzymes

Boron:

Boron is important in:

- Sugar transport
- Cell division
- Synthesizing certain enzymes

Q.4 What is the role of phosphorus and potassium in plant life? (A.B)

Ans: **ROLE OF PHOSPHORUS AND POTASSIUM IN PLANT LIFE**

Phosphorus:

It is the component of:

- ATP
- Nucleic acids
- Coenzymes

It is necessary for:

- Seed germination
- Photosynthesis
- Protein formation

Potassium:

- It regulates the opening and closing of the stomata.
- It reduces water loss from the leaves.

Q.5 Discuss the role of nitrogen in plants. (A.B)

Ans: **ROLE OF NITROGEN IN PLANTS**

- Nitrogen is a necessary part of all proteins and enzymes.
- It is also a present in chlorophyll.
- Nitrogen helps plants for rapid growth.
- It increases seed and fruit production and also improves the quality of leaf.
- Plant roots absorb nitrogen in the form of nitrates.

Q.6 Describe the importance of magnesium for plants? (K.B)

Ans: **ROLE OF MAGNESIUM IN PLANTS**

- Magnesium is a part of chlorophyll.
- It also activates many plant enzymes needed for growth.
- It also helps in fruit formation and germination of seeds.

Q.7 Why yellowing in plants is seen in the older leaves first? (U.B)

Ans: **YELLOWING OF LEAVES**

When a plant faces N or Mg deficiency, it transports these elements from older to younger leaves. So, the yellowing of leaves is seen in old leaves first. If deficiency continues, this symptom progresses to the young leaves.

Q.8 Why carnivorous plants eat animals? (U.B)

Ans: **CARNIVOROUS PLANTS**

Carnivorous plants trap and digest small animals. Such plants fulfil their needs of nitrogen from the prey animals.

MULTIPLE CHOICE QUESTIONS

11. Which one is a macronutrient? (K.B)
(A) Iron (B) Magnesium
(C) Copper (D) Boron

12. Which of the following nutrient(s) is a structural component of cell wall? (K.B)
(A) Iron (B) Calcium
(C) Potassium (D) Copper

13. Which of the following is a micronutrient? (K.B)
(A) Potassium (B) Sulphur
(C) Copper (D) Calcium

14. Which of the following nutrient is/are components of enzymes? (K.B)
(A) Molybdenum (B) Copper
(C) Sulphur (D) All of these

15. The functions of phosphorous are: (A.B)
(A) It is component of ATP, nucleic acids and coenzymes.
(B) It is necessary for seed germination.
(C) Photosynthesis and protein formation.
(D) All of these

16. Which of the following nutrient(s) activates enzymes? (K.B)
(A) Calcium (B) Iron
(C) Manganese (D) All of these

17. Plants get nitrogen in the form of: (U.B)
(A) Nitrites (B) Nitrates
(C) Nitric acid (D) All of these

18. Chlorine is involved in: (K.B)
(A) Respiration (B) Reduction of nitrates into ammonia
(C) Osmosis of water (D) Opening and closing of stomata

19. Deficiency of which element causes the yellowing of leaves in plants? (A.B)
(A) Zinc (B) Magnesium
(C) Copper (D) Chlorine

20. Carnivorous plants eat animals to get: (K.B)
(A) Oxygen (B) Nitrogen
(C) Carbon (D) Chlorine

9.2 TRANSPORT IN PLANTS

LONG ANSWER QUESTIONS

Q.1 Explain the internal structure of root and describe the uptake of salt and water by root. (K.B)

Ans:

STRUCTURE OF ROOT

Definition:

Roots are the organs which absorb **water** and **salts** from the soil.

Internal Structure of Root:

The internal structure of a root shows the following features that help the roots to perform this function.

1. **Epidermis**
   The outermost covering of the root i.e. **epidermis** is a single layer of cells.
2. **Root Hairs**
   - Many cells of epidermis have tiny **hair-like extensions** into the spaces among soil particles.

- These extensions called **root hairs** are in direct contact with soil water.
- Root hairs have large surface area.

3. **Cortex**
   It is **broad zone** of cells just inside the epidermis. Water moves from epidermis to cortex.
4. **Endodermis**
   It is the **innermost boundary** of cortex that receive water from cortex.
5. **Pericycle**
   It is a **narrow layer of cells** present on the inner side of endodermis.
6. **Vascular Tissues**
   - **Xylem** and **phloem** (collectively called vascular bundle) are present in the innermost region of the root.
   - They are in the form of a **rod** which is connected to the similar rod in the stem.

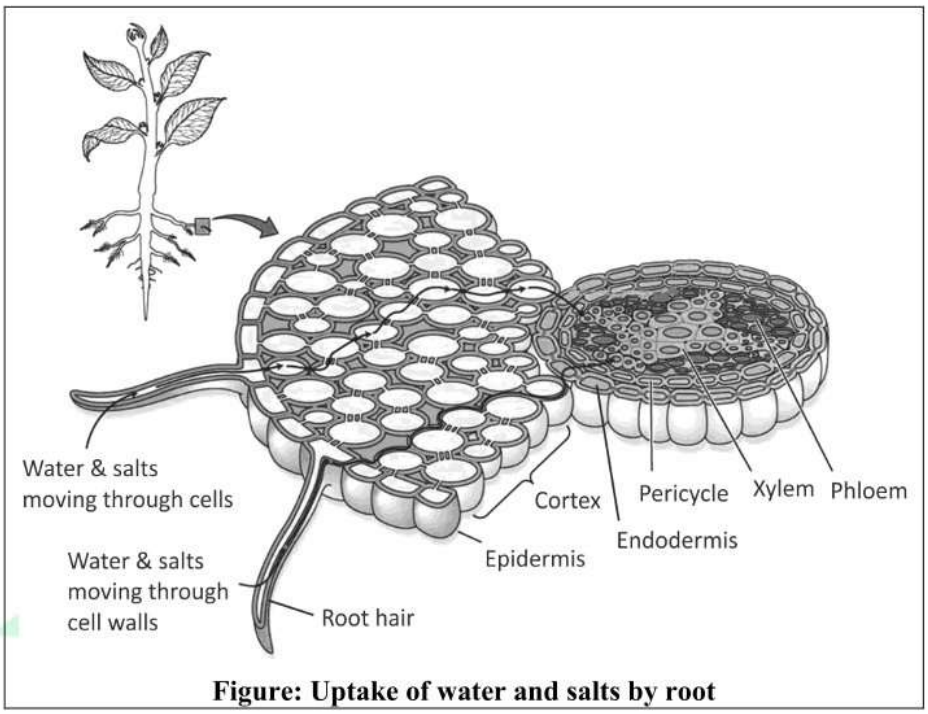


Figure: Uptake of water and salts by root

Uptake of Water and Salts:

1. **Uptake by Root Hairs**
   - The soil water has a **lower concentration** of salts as compared to root hairs.
   - Root hairs take in more salts by **active transport**.
   - Due to the difference in the concentration of salts in soil and root hair, water moves by osmosis (passive transport) from soil to the root hairs.
2. **Movement of Water and Salts**
   - From root hairs, the water with dissolved salts moves to the other cells of epidermis.
   - Water moves from **epidermis** to **cortex** to **pericycle**.
   - Water from pericycle moves into the xylem of root from where it is transported to the xylem of the stem.

Types of Pathway:

Inside the root, water and salts take two pathways to reach the core of the root i.e., through the cells and through cell walls and intercellular spaces.

SHORT ANSWER QUESTIONS

Q.1 Give the pathway of water and ion uptake in plant from soil. (K.B)

Ans:

WATER AND ION UPTAKE

Uptake by Root Hairs:

- The soil water has a **lower concentration** of salts as compared to root hairs.
- Root hairs take in more salts by **active transport**.
- Due to the difference in the concentration of salts in soil and root hair, water moves by osmosis (passive transport) from soil to the root hairs.

Movement of Water and Salts:

- From root hairs, the water with dissolved salts moves to the other cells of epidermis.
- Water moves from **epidermis** to **cortex** to **pericycle**.
- Water from pericycle moves into the xylem of root from where it is transported to the xylem of the stem.

Q.2 What are root hairs? Write down their function. (K.B)

Ans:

ROOT HAIRS

Definition:

Many cells of epidermis have tiny **hair-like extensions** into the spaces among soil particles. These extensions called **root hairs** are in direct contact with soil water.

Function:

Root hairs increase the **surface area** for water and salts absorption from soil.

Q.3 What do you mean by vascular tissues? (K.B)

Ans:

VASCULAR TISSUES

Definition:

Xylem and **phloem** are collectively called vascular bundle.

Location:

They are present in the **innermost region** of the root.

Structure:

They are in the form of a **rod** which is connected to the similar rod in the stem.

Functions:

Xylem transports water and salts in plant. While **phloem** is responsible for transportation of food.

Q.4 Enlist the tissues inside the root of plants. (K.B)

Ans:

TISSUES IN ROOT

Following tissues are present inside the root:

- Root Hairs
- Epidermis
- Cortex
- Endodermis
- Pericycle
- Vascular tissues

Q.5 What is the role of endodermis in the root? (K.B)

Ans:

ROLE OF ENDODERMIS

The endodermis is the innermost boundary of the cortex, receiving water from the cortex and directing it inward.

Q.6 What are the two pathways for water and salts inside the root? (K.B)

Ans:

PATHWAYS

Water and salts move either through the cells (symplast pathway) or through cell walls and intercellular spaces (apoplast pathway).

