

## Descriptive Questions

### Introduction

**Q.1 Differentiate between autotrophic and heterotrophic organisms.**

09409001

**Ans.**

**a. Autotrophic Organisms**

**Definition**

Autotrophic organisms obtain water, carbon dioxide and minerals from their environment and prepare their food.

**Examples**

Some bacteria, all algae, and all plants.

**b. Heterotrophic Organisms**

**Definition**

Heterotrophic organisms obtain their food from other organisms.

**Examples**

Most bacteria, and all protozoans, fungi and animals.

### Nutrition in Plants

**Q.2 Define nutrition and nutrients.**

09409002

**Ans. Nutrition**

Nutrition means the processes in which food is prepared or obtained and converted into body substances for growth and energy.

**Nutrients**

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

**Q.3 Define macronutrients and micronutrients. Explain role of mineral nutrients in plant life.**

09409003

**Ans. Mineral Nutrition**

These are special chemical elements absorbed from soil that are essential for the plants to grow.

**Macronutrients**

The minerals which are required in larger quantities are called macronutrients e.g. carbon, hydrogen, oxygen, phosphorus, potassium, nitrogen, sulphur, calcium, and magnesium.

**Micronutrients**

The minerals which are required in lower quantities are called micronutrients e.g. iron, molybdenum, boron, copper, manganese, zinc, chlorine, and nickel.



**Table: 9.1: Role of Mineral Nutrients in Plant Life**

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

Micronutrients	Role in Plant Life
Iron	Necessary for photosynthesis, activates many enzymes
Molybdenum	Component of the enzyme that converts 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 What is the role of nitrogen and magnesium in plant growth?**

09409004

**Ans.****a. Role of Nitrogen**

- 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.
- 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.

**Effects of 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.

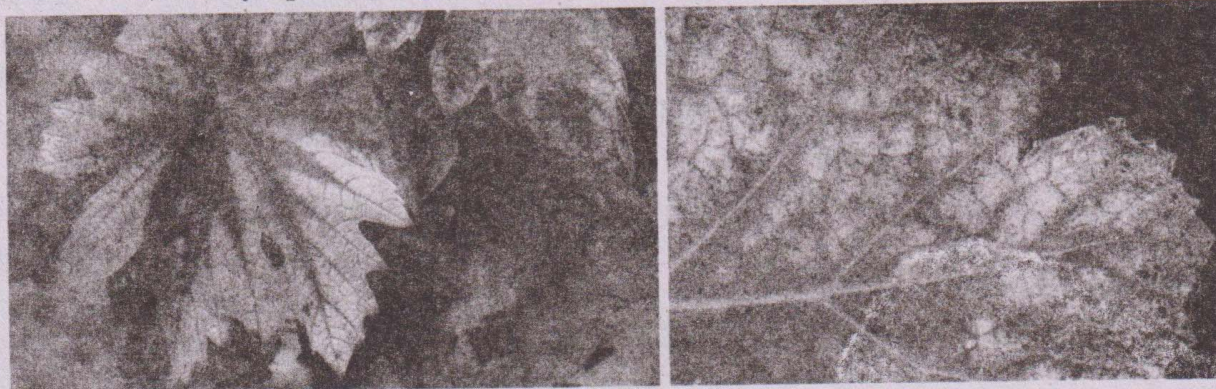
**b. Role of Magnesium**

- 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.
- Plant roots absorb magnesium in ionic form ( $Mg^{+2}$ ).



### Effects of Magnesium Deficiency

- 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.
- 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.



(a)

(b)

Figure 9.1: (a) Chlorosis due to Nitrogen deficiency, (b) Chlorosis due to magnesium deficiency

### Transport in Plants

**Q.5 (a) What is transport in plants? How does it take place?**

09409005

**Ans. Definition**

Transport means the movement of substances, such as water, nutrients, hormones, and waste products within an organism.

**Need of Transport**

This movement is essential for cellular functions, growth, and responses to environmental changes.

**Explanation**

- Plants get water and mineral nutrients (salts) from the soil. These materials are transported to the aerial parts of the body.
- Similarly, the food prepared by leaves is transported to other parts of the body.
- In all land plants (except mosses and liverworts), the transport of water, salts and food is carried out by xylem and phloem tissues.
  - Xylem** is responsible for the transport of water and salts.
  - Phloem** is responsible for the transport of food.