MULTIPLE CHOICE QUESTIONS

1. A narrow layer of cells inside the endodermis is known as: (K.B)
(A) Epidermis (B) Pericycle
(C) Vascular tissue (D) Cortex

2. A broad zone of cells just beneath the epidermis is: (K.B)
(A) Pericycle (B) Cuticle
(C) Endodermis (D) Cortex

3. The outermost layer of the root: (K.B)
(A) Endodermis (B) Cortex
(C) Pericycle (D) Epidermis

4. Root performs vital function such as: (A.B)
(A) They absorb water and salts from soil (B) Provide conducting tissue
(C) They anchor the plant (D) All

5. Root hairs are actually the extensions of: (K.B)
(A) Epidermal Cells (B) Endodermal cells
(C) Xylem cells (D) Phloem cells

6. The roots and root hairs absorb water from soil by: (K.B)
(A) Osmosis (B) Diffusion
(C) Phloem (D) Filtration

7. What is the primary function of the vascular tissues in roots? (K.B)
(A) Protection (B) Photosynthesis
(C) Transport of water and salts (D) Absorption

8. Which part of the root receives water from the cortex? (U.B)
(A) Epidermis (B) Endodermis
(C) Pericycle (D) Xylem

9. What is the main mechanism for water movement into root hairs? (U.B)
(A) Active transport (B) Osmosis
(C) Diffusion (D) Filtration

9.3 TRANSPIRATION

LONG ANSWER QUESTIONS

Q.1 Describe the events involved in the opening and closing of stomata. (K.B)

Ans:

OPENING AND CLOSING OF STOMATA

Mechanism of the Opening and Closing of Stomata:

Stomata open and close because of changes in the **turgor pressure** of their guard cells.

Structure of Guard Cells:

- The **sausage-shaped guard cells** are the only epidermal cells which contain chloroplasts.
- Their cell wall is thicker on the inside and thinner elsewhere.
- When guard cells become turgid, they become **bean-shaped**.
- In this condition, their inner walls of two guard cells move away from each other and the **stoma** between them **opens**.

Opening of Stomata during Daytime:

- The guard cells take in **potassium ions** from the surrounding cells by **active transport**.
- As a result, the solute concentration of guard cells increases as compared to the other cells of epidermis.
- So, water moves from epidermal cells to guard cells by **osmosis**.
- The guard cells become **turgid** and their inner sides move away from each other.
- In this way, the **stoma** between them **opens**.

- The solute concentration remains high in guard cells because they are doing **photosynthesis** and prepare glucose in them.
- So, water stays in them and they remain turgid.

Closing of Stomata during Evening:

- At **evening**, the glucose concentration falls in guard cells and potassium ions also move back to epidermal cells.
- As a result, water moves out from guard cells and they **lose turgor**.
- Their inner sides touch each other and the **stoma closes**.

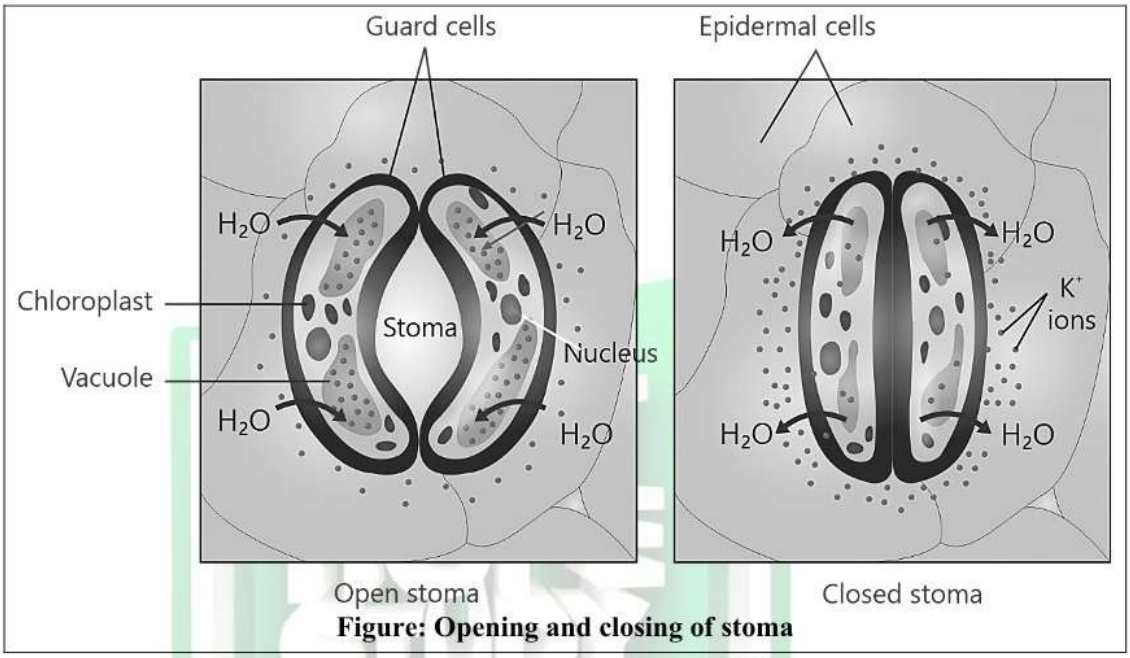


Figure: Opening and closing of stoma

Q.2 Define transpiration. Why it is considered as a necessary evil? (K.B)

Ans:

TRANSPIRATION

Transpiration:

The **loss of water** in the form of **vapours** from plant surface is called transpiration.

Sites of Transpiration:

This loss may occur through:

- **Stomata** in leaves
- Through the **cuticle** present on leaf epidermis
- Through special openings called **lenticels** present in the stems of some plants

Stomatal Transpiration:

- Most of the transpiration occurs through stomata and is called **stomatal transpiration**.
- In leaves, water moves from the xylem into the cell walls of mesophyll cells.
- From the moist walls of **mesophyll cells**, water evaporates into the **air spaces** of the leaf.
- These water vapours then move towards the **stomata** and then pass to the outside air.

Transpiration is a Necessary Evil:

- Although transpiration is the loss of water from plant but, yet it creates a pull on the **water columns** in the xylem tissue of leaves, stem and root.
- This pull is responsible for the **transport of water** and **salts** from root to leaves.
- But if there is deficiency of water in soil, then transpiration can result in serious **desiccation** or even **death** of the plant.

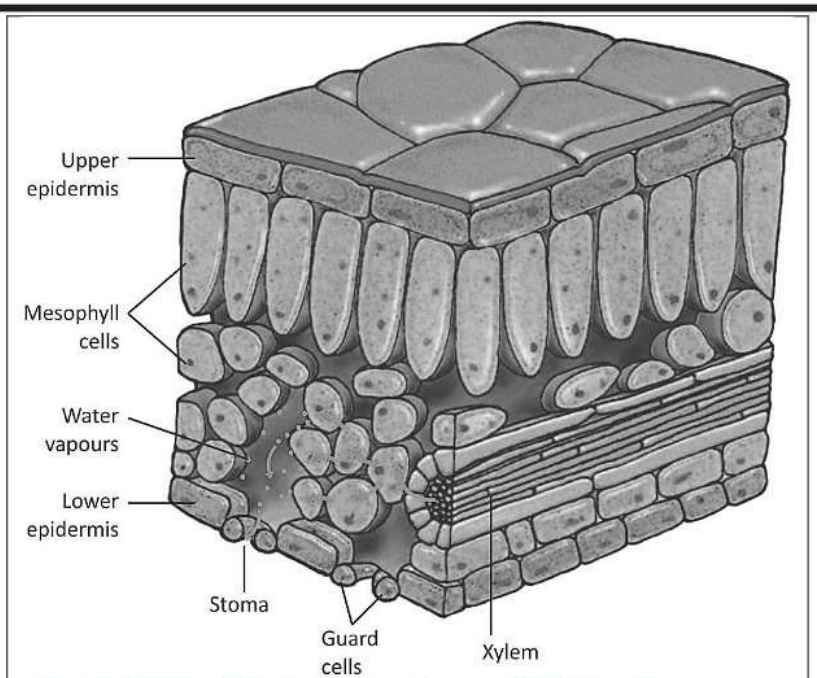


Figure: Events of transpiration

Q.3 Describe temperature, wind and humidity as the factors affecting the rate of transpiration. (U.B)

Ans:

FACTORS AFFECTING THE RATE OF TRANSPIRATION

Transpiration:

The loss of water in the form of vapours from plant surface is called transpiration.

Factors Affecting the Rate of Transpiration:

Transpiration is affected by several **factors**. For example:

1. **Temperature**
   - Increase in temperature results in an **increase** in the rate of transpiration.
   - It is due to the fact that at higher temperature, water **evaporates** more **quickly**.
2. **Wind**
   Wind speeds up transpiration by carrying away **humid air** surrounding the leaves, allowing for more water to evaporate.
3. **Humidity**
   The higher is humidity (the **percentage of water vapour** in the atmosphere), the lower is the rate of transpiration.
4. **Surface Area and Distribution of Stomata**
   - Leaves with more surface area transpire more than the leaves with **narrow blades**.
   - In most plants the number of stomata on the **lower leaf surface** is greater than on the upper surface.
   - Therefore, the **rate of transpiration** from the lower surface is greater than from the upper surface.

SHORT ANSWER QUESTIONS

Q.1 How guard cells open the stomata? (K.B)

Ans:

OPENING OF STOMATA

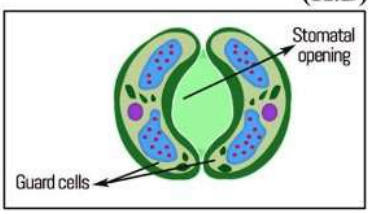
Steps:

- When guard cells become turgid, they become **bean-shaped**.
- In this condition, their inner walls of two guard cells move away from each other and the **stoma** between them **opens**.

Q.2 Explain the structure of guard cells. (K.B)

Ans:

GUARD CELLS



Structure of Guard Cells:

- The **sausage-shaped guard cells** are the only epidermal cells which contain chloroplasts.
- Their cell wall is thicker on the inside and thinner elsewhere.
- When guard cells become turgid, they become **bean-shaped**.