**Q.5 (b) Define the following terms:**

- Diffusion**
- Passive Transport and Active Transport**
- Osmosis**

**Ans. Diffusion:** It is the movement of molecules from an area of higher concentration to an area of lower concentration, until they are evenly spread out. In organisms, the diffusion of molecules is of two types:



**Passive Transport:** It is the movement of molecules across a cell membrane from a high to a low concentration, without using energy.

**Active Transport:** It is the movement of molecules across a cell membrane from a low concentration to a high concentration, using energy.

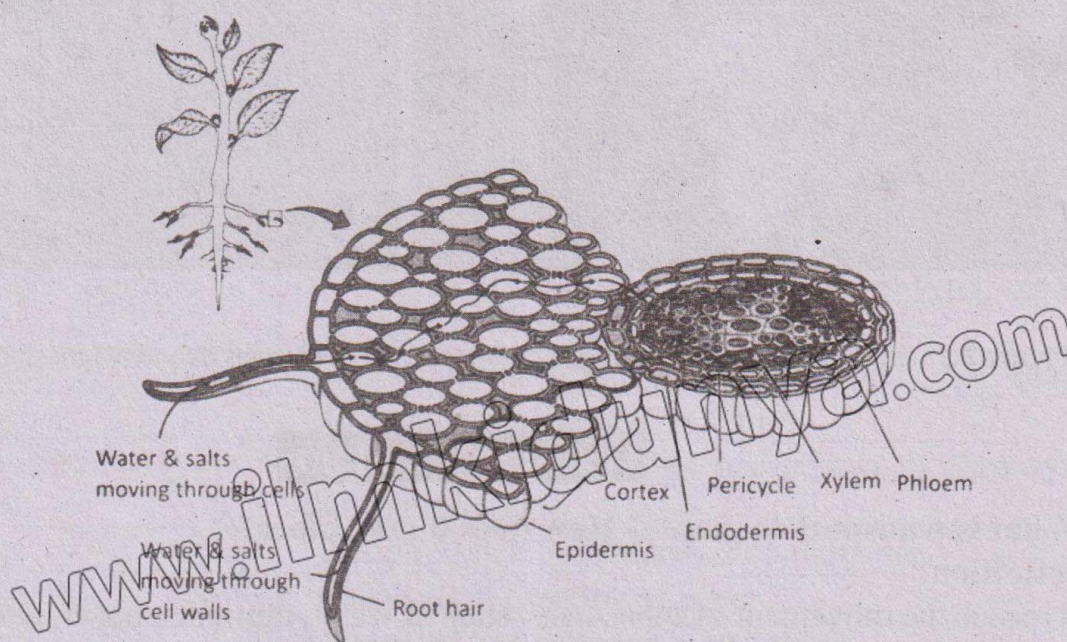
**Osmosis:** It is the movement of water molecules through a semi-permeable membrane from a region of lower solute concentration to a region of higher solute concentration.

**Q.6 Explain the internal structure of root and describe the uptake of water and salts by roots.**

09409006

**Ans. Introduction**

Roots are the organs which absorb water and salts from the soil. The internal structure of a root shows the following features that help the roots to perform this function.



**Figure 9.2:** Uptake of water and salts by root

## Internal Structure of Root Epidermis

### Epidermis

The outermost covering of the root i.e. epidermis is a single layer of cells.

### 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.

### Absorption and Transport of Water

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. From root hairs, the water with dissolved salts moves to the other cells of epidermis.

**Cortex:** It is broad zone of cells just inside the epidermis. Water moves from epidermis to cortex.

**Endodermis:** It is the innermost boundary of cortex that receive water from cortex.

**Pericycle:** It is a narrow layer of cells present on the inner side of endodermis.



## 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.
- Water from pericycle moves into the xylem of root from where it will be transported to the xylem of the stem.
- 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.