Q.3 Why stomata closes at evening? (U.B)

Ans:

STOMATA AT EVENING

- At **evening**, the glucose concentration falls in guard cells and potassium ions also move back to epidermal cells.
- As a result, water moves out from guard cells and they **lose turgor**.
- Their inner sides touch each other and the **stoma closes**.

Q.4 Explain transpiration. (K.B)

Ans:

TRANSPIRATION

Definition:

The loss of water in the form of vapours from plant surface is called transpiration.

Sites of Transpiration:

This loss may occur through:

- **Stomata** in leaves
- Through the **cuticle** present on leaf epidermis
- Through special openings called **lenticels** present in the stems of some plants

Q.5 How transpiration occurs from stomata? / Describe stomatal transpiration. (K.B)

Ans:

STOMATAL TRANSPIRATION

Definition:

Most of the transpiration occurs through stomata and is called **stomatal transpiration**.

Stomatal Transpiration:

- In leaves, water moves from the xylem into the cell walls of mesophyll cells.
- From the moist walls of **mesophyll cells**, water evaporates into the **air spaces** of the leaf.
- These water vapours then move towards the **stomata** and then pass to the outside air.

Q.6 What is the relation of surface area with rate of transpiration? (U.B)

Ans:

RATE OF TRANSPIRATION

- Flat and broad leaves have more surface area because they have more stomata than narrow leaves.
- So, there is more transpiration from broad leaves.
- In most plants the number of stomata on the lower leaf surface is greater than on the upper surface.
- Therefore, the rate of transpiration from the lower surface is greater than from the upper surface.

Q.7 Write down the effect of humidity and wind on the rate of transpiration. (U.B)

Ans:

HUMIDITY AND WIND

Humidity:

- Humidity is the percentage of water vapours present in atmosphere.
- The higher is the humidity in atmosphere, the lower is the rate of transpiration.
- In low humidity, there are less water vapours in atmosphere.
- So, the rate of the loss of water vapours from leaf is high.

Wind:

Wind speeds up transpiration by carrying away **humid air** surrounding the leaves, allowing for more water to evaporate.

Q.8 How transpiration is beneficial for plants? Explain. (U.B)

Ans:

TRANSPIRATION

Importance:

- Due to the transpiration of water from leaves, there is a pulling force on the water columns in xylem tissue of leaves, stem and root.
- It helps water and salts to enter the root cells.
- Moreover, when water transpires from the surfaces of the plant, it has a cooling effect on plant.
- This is especially important in warmer environments

Q.9 Can transpiration be harmful for plants? Explain. (U.B)

Ans:

HARM OF TRANSPIRATION

- When soil water is not available to the roots, excessive transpiration from leaves may result in wilting.
- During such shortage of water, guard cells lose turgor and so stomata are closed.
- In this way rate of transpiration is decreased.
- This prevents wilting of the leaves.

MULTIPLE CHOICE QUESTIONS

1. A stoma is covered by: (K.B)

(A) Epidermis (B) Cuticle
(C) Guard cells (D) Adipose

2. Stoma open when water enter the guard cells to make them: (A.B)

(A) Dissapear (B) Turgid
(C) Large (D) Flaccid

3. The loss of water from plant surface is known as: (K.B)

(A) Transpiration (B) Evaporation
(C) Condensation (D) Translocation

4. During transpiration, the loss of water is about: (K.B)

(A) 20% (B) 40%
(C) 60% (D) 90%

5. At higher temperature, the rate of transpiration is: (K.B)

(A) Low (B) High
(C) Same (D) Stopped

6. It is not related with the characteristics of transpiration: (A.B)

(A) It is a necessary evil
(B) Causes cooling effect
(C) Decreases with the increase in wind
(D) Causes wilting of leaves, when soil has low water content

7. _____ provide large surface area for the evaporation of water. (K.B)

(A) Mesophyll cell (B) Epidermal cell
(C) Endodermal cell (D) Cells of cortex

8. Transpiration from plant surface takes place through: (K.B)

(A) Cuticle (B) Stomata
(C) Lenticels (D) All of these

9. The rate of transpiration doubles with every rise of temperature. (K.B)

(A) 10ºC (B) 20 ºC
(C) 30ºC (D) 40 ºC

10. Transpiration rate depends upon: **(U.B)**
(A) Leaf surface area (B) Wind
(C) Temperature (D) All of these

11. In humid air the rate of transpiration is: **(U.B)**
(A) High (B) Low
(C) Normal (D) Not at all

12. Transpiration can cause wilting of leaves when there is: **(U.B)**
(A) Less water in soil (B) Less water in xylem
(C) No water in air (D) Closure of stomata

13. Humidity is the percentage of water vapours in: **(U.B)**
(A) Soil (B) Leaves
(C) Atmosphere (D) Xylem

9.4 TRANSPORT OF WATER AND SALTS IN PLANTS

LONG ANSWER QUESTIONS

Q.1 Describe the mechanism of transport of water and salts in plants. **(K.B)**

Ans:

TRANSPORT OF WATER AND SALTS

Transpirational Pull:

- **Roots** cannot push the absorbed water and salts to the leaves of the plant.
- Instead, the leaves apply a **pulling force** on water present in roots.
- The pulling force in leaves is created by the transpiration of water from their surfaces.
- Therefore, it is called **transpirational pull**.

Mechanism of Transport:

1. **Water Column**
   - When **mesophyll cells** of leaf lose water, more water enters in them from xylem vessels.
   - Inside xylem vessels, there is a **continuous water column**.
   - This water column extends from leaves to stem and to the roots.
2. **Forces behind Water Column**
   The continuous water column is created due to three reasons:
   i. The **forces of attraction** among water molecules.
   ii. The **narrow diameter** of xylem vessels.
   iii. The force by which water molecules are **adhered** to the walls of xylem vessels.
3. **Tension in Water Column**
   - When one water molecule moves up by the xylem of the leaf, it produces a **tension** on the entire water column in the xylem of leaves, stem and root.
   - As a result, the entire water column is **pulled upwards**.

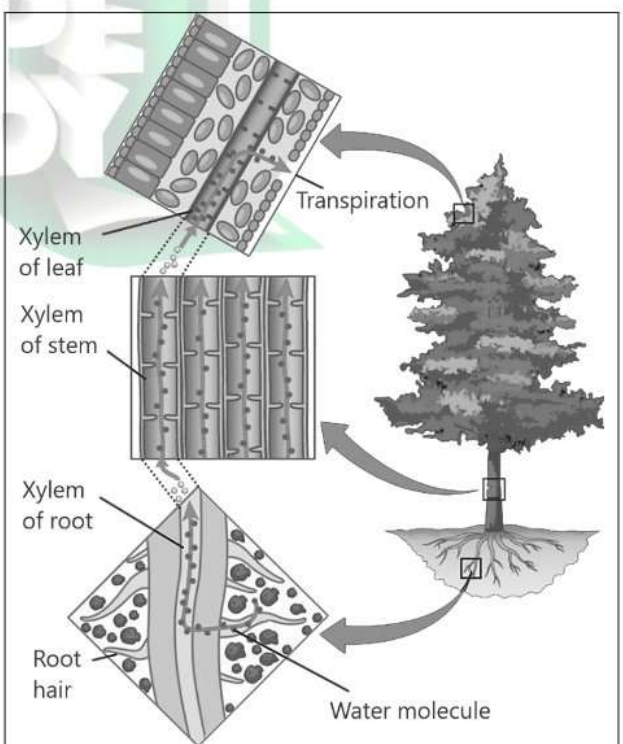


Figure: Transport of water in plants

9.5 TRANSLOCATION OF FOOD IN PLANTS

LONG ANSWER QUESTIONS

Q.1 Explain the mechanism of food translocation by Pressure Flow Mechanism. (K.B)

Ans:

TRANSLOCATION OF FOOD

Introduction:

- Inside the plant body, food is **transported** from one part to the other through **phloem tissue**.
- For transportation in most plants, **glucose** is converted into **sucrose**.
- The mechanism of the transport of food in plants is called **pressure flow mechanism**.

Pressure-Flow Mechanism:

According to pressure flow mechanism, dissolved food flows from a **source** to a **sink**.

Source:

The sources include **photosynthetic tissues** (e.g. mesophyll of leaves) and **storage tissues** (e.g. roots).

Sink:

Sinks include the sites of **food utilization** (e.g. growing tips of roots and stems) and the **storage tissues**.

Process of Food Translocation:

1. **At Source**
   - At the source site, food (**sucrose**) enters the **sieve tubes** of phloem by active transport.
   - **Companion cells** of phloem provide energy for this transport.
   - Due to higher solute concentration in sieve tubes than the nearby xylem tissue, water flows into sieve tubes by **osmosis**.
   - In this way, the **osmotic pressure** in sieve tubes increases and the solution of food flows towards the sink.
2. **At Sink**
   - At the sink, sucrose is actively **unloaded** from the phloem cells into sink tissues.
   - It reduces osmotic pressure in the phloem cells.
   - So, water also flows out and moves to xylem tissue.

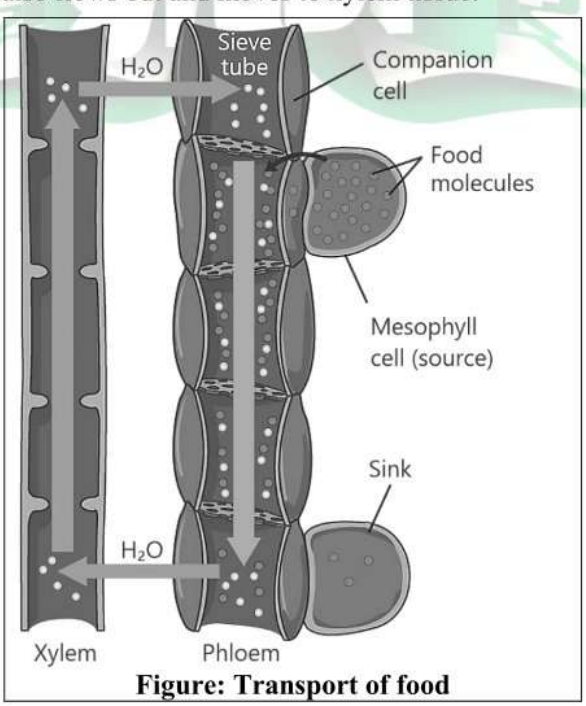


Figure: Transport of food

SHORT ANSWER QUESTIONS

Q.1 What is transpirational pull? (K.B)

Ans:

TRANSPIRATIONAL PULL

- **Roots** cannot push the absorbed water and salts to the leaves of the plant.
- Instead, the leaves apply a **pulling force** on water present in roots.
- The pulling force in leaves is created by the transpiration of water from their surfaces.
- Therefore, it is called **transpirational pull**.

Q.2 Which forces maintain the water column in xylem? (K.B)

Ans:

WATER COLUMN IN XYLEM

The continuous water column is created due to three reasons:

- The **forces of attraction** among water molecules.
- The **narrow diameter** of xylem vessels.
- The force by which water molecules are **adhered** to the walls of xylem vessels.

Q.3 What is the role of tension among water molecules? (U.B)

Ans:

TENSION AMONG WATER MOLECULES

When one water molecule moves up by the xylem of the leaf, it produces a **tension** on the entire water column in the xylem of leaves, stem and root. As a result, the entire water column is **pulled upwards**.

Q.4 Explain pressure flow mechanism. (K.B)

Ans:

PRESSURE FLOW MECHANISM

Statement:

According to pressure flow mechanism, dissolved food flows from a **source** to a **sink**.

Source:

The sources include **photosynthetic tissues** (e.g. mesophyll of leaves) and **storage tissues** (e.g. roots).

Sink:

Sinks include the sites of **food utilization** (e.g. growing tips of roots and stems) and the **storage tissues**.

Q.5 According to pressure flow mechanism, what happens at the source? (K.B)

Ans:

AT SOURCE

Loading of Food in Phloem:

- At the source site, food (**sucrose**) enters the **sieve tubes** of phloem by active transport.
- **Companion cells** of phloem provide energy for this transport.

Flow of the Food:

- Due to higher solute concentration in sieve tubes than the nearby xylem tissue, water flows into sieve tubes by **osmosis**.
- In this way, the **osmotic pressure** in sieve tubes increases and the solution of food flows towards the sink.

MULTIPLE CHOICE QUESTIONS

1. Xylem tissues are responsible for the transport of: (K.B)

(A) Sugar (B) Mineral
(C) Water & dissolved substance (D) Food

2. What creates the transpirational pull in plants? (K.B)

(A) Root pressure (B) Active transport
(C) Transpiration in leaves (D) Photosynthesis

3. What maintains the continuous water column in xylem vessels? (K.B)

(A) Root pressure
(B) Forces of attraction between water molecules
(C) Gravity
(D) Cell division

4. **Which force helps water molecules adhere to xylem vessel walls?** **(K.B)**
(A) Cohesion (B) Tension
(C) Osmosis (D) Adhesion

5. **What happens when mesophyll cells lose water?** **(K.B)**
(A) They dry out (B) They collapse
(C) Water enters them from xylem vessels (D) Photosynthesis stops

6. **What is transported through phloem tissue?** **(K.B)**
(A) Water (B) Glucose
(C) Sucrose (D) Salts

7. **What is the concept for the movement of food in plants?** **(K.B)**
(A) Osmosis (B) Root pressure
(C) Pressure flow mechanism (D) Active transport

8. **Which part of a plant acts as the source in the pressure flow mechanism?** **(U.B)**
(A) Growing roots (B) Xylem vessels
(C) Photosynthetic tissues (D) Stem tips

9. **Which part of a plant is a sink for food transport?** **(U.B)**
(A) Mesophyll cells (B) Epidermis
(C) Growing tips of roots and stems (D) Root hairs

10. **How does sucrose enter the sieve tubes at the source?** **(K.B)**
(A) Diffusion (B) Osmosis
(C) Active transport (D) Adhesion

9.6 GASEOUS EXCHANGE IN PLANTS

LONG ANSWER QUESTIONS

Q.1 **Describe the process of gaseous exchange in plants.** **(K.B)**

Ans:

GASEOUS EXCHANGE IN PLANTS

Gaseous Exchange in Plants:

- During daytime leaves are **releasing oxygen** and **taking carbon dioxide** from the environment.
- During night, all cells are carrying out **respiration** while there is **no photosynthesis**.
- So, the plant is taking in oxygen from environment and releasing carbon dioxide.

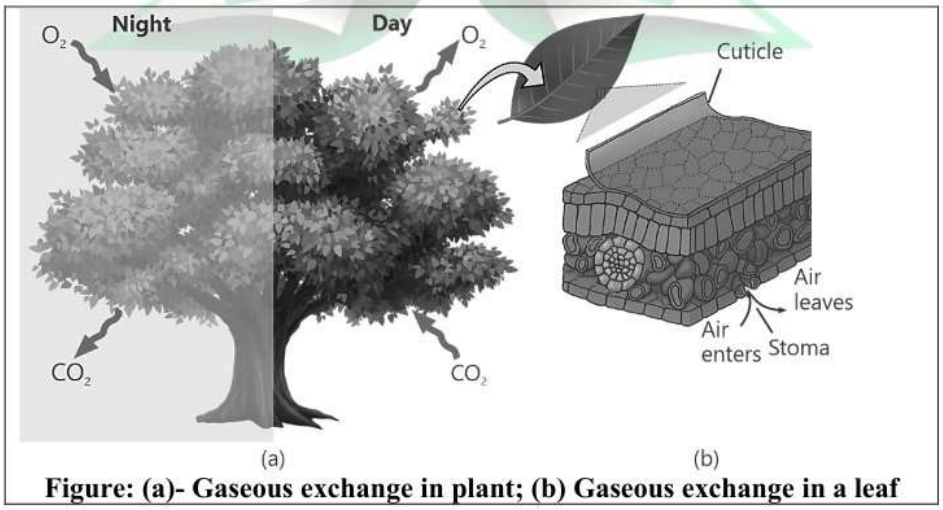


Figure: (a)- Gaseous exchange in plant; (b) Gaseous exchange in a leaf

Process of Gaseous Exchange:

1. **Through Plant Surface**
   - In plants, the gaseous exchange between body and the environment occurs through the **surface**.

- The **epidermis** of root, stem and leaves allows the exchange of gases between the inner cells and environment.

2. **Through Cuticle**
   - At some parts a **thick cuticle** is present over epidermis.
   - It also allows the exchange of gases.
3. **Through Stomata**
   - In leaves and young stems, the air moves in and out through the **stomata** present in epidermis.
   - Inside body, gaseous exchange occurs between cells and air.
4. **Through Lenticels**
   - In **woody stems**, the entire surface is covered by **bark**.
   - Gaseous exchange cannot occur through bark.
   - The bark contains special pores called **lenticels**, which allow the gaseous exchange with the environment.

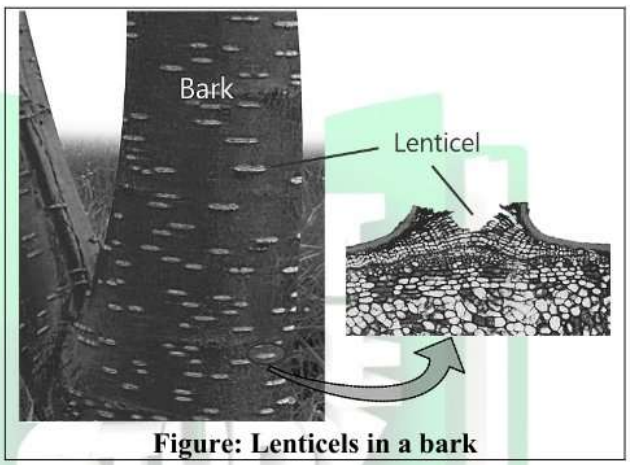


Figure: Lenticels in a bark

9.7 MECHANISM FOR EXCRETION

LONG ANSWER QUESTIONS

Q.1 Describe the mechanism/adaptations in plants for excretion of wastes. (K.B)

Ans:

EXCRETION OF WASTES

Excretion of Extra Carbon dioxide and Oxygen:

1. **During Day**
   - During the day, plants use the **carbon dioxide** produced in **cellular respiration** for **photosynthesis**.
   - The **oxygen** produced during photosynthesis is used for cellular respiration during the day.
   - Excess of **oxygen** is released into the atmosphere through the **stomata**.
2. **At Night**
   - At night, when photosynthesis is not occurring, carbon dioxide becomes a **waste** product.
   - Plants release this excess carbon dioxide through their **general surfaces** and **stomata**.

Excretion of Extra Water:

- Plants store large amounts of water in the **vacuoles** of their cells.
- It results in **turgor**, which provides support to the soft parts of the body.
- If plants have extra water, they remove it in two ways:

1. **Transpiration**
   - During the day, plants remove their extra water by **transpiration**.

- There are three types of transpiration: **stomatal transpiration**, **cuticular transpiration**, and **lenticular transpiration**.