## Transpiration

**Q.7 Define transpiration. Where does it take place?**

09409007

**Ans. Definition**

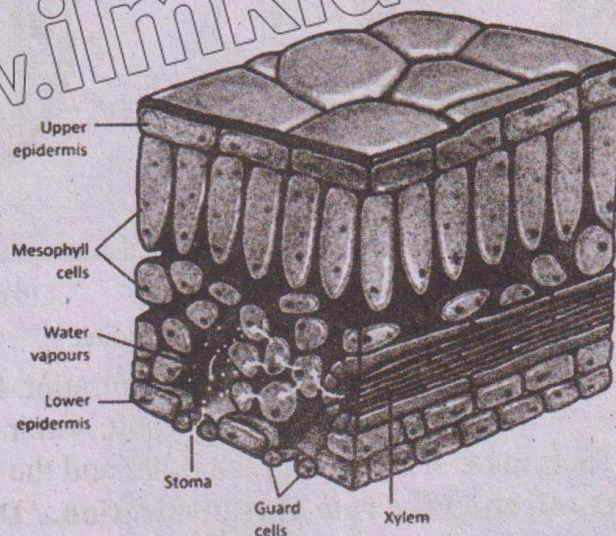
The loss of water in the form of vapours from plant surface is called transpiration.

### Occurrence

This loss may occur through stomata in leaves, through the cuticle present on leaf epidermis, or 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.



**Figure 9.3: Event of transpiration**

**Q.8 Describe the events involved in the opening and closing of stomata. / Describe the mechanism of opening and closing of stomata.**

09409008

**Ans. Introduction**

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



## Transport of Water and Salts and Transpiration Pull

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.

### Movement of Water from Epidermal Cells to Guard Cells

**a. Events 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.

### b. Opening of Stomata

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 do photosynthesis and prepare glucose in them. So, water stays in them and they remain turgid.

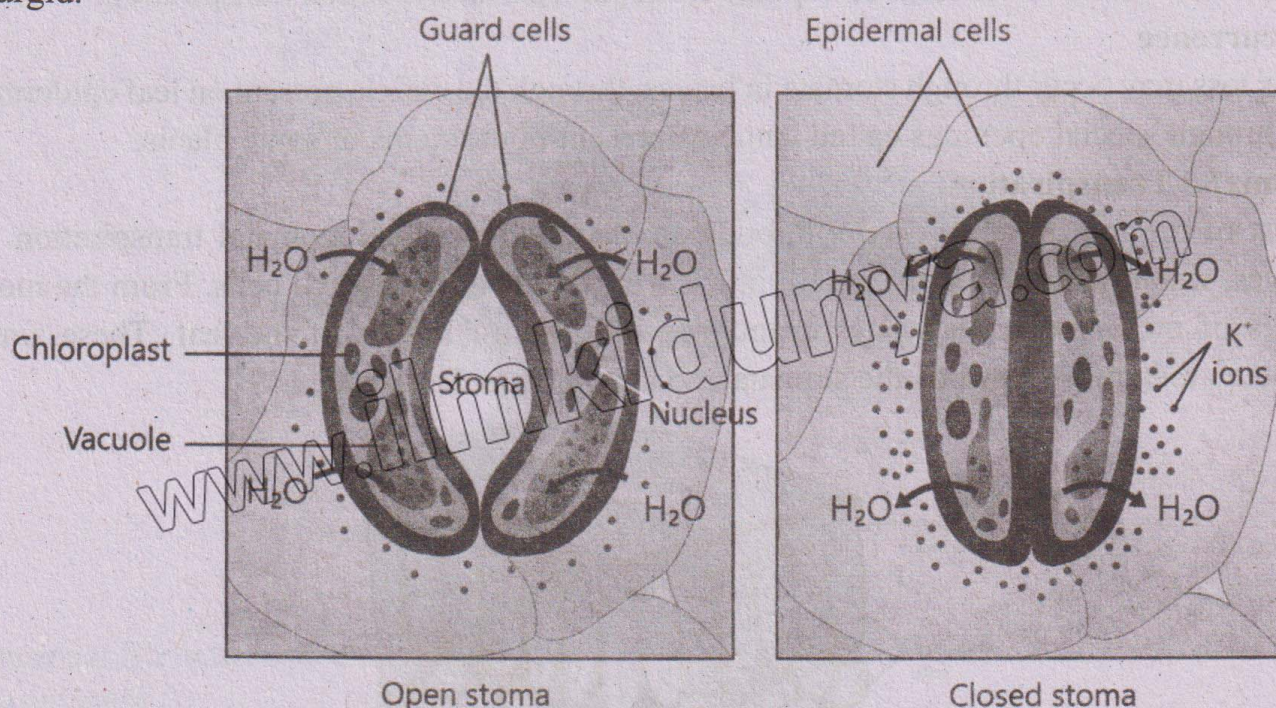


Figure 9.4: Opening and Closing of Stoma

**c. Events 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.

**Q.9 Describe the factors affecting the rate of transpiration. / Describe temperature, wind and humidity as the factors affecting the rate of transpiration.** 09409009

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

- **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.
- **Wind:** Wind speeds up transpiration by carrying away humid air surrounding the leaves, allowing for more water to evaporate.
- **Humidity:** The higher is humidity (the percentage of water vapour in the atmosphere); the lower is the rate of transpiration.