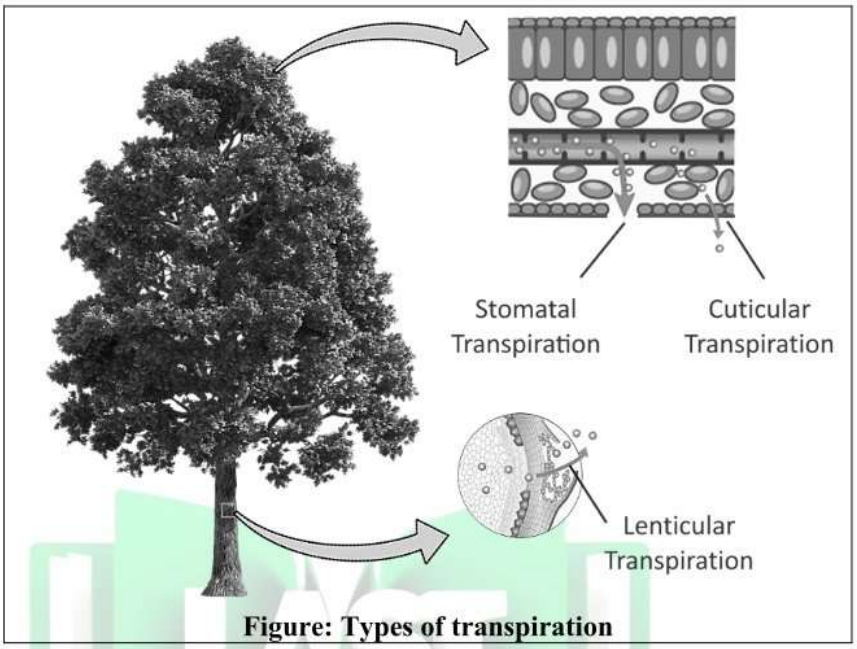


Figure: Types of transpiration

2. Guttation

- At night, when stomata are closed, many plants store excess water in their **xylem tissue**.
- This water is removed during the day.
- Some plants, such as **grasses**, have a specialized mechanism called **guttation** to remove excess water at night.

Definition:

- Guttation involves the release of **water droplets** through small pores located at the **tips** or **edges** of leaves.
- This process helps to regulate the plant's water content.

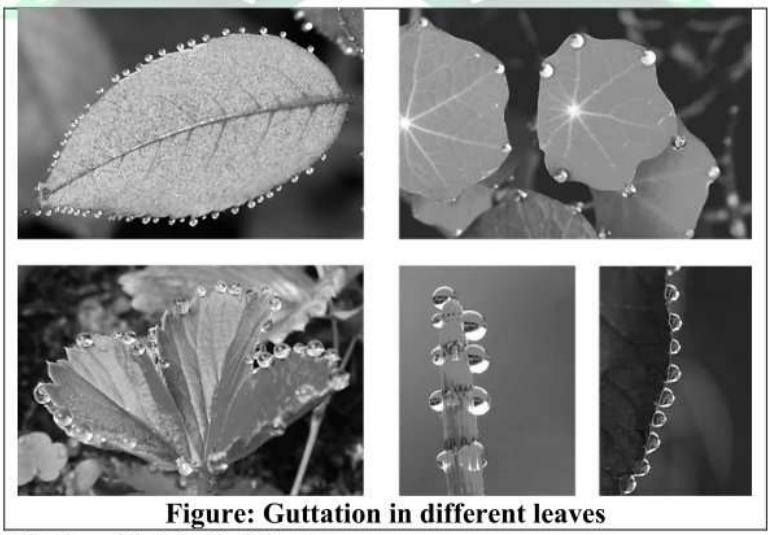


Figure: Guttation in different leaves

Excretion of other Metabolic Wastes:

- Plants adopt different methods to remove other **metabolic wastes** from their bodies.
- Some plants can store wastes in the form of **harmless crystals**.

- Some plants keep their wastes in their leaves.
- When their leaves fall, plant body also **gets rid of** these wastes.
- Some plants excrete their wastes through special pores by applying force.

Examples:

- **Rubber plant** excretes latexes
- ***Acacia* (keekar)** tree excretes gums
- **Coniferous trees** excrete resins
- **Ladyfinger** excretes mucilage

Figure: Excretion in Plants

SHORT ANSWER QUESTIONS

Q.1 What are the sites of gaseous exchange in plant? (K.B)

Ans:

SITES OF GASEOUS EXCHANGE

In plants, gaseous exchange occurs through:

- Plant surface (Epidermis)
- Cuticle
- Stomata
- Lenticels

Q.2 What are lenticels? (K.B)

Ans:

LENTICELS

Definition:

In woody stems, the entire surface is covered by bark. Gaseous exchange cannot occur through bark. The bark contains special pores called lenticels, which allow the gaseous exchange with the environment.

Q.3 Which gas is released as a waste by plants, during daytime? (K.B)

Ans:

DAYTIME

Processes during Daytime:

- During the day, plants use the **carbon dioxide** produced in **cellular respiration** for **photosynthesis**.
- The **oxygen** produced during photosynthesis is used for cellular respiration during the day.

Waste Gas:

As the rate of photosynthesis is more than respiration during day, so excess of **oxygen** is released into the atmosphere through the **stomata**.

Q.4 **Enlist the types of transpiration.** **(K.B)**

Ans:

TYPES OF TRANSPIRATION

There are three types of transpiration:

1. Stomatal transpiration
2. Cuticular transpiration
3. Lenticular transpiration

Q.5 **Define guttation.** **(K.B)**

Ans:

GUTTATION

Some plants, such as **grasses**, have a specialized mechanism called **guttation** to remove excess water at night.

Definition:

Guttation involves the release of **water droplets** through small pores located at the **tips** or **edges** of leaves. This process helps to regulate the plant's water content.

Q.6 **Enlist metabolic wastes in various plants.** **(K.B)**

Ans:

METABOLIC WASTES

Plant	Metabolic waste
Rubber plant	Latex
Acacia (Keekar)	Gums
Coniferous trees	Resins
Ladyfinger	Mucilage

Q.7 **How plants excrete different metabolic wastes?** **(K.B)**

Ans:

EXCRETION OF METABOLIC WASTES

Excretion of Different Metabolic Wastes:

- Plants adopt different methods to remove other **metabolic wastes** from their bodies.
- Some plants can store wastes in the form of **harmless crystals**.
- Some plants keep their wastes in their leaves.
- When their leaves fall, plant body also **gets rid of** these wastes.
- Some plants excrete their wastes through special pores by applying force.

MULTIPLE CHOICE QUESTIONS

1. **Which of the following process does not happen in plants at night:** **(U.B)**

(A) Photosynthesis (B) Respiration
(C) Guttation (D) Both A and B

2. **The gaseous exchange between inner cells of plant and environment is by:** **(K.B)**

(A) Xylem (B) Epidermis
(C) Intercellular spaces (D) All of these

3. **In the bark of woody stems, some pores are present. These are known as:** **(K.B)**

(A) Lenticels (B) Stomata
(C) Intercellular spaces (D) Hydathodes

4. **During daytime, the waste gas excreted by plants is:** **(K.B)**

(A) Hydrogen (B) Oxygen
(C) Nitrogen (D) Carbon dioxide

5. **Transpiration can occur through:** **(K.B)**

(A) Stomata (B) Lenticels
(C) Cuticle (D) All of these

6. **Guttation means the release of water from _____ of leaves:** **(K.B)**

(A) Base (B) Surface
(C) Edges (D) Stomata

7. **The metabolic waste of rubber plant is:** **(K.B)**
(A) Latex (B) Gums
(C) Resins (D) Mucilage

8. **The metabolic waste of coniferous trees is:** **(K.B)**
(A) Latex (B) Gums
(C) Resins (D) Mucilage

9. **Resins are secreted by:** **(K.B)**
(A) Rubber plant (B) Coniferous tree
(C) Keekar (D) Ladyfinger

10. **In some plants, cuticle is present:** **(K.B)**
(A) Around stomata (B) Inside of epidermis
(C) Around mesophyll cells (D) Over the epidermis

9.8 OSMOTIC ADJUSTMENTS IN PLANTS

LONG ANSWER QUESTIONS

Q.1 **Explain osmotic adjustments across various plant groups.** **(K.B)**

Ans:

OSMOTIC ADJUSTMENTS

Osmotic Adjustments in Plants:

On the basis of **habitats**, there are four types of plants.

1. **Mesophytes**

These are the **terrestrial plants** which live in **lands** where medium quantity of water is available.

Adaptations:

- They absorb water through **roots**.
- Most of their body surface is covered with **waxy cuticle**, which prevents water loss.
- They also control extra transpiration of water by closing their stomata.

Examples:

Examples of mesophytes are **maize** (**corn**), **clover** and **rose** etc.

2. **Hydrophytes**

They live in **freshwater** (ponds, and lakes etc.) or in **wet soil**.

Adaptations:

- In these plants, the absorption of water occurs through the **whole surface**.
- They use different ways to remove extra water from their bodies.
- Many hydrophytes have **broad leaves** which **float** on the surface of water.
- These leaves have large number of stomata on their upper surfaces.
- Water moves out through these stomata.

Examples:

The most common example of such plants is **water lily**.

3. **Xerophytes**

They live in extremely **dry environments** (deserts).

Adaptations:

- They have deep roots to absorb water from almost **dry soil**.
- Their body surface has very **few stomata**.
- It is also covered with thick **waxy cuticle** to reduce the loss of water.

Succulent Organs:

- Some xerophytes e.g. **Cacti** (singular: Cactus) store water in their specialized stems or roots.
- Such stems or roots are **soft** and **juicy** and are called **succulent organs**.

Examples:

The most common xerophytes are **cactus** and **pineapple**.

4. **Halophytes**

They live in habitats with **salty waters** (e.g. **sea** or **salty marshes**).

Issues:

Water tries to move out from their **hypotonic** bodies into the **hypertonic** environment.

Adaptations:

- These plants absorb salts from outside and make their bodies hypertonic.
- In this way, water does not move out of cells.
- The excess salt can be stored in cells or **excreted out** from **salt glands** on leaves.

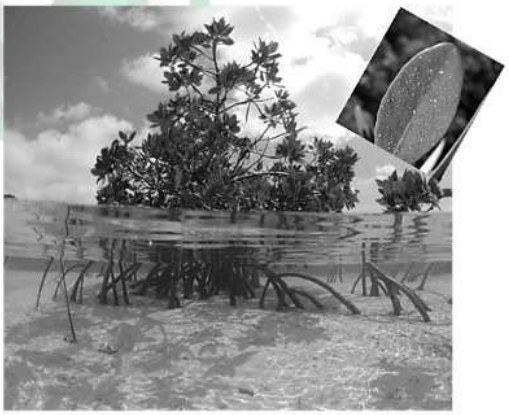
Examples:

Many **sea grasses** are included in this group.