- **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.

### Transport of Water and Salts in Plants

**Q.10** Describe the mechanism of transport of water and salts in plant.

09409010

**Ans. Introduction**

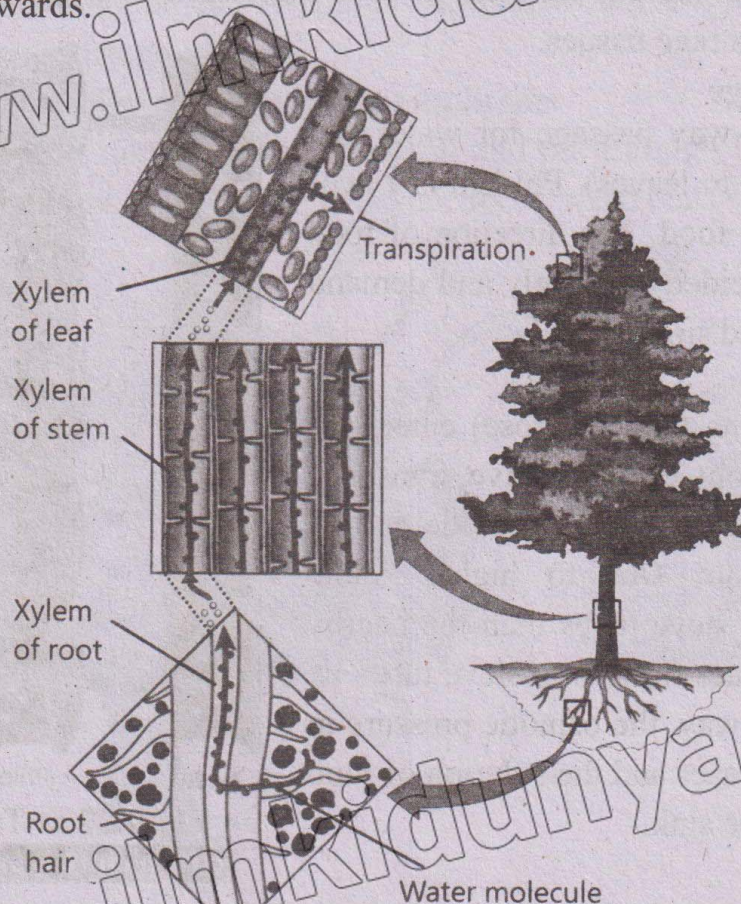
Roots cannot push the absorbed water and salts to the leaves of the plant. Instead, the leaves apply a pulling force on water present in roots. The pulling force in leaves is created by the transpiration of water from their surfaces. Therefore, it is called transpirational pull.

#### Explanation

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. 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.

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 9.5:** Transport of Water in Plants



## Translocation of Food in Plants

- ◆ Theories
- ◆ Pressure Flow Mechanism
- ◆ Source / Sink



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**Q.11 Explain the mechanism of food translocation by pressure flow mechanism.**

09409011

### Ans. 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**.

#### i. Explanation

According to pressure flow mechanism, dissolved food flows from a source to a sink. The sources include photosynthetic tissues (e.g. mesophyll of leaves) and storage tissues (e.g. roots). Sinks include the sites of food utilization (e.g. growing tips of roots and stems) and the storage tissues.

#### ii. Two-way Passage

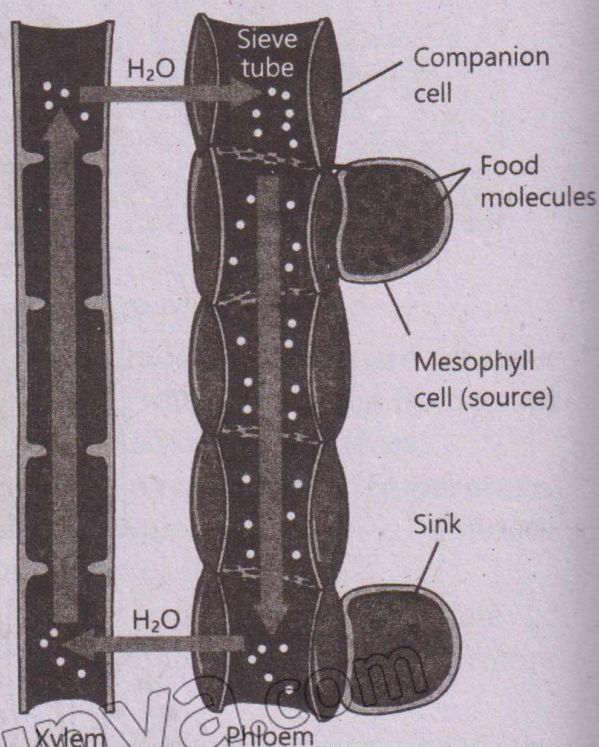
Xylem is a one-way passage for water and salts (from roots to leaves). Phloem is a two-way passage for food. The direction of food movement is decided by supply and demand in the sources and sinks.

#### iii. Sources

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.

#### iv. Sinks

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 9.6: Transport of food**  
(HQ picture is available on Pg # 212)



## Gaseous Exchange

**Q.12** Describe the process of gaseous exchange in plants.

09409012

**Ans. During Daytime**

During the daytime, all plant cells are carrying out cellular respiration while their green parts are carrying out photosynthesis.

- In photosynthesis, they use carbon dioxide and release oxygen. They take carbon dioxide which they produce in respiration. They also take carbon dioxide from the environment.
- In respiration, they use oxygen produced during photosynthesis. They release carbon dioxide to the environment.

So, during daytime leaves are releasing oxygen and taking carbon dioxide from the environment.

**During Night Time**

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.

**Process of Gaseous Exchange**

**i. Gaseous Exchange through Epidermis and Cuticle**

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. At some parts a thick cuticle is present over epidermis. It also allows the exchange of gases.

**ii. Gaseous Exchange through the Leaves and Stems**

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.

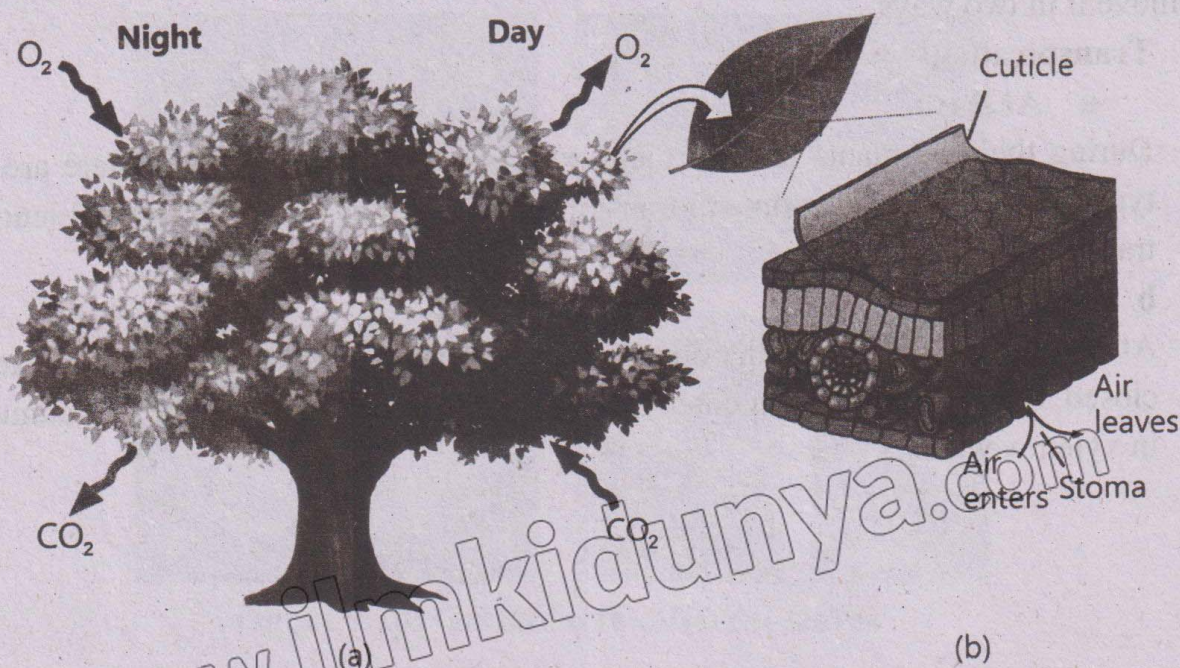


Figure 9.7: (a) Gaseous exchange in plant; (b) Gaseous exchange in a leaf



### iii. Gaseous Exchange in Woody Stems

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.