(1)- Closed stomata in the leaf of tomato (a mesophyte)

(2)- Broad leaves of waterlily (a hydrophyte)

(3)- Succulent stem of *Cactus* (a xerophyte)



(4)- Salt crystals on the leaf of a sea plant (a halophyte)

SHORT ANSWER QUESTIONS

Q.1 How will you differentiate between various plant groups on the basis of their habitat? (K.B)

Ans:

PLANT GROUPS

Plant Group	Habitat
Mesophytes	Terrestrial (land) environment
Hydrophytes	Freshwater (ponds, lakes) or wet soil

Xerophytes	Dry environment (deserts)
Halophytes	Salty water (sea or salty marshes)

Q.2 What are mesophytes? How do mesophytes prevent water loss from their bodies? (K.B)

Ans:

MESOPHYTES

Definition:

These are the **terrestrial plants** which live in **lands** where medium quantity of water is available.

Adaptations:

- They absorb water through **roots**.
- Most of their body surface is covered with **waxy cuticle**, which prevents water loss.
- They also control extra transpiration of water by closing their stomata.

Q.3 How do hydrophytes remove extra water from their bodies? (K.B)

Ans:

HYDROPHYTES

Adaptations:

- In these plants, the absorption of water occurs through the **whole surface**.
- They use different ways to remove extra water from their bodies.
- Many hydrophytes have **broad leaves** which **float** on the surface of water.
- These leaves have large number of stomata on their upper surfaces.
- Water moves out through these stomata.

Q.4 What adaptations help xerophytes survive in dry environments? (K.B)

Ans:

XEROPHYTES

Adaptations:

- They have deep roots to absorb water from almost **dry soil**.
- Their body surface has very **few stomata**.
- It is also covered with thick **waxy cuticle** to reduce the loss of water.

Succulent Organs:

- Some xerophytes e.g. **Cacti** (singular: Cactus) store water in their specialized stems or roots.
- Such stems or roots are **soft** and **juicy** and are called **succulent organs**.

Q.5 What are succulent organs, and in which plant group are they found? (K.B)

Ans:

SUCCULENT ORGANS

Definition:

Some xerophytes e.g. **Cacti** (singular: Cactus) store water in their specialized stems or roots. Such stems or roots are **soft** and **juicy** and are called **succulent organs**.

Q.6 What mechanisms do halophytes use to manage excess salts? (K.B)

Ans:

HALOPHYTES

Issues:

Water tries to move out from their **hypotonic** bodies into the **hypertonic** environment.

Adaptations:

- These plants absorb salts from outside and make their bodies hypertonic.
- In this way, water does not move out of cells.
- The excess salt can be stored in cells or **excreted out** from **salt glands** on leaves.

MULTIPLE CHOICE QUESTIONS

1. What is the habitat of mesophytes? (K.B)

(A) Desert (B) Freshwater bodies
(C) Salty marshes (D) Terrestrial environment

2. Which adaptation helps mesophytes reduce water loss? (K.B)

(A) Broad leaves (B) Salt glands
(C) Waxy cuticle (D) Deep roots

3. **How do hydrophytes mainly absorb water?** **(K.B)**
(A) Through roots (B) Through their whole surface
(C) Through specialized stems (D) Through stomata

4. **What feature is commonly found on the leaves of hydrophytes?** **(U.B)**
(A) Thick cuticle (B) Salt glands
(C) Succulent stems (D) Stomata on the upper surface

5. **Which plant group is adapted to survive in deserts?** **(K.B)**
(A) Mesophytes (B) Hydrophytes
(C) Xerophytes (D) Halophytes

6. **What helps xerophytes store water?** **(K.B)**
(A) Succulent organs (B) Broad leaves
(C) Salt glands (D) Floating leaves

7. **In halophytes, what adaptation prevents water loss in salty environments?** **(K.B)**
(A) Thick cuticle (B) Broad leaves
(C) Absorption of salts (D) Less number of stomata

8. **Which plant group is adapted to live in salty water?** **(K.B)**
(A) Hydrophytes (B) Xerophytes
(C) Mesophytes (D) Halophytes

9. **Which of the following is an example of a xerophyte?** **(K.B)**
(A) Maize (B) Water lily
(C) Cactus (D) Sea grass

TEXTBOOK EXERCISE

MULTIPLE CHOICE QUESTIONS

1. **Which of the following plant nutrients is required in large amount?**
(A) Iron (B) Zinc
(C) Potassium (D) Boron

2. **Which element is required by plants for the formation of chlorophyll?**
(A) Phosphorus (B) Calcium
(C) Magnesium (D) Sulphur

3. **The primary function of root hairs is:**
(A) Transport of nutrients (B) Storage of food
(C) Increase surface area for absorption (D) Synthesis of proteins

4. **Root hairs absorb salts from soil by;**
(A) Diffusion (B) Osmosis
(C) Active transport (D) Filtration

5. **Water moves from the soil into root cells by:**
(A) Osmosis (B) Active transport
(C) Facilitated diffusion (D) Bulk flow

6. **The transpiration is regulated by;**
(A) Mesophyll (B) Guard cells
(C) Xylem (D) Phloem

7. **Under which condition, there will be high rate of transpiration?**
(A) High humidity (B) Low light intensity
(C) Wind (D) Waterlogged soil

8. Which ion plays a role in the opening of stomata?

(A) Sodium (Na) (B) Potassium (K)
(C) Calcium (Ca^{2+}) (D) Magnesium (Mg^{2+})

9. In most plants the food is transported in the form of:

(A) Glucose (B) Sucrose
(C) Starch (D) Maltose

10. What is TRUE according to the pressure flow mechanism of food transport?

(A) Water enters the source, creating pressure
(B) Water is pulled from the sink
(C) Movement of food in phloem is due to gravity
(D) Solutes move from low to high concentration

11. Succulent organs are present in:

(A) Xerophytes (B) Hydrophytes
(C) Mesophytes (D) Halophytes

SHORT ANSWER QUESTIONS

Q.1 Define mineral nutrition in plants.

Ans:

MINERAL NUTRITION IN PLANTS

Definition:

Mineral nutrition in plants refers to the **essential chemical elements** which are absorbed from the soil that are necessary for their **growth**, **development**, and other biochemical processes.

Examples:

Macronutrients: C, H, O, P, K, N, S, Ca, Mg
Micronutrients: Fe, B, Mn, Zn, Cl, Ni, Cu, Mo

Q.2 Define macronutrients and micronutrients and give examples.

Ans:

DEFINITION

Macronutrients:

The minerals which are required in **larger quantities** are called macronutrients.

Example:

Carbon, hydrogen, oxygen, phosphorus, potassium, nitrogen, sulphur, calcium, and magnesium.

Micronutrients:

The minerals which are required in **lower quantities** are called micronutrients.

Example:

Iron, molybdenum, boron, copper, manganese, zinc, chlorine, and nickel.

Q.3 State the roles of nitrogen and magnesium in plants.

Ans:

NITROGEN AND MAGNESIUM

Role of Nitrogen in Plants:

- Nitrogen is a necessary part of all **proteins**, **enzymes** and **nucleic acids**.
- It is also a part of **chlorophyll**.
- Nitrogen helps plants for **rapid growth**, increasing seed and fruit production and improving the quality of leaf.

Role of Magnesium in Plants:

- Magnesium is part of the **chlorophyll**.
- It also activates many plant enzymes needed for growth.
- It also helps in **fruit formation** and **germination of seeds**.

Q.4 Define transpiration and its types.

Ans:

TRANSPIRATION

Transpiration:

The **loss of water** in the form of **vapours** from plant surface is called transpiration.

Types of Transpiration:

The types of transpiration include:

- **Stomata** transpiration
- **Cuticular** transpiration
- **Lenticular** transpiration

Q.5 How is the transpirational pull important in plants?

Ans:

TRANSPIRATIONAL PULL

Definition:

Roots cannot push the absorbed water and salts to the leaves of the plant. Instead, the leaves apply a **pulling force** on water present in roots. The pulling force in leaves is created by the transpiration of water from their surfaces. Therefore, it is called **transpirational pull**.

Q.6 Transpiration is the loss of water from plants. Is it a harmful phenomenon? If no, what is its importance?

Ans:

TRANSPIRATION

Transpiration is beneficial for plants. Although in some cases, it can also be harmful.

Importance:

- Although transpiration is the loss of water from plant but, yet it creates a pull on the **water columns** in the xylem tissue of leaves, stem and root.
- This pull is responsible for the **transport of water** and **salts** from root to leaves.

Deficiency:

But if there is deficiency of water in soil, then transpiration can result in serious **desiccation** or even **death** of the plant.

Q.7 Differentiate between:

i. Xylem and Phloem

Ans:

DIFFERENTIATION

Xylem	Phloem
DEFINITION	
Transports water and minerals from roots to other parts of plant.	Transports food (sucrose) from source to sink.
STRUCTURE	
Made up of tracheids and vessels elements.	Made up of sieve tubes and companion cells.
CELL TYPE	
Mostly dead cells.	Mostly living cells
WALL THICKNESS	
Thick walls with lignin.	Thin walls without lignin.

ii. Transpiration and Guttation

Ans:

DIFFERENTIATION

Transpiration	Guttation
DEFINITION	
Loss of water vapours from aerial parts of the plant.	Loss of water in the form of droplets from leaf edges or tips.
TIME OF OCCURRENCE	
Occurs during the day when stomata are open.	Occurs at night or early morning when humidity is high and transpiration is low

LOCATION	
Takes place mainly through stomata, cuticle, and lenticels.	Takes place through pores of leaf margins or tips.

iii. Hydrophytes and Halophytes

Ans: **DIFFERENTIATION**

Hydrophytes	Halophytes
HABITAT	
Live in freshwater (ponds, lakes) or wet soil.	Live in habitats with salty waters (e.g., sea or salty marshes).
WATER ABSOPRTION	
Absorb water through the whole surface of the plant.	Absorb water but also need to manage excess salt intake.
LEAF ADAPTATIONS	
Broad leaves with large number of stomata on upper surfaces.	Leaves have specialized structures (salt glands) to excrete excess salt.
EXAMPLES	
Water lily	Sea grasses

iv. Hydrophytes and Xerophytes

Ans: **DIFFERENTIATION**

Hydrophytes	Halophytes
HABITAT	
Live in freshwater (ponds, lakes) or wet soil.	Live in extremely dry environments (deserts).
WATER ABSOPRTION	
Absorb water through the whole surface of the plant.	Have deep roots to absorb water from almost dry soil.
LEAF ADAPTATIONS	
Broad leaves with large number of stomata on upper surfaces.	Have few stomata and thick waxy cuticles to reduce water loss.
EXAMPLES	
Water lily	Cactus

v. Lenticular transpiration and Stomatal transpiration

Ans: **DIFFERENTIATION**

Lenticular transpiration	Stomatal transpiration
LOCATION	
Transpiration occurs through the lenticels (small openings in the bark or stems).	Transpiration occurs through the stomata (pores mainly found on leaves).
RATE	
Generally lower rate of transpiration as compared to stomatal transpiration.	Higher rate of transpiration as stomata are more abundant.
OCCURRENCE	
Occurs in woody plants like trees, mainly through stems and bark.	Occurs mainly in leaves, but can also be present in stems and other parts.

Q.8 How do the plants of rubber and keekar excrete their wastes?

Ans: **WASTE EXCRETION**

Rubber Plant:

Rubber plants excrete their wastes in the form of **latex**, by the process of **guttation**.

Keekar Tree:
Keekar trees excrete their wastes in the form of **gums**, through **glands** located on the leaves and stems.

EXTENSIVE ANSWER QUESTIONS

Q.1 Describe the events involved in the opening and closing of stomata.
See Q.No.1 of topic 9.3

Q.2 Explain the internal structure of root and describe the uptake of salt and water by root.
See Q.No.1 of topic 9.2

Q.3 Describe temperature, wind and humidity as the factors affecting the rate of transpiration.
See Q.No.3 of topic 9.3

Q.4 Describe the mechanism of transport of water and salt in plants.
See Q.No.1 of topic 9.4

Q.5 Explain the mechanism of food translocation by Pressure Flow Mechanism.
See Q.No.1 of topic 9.5

Q.6 How do the plants excrete extra water and salts from their bodies?
Consult Q.No.1 of topic 9.7

Q.7 Describe the process of gaseous exchange in plants
See Q.No.1 of topic 9.6

Q.8 Describe the mechanisms/adaptations in plants for excretion of wastes.
See Q.No.1 of topic 9.7

Q.9 Explain osmotic adjustments in in hydrophytes, xerophytes and halophytes.
See Q.No.1 of topic 9.8

INQUISITIVE ANSWER QUESTIONS

Q.1 Why do plants transpire more on a windy day compared to a humid one?

Ans:

RATE OF TRANSPIRATION

Plants transpire more on a windy day than on a humid day due to the following reasons:

Effect of Wind:

- On a windy day, moving air carries away the **water vapor** around the leaves.
- This creates a low concentration of water vapor near the leaf surface, increasing the gradient between the inside and outside of the leaf.
- As a result, water **evaporates** faster from the leaf through **stomata**, increasing the rate of transpiration.

Effect of Humidity:

- On a humid day, the air already contains a lot of water vapor, so the concentration gradient between the inside of the **leaf** (high water vapours) and the **outside air** (already moist) is smaller.
- This slows down the rate of water loss from the leaves, reducing transpiration.

EXTRA CONCEPTUAL MCQs

8. What is the primary role of magnesium in plants?
(A) Aids in root growth
(B) Central molecule in chlorophyll
(C) Helps in water absorption
(D) Increases fruit formation

9. Which of the following is not a macronutrient for plants?
(A) Nitrogen
(B) Copper
(C) Potassium
(D) Calcium

10. What is the process called when water moves from the soil into plant roots?
(A) Photosynthesis (B) Transpiration
(C) Absorption (D) Respiration

11. What role does nitrogen play in plants?
(A) Chlorophyll formation (B) Fruit quality improvement
(C) Protein synthesis (D) Stomatal opening and closing

12. Where are waste products in plants primarily stored?
(A) Roots (B) Stems
(C) Leaves (D) Flowers

13. What does the pressure flow theory explain in plants?
(A) How plants absorb sunlight (B) The movement of water from roots to leaves
(C) The transport of sugars in the phloem (D) The growth of plant roots

14. What is the main site for gas exchange in a plant?
(A) Roots (B) Seeds
(C) Leaves (D) Flowers

15. How do plants excrete waste products?
(A) Through the stomata and lenticels (B) By shedding leaves
(C) Through the roots (D) A and B are correct

16. Which of the following is not a function of roots in plants?
(A) Absorption of water (B) Photosynthesis
(C) Nutrient absorption (D) Anchor the plant

17. The process which is not involved with water transport in plants.
(A) Transpiration (B) Photosynthesis
(C) Root pressure (D) Capillary action

18. What is/are the role(s) of stomata in plants?
(A) Gaseous exchange (B) Water absorption
(C) Translocation (D) Nutrient uptake

19. Which component is part of the plant's vascular system?
(A) Root hairs (B) Phloem
(C) Cuticle (D) Stomata

20. It is not among the functions of leaves in plants?
(A) Photosynthesis (B) Waste storage
(C) Water storage (D) Gas exchange

21. Which factors influence the rate of transpiration in plants?
(A) Wind (B) Light intensity
(C) Humidity (D) All of these

22. It is the function of root hairs.
(A) Transport of water and minerals (B) Transport of food
(C) Absorption of water (D) Protein synthesis

STUDENT LEARNING OUTCOMES (SLOs)

SHORT ANSWER QUESTIONS

Q.1 Why the uptake of nutrients in plants is assisted by the use of water?

Ans:

ROLE OF WATER

- Water plays a pivotal role in the uptake and transport of nutrients in plants.
- It serves as a **solvent**, allowing nutrients to dissolve and be absorbed through roots.
- It also drives the movement of these nutrients within the plant through processes like **transpiration**.

Q.2 What is chlorosis?

Ans:

CHLOROSIS

Chlorosis is a condition where leaves **fail** to synthesize sufficient **chlorophyll**, leading to reduced photosynthesis and **pale (yellow) coloured leaves**.

Q.3 Explain different pathways for water entering the root.

Ans:

WATER ENTERING PATHWAYS

During water absorption by roots, the flow of water and minerals from the epidermis through the root hairs to the xylem can occur through three distinct pathways:

1. **Apoplast Pathway**
   Apoplast pathway is the movement of water through **adjacent cell walls** and **intercellular spaces**, without entering in cytoplasm until it reaches the in the endodermis.
2. **Symplast Pathway**
   Symplast pathway is water movement through the **cytoplasmic junction** (plasmodesmata) between adjacent cells, allowing water to pass directly from cell to another through their shared cytoplasm.
3. **Vacuolar Pathway**
   Vacuolar pathway is a movement of water through **vacuoles** where water travels from one vacuole to another within the cell, passing through the cytoplasm and connecting, via **plasmodesmata**, to neighbouring cells.

Q.4 Enlist the osmotic modifications in hydrophytes.

Ans:

OSMOTIC MODIFICATIONS IN HYDROPHYTES

Hydrophytes:

Hydrophytes are the plants that live in areas where there is more than the required amount of water is available.

Osmotic Modifications:

They have the following modifications for **osmoregulation**.

- They have a **poor root system**.
- They have **broad leaves** with a large surface area.
- The **cuticle** is either absent or very thin.
- Stomata are higher in number and are usually present on the upper surface.

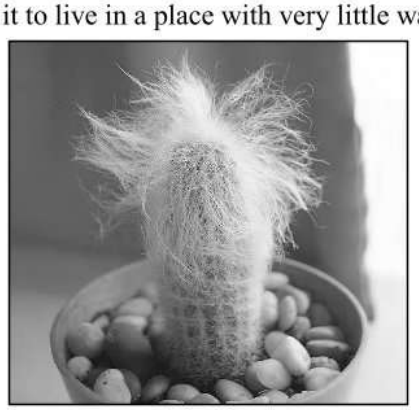
Q.5 What is the strategy of xerophytes for cooling down? Explain with an example.

Ans:

COOLING EFFECT IN XEROPHYTES

Old-Man Cactus:

- The **old man cactus** has lots of white, **fluffy hairs** that act like a mirror for the sun's rays, bouncing them back and keeping the cactus cool and hydrated in the hot **Mexican desert**.
- This **clever trick** helps it to live in a place with very little water.



MULTIPLE CHOICE QUESTIONS

26. It is the central atom in chlorophyll molecules.
(A) Magnesium (B) Boron
(C) Nitrogen (D) Iron

27. Chlorosis is when plant fails to synthesis sufficient:
(A) Nutrients (B) Food
(C) Gases (D) Chlorophyll

28. When water uses plasmodesmata to move among the adjacent cells, it is:
(A) Apoplast pathway (B) Symplast pathway
(C) Vacuolar pathway (D) Plasmo pathway

29. In tall trees, the speed of water due to TACT forces is:
(A) 2 m/hr (B) 4 m/hr
(C) 6 m/hr (D) 8 m/hr

30. Other than tall trees, the speed of water due to TACT forces is:
(A) 1 m/hr (B) 4 m/hr
(C) 5 m/hr (D) 8 m/hr

31. The amount of water lost in plants due to transpiration is:
(A) 1% (B) 99%
(C) 50% (D) 90%

32. Which light triggers the opening of stomata by activating proton pumps?
(A) Blue (B) Red
(C) White (D) Yellow

33. Pressure flow theory was hypothesized by:
(A) F. Miescher (B) Ernst Munch
(C) Elbert Wallace (D) Robert Hooke

34. Due to higher rate of photosynthesis during daytime, plant release:
(A) Food (B) Carbon dioxide
(C) Oxygen (D) Water vapours

35. Poor root system, thin cuticle, higher stomatal number, as the characteristics of:
(A) Mesophytes (B) Xerophytes
(C) Halophytes (D) Hydrophytes

36. An adaptation of plants for removal of wastes is:
(A) Crystals formation (B) Hydathodes
(C) Leaf fall (D) Guttation

37. In which of the following plants, there will be no transpiration?
(A) Plant in a hilly area (B) Plant in a desert
(C) Aquatic plant submerged in water (D) Aquatic plant with floating leaves

38. Most of the uptake of water and minerals from soil takes place through:
(A) Epidermal cells (B) Root cap
(C) Root (D) Root hair

39. Which category of plants stores a small amount of water and has a thin cuticle?
(A) Hydrophytes (B) Xerophytes
(C) Mesophytes (D) Succulents

40. What is a key role of leaves in managing waste in plants?
(A) Storing waste materials (B) Producing chlorophyll
(C) Absorbing water from the soil (D) Converting waste into energy

41. When the rate of photosynthesis become equal to that rate of respiration in the plant body, which of the following pattern of gaseous exchange occurs between plant and its environment:
(A) Carbon dioxide is absorbed, and oxygen is released
(B) Oxygen is absorbed, and carbon dioxide is released
(C) Both carbon dioxide and oxygen are absorbed
(D) Neither carbon dioxide nor oxygen are absorbed

42. What is the role of companion cells in the translocation process?
(A) They store excess solutes in the phloem
(B) They help regulate water potential in the xylem
(C) They actively transport sugars into the phloem's sieve tube elements
(D) They assist in the absorption of water by roots

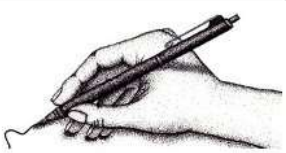
43. What drives the translocation of organic solutes in plants?
(A) Differences in sugar concentration (B) Differences in leaf size
(C) Differences in root structure (D) Differences in stem length

44. According to the TACT theory, what are the four factors that work together to move water and minerals up a plant?
(A) Temperature, humidity, sunlight, and soil type
(B) Transpiration pull, Adhesion, Cohesion, and Tension
(C) Stomata, xylem, phloem, and roots
(D) Leaves, stems, roots, and flowers

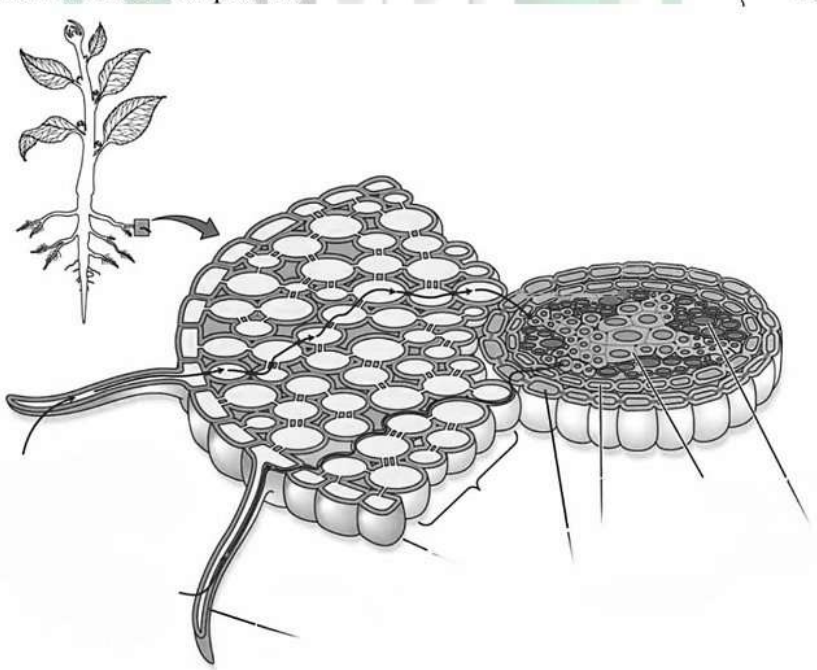
45. What drives the bulk flow of water to the top of the plant according to the TACT theory?
(A) Root pressure (B) Solar energy from photosynthesis
(C) Soil moisture (D) Transpiration from the leaves

ASSIGNMENT

LET'S DRAW AND LABEL



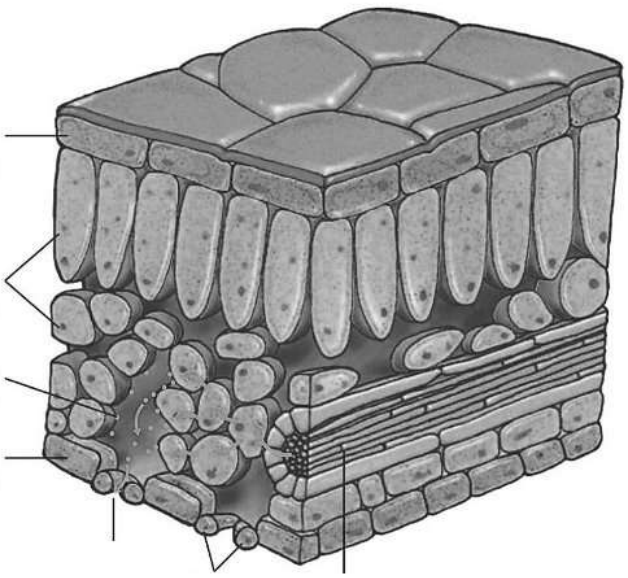
(A) Internal Structure of Root
Instructions:
Identify and label the inner components.



(B) Internal Structure of Leaf

Instructions:

Identify and label the inner components.



(C) Translocation of Food

Instructions:

Make a diagram showing translocation of food in plants.

Terms to Know	
Active Transport	Energy-requiring process by which substances are transported across cell membranes against their concentration gradient.
Adhesion	Attraction between different molecules, such as water and the walls of xylem vessels.
Apomixis	A form of asexual reproduction in plants where seeds are produced without fertilization.
Ascent of Sap	The process by which water and nutrients are transported from roots to leaves in plants.
Casparian Strips	Bands of suberin in the cell walls of the endodermis, preventing water and solute movement between cells.
Chlorosis	A condition in plants characterized by yellowing of leaves due to insufficient chlorophyll production.
Cohesion	Attraction between molecules of the same substance, such as water molecules sticking together.
Companion Cells	Specialized cells associated with sieve tube elements in the phloem, assisting in nutrient transport.
Compensation Point of Photosynthesis	Light intensity at which the rate of photosynthesis equals the rate of respiration in plants.
Cortex	Region of tissue in plant roots and stems between the epidermis and vascular tissue, involved in storage and transport.
Cuticle	Waxy, waterproof layer covering the outer surface of leaves and stems.
Cuticular Transpiration	Transpiration through the waxy cuticle covering leaf surfaces.
Endodermis	Innermost layer of the root cortex, regulating the movement of water and nutrients into the vascular tissue.
Endosmosis	Inward movement of water across a semipermeable membrane.
Epidermis	Outermost layer of cells covering plant surfaces, providing protection and regulating water loss.
Exosmosis	Outward movement of water across a semipermeable membrane.
Floral Buds	Undeveloped flower structures containing floral meristems.
Floral Leaves	Modified leaves of a flower, Including sepals, petals, stamens, and carpels.
Lenticels	Pores in the bark of woody stems. allowing gas exchange between internal tissues and the atmosphere
Lenticular transpiration	Transpiration through lenticels - small openings in the bark of woody stems.
Macronutrients	Essential nutrients required by plants in relatively large quantities, including nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur.

Answer Key

TOPIC 9.1

1	B	**2**	B	**3**	C	**4**	D	**5**	D
6	A	**7**	B	**8**	C	**9**	B	**10**	B

TOPIC 9.2

1	B	**2**	D	**3**	D	**4**	D	**5**	A
6	A	**7**	C	**8**	B	**9**	B		

TOPIC 9.3

1	C	**2**	B	**3**	A	**4**	D	**5**	B
6	C	**7**	A	**8**	D	**9**	A	**10**	D
		11	B	**12**	A	**13**	C		

TOPIC 9.5

1	C	**2**	C	**3**	B	**4**	D	**5**	C
6	C	**7**	C	**8**	C	**9**	C	**10**	C

TOPIC 9.7

1	A	**2**	C	**3**	A	**4**	B	**5**	D
6	C	**7**	A	**8**	C	**9**	B	**10**	D

TOPIC 9.8

1	D	**2**	A	**3**	B	**4**	D	**5**	C
6	A	**7**	C	**8**	D	**9**	C		

TEXTBOOK EXERCISE MCQs

1	C	**2**	C	**3**	C	**4**	C	**5**	A
6	B	**7**	C	**8**	B	**9**	B	**10**	A
				11	A				

EXTRA CONCEPTUAL MCQs

1	B	**2**	B	**3**	C	**4**	C	**5**	C
6	C	**7**	C	**8**	D	**9**	B	**10**	B
11	A	**12**	B	**13**	B	**14**	D	**15**	C

SLOs MCQs

1	A	**2**	D	**3**	B	**4**	C	**5**	A
6	B	**7**	A	**8**	B	**9**	C	**10**	D
11	C	**12**	C	**13**	D	**14**	C	**15**	A
16	D	**17**	C	**18**	A	**19**	B	**20**	D