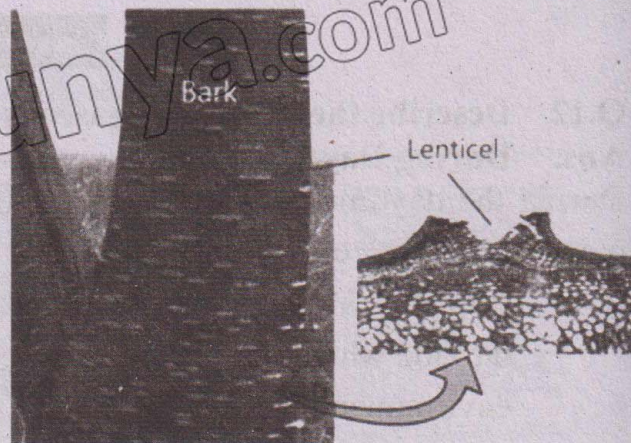


Figure 9.8: Lenticels in a bark

## Mechanism for Excretion

**Q.13** How do plants exchange extra water and salts from their bodies? / Describe the mechanism / adaptations in plants for excretion.

09409013

**Ans.**

#### a. Excretion of Extra Carbon dioxide and Oxygen

During the day, plants use the carbon dioxide produced in cellular respiration for photosynthesis. However, 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.

Similarly, the oxygen produced during photosynthesis is used for cellular respiration during the day. Excess of oxygen is released into the atmosphere through the stomata.

#### b. 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 plant body. If plants have extra water, they remove it in two ways.

##### 1. Transpiration

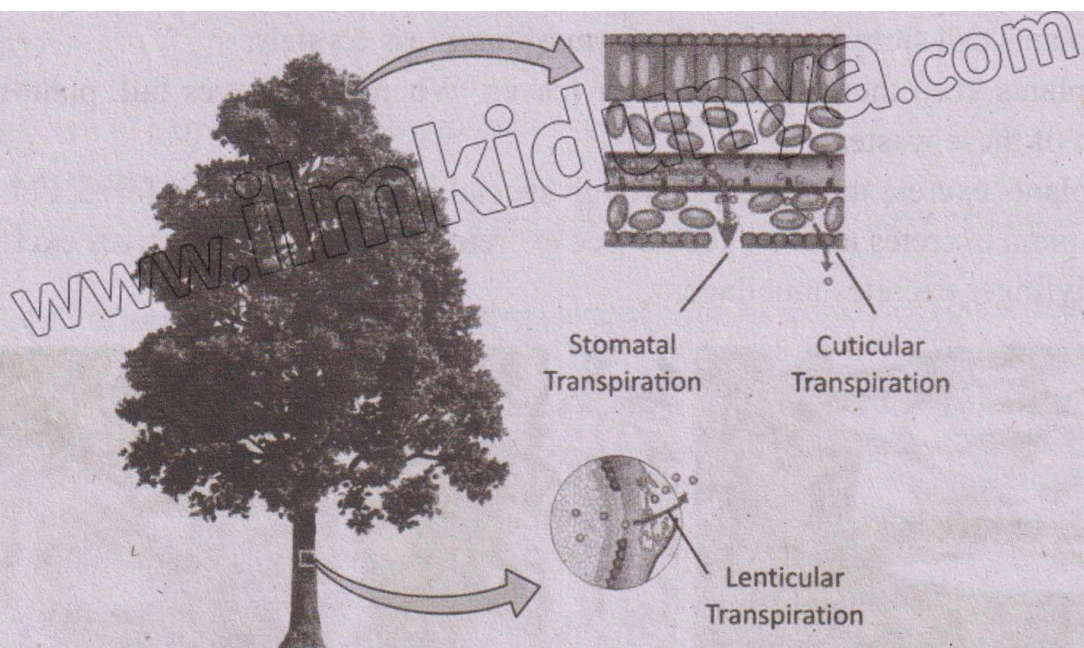
###### a At Day

During the day, plants remove their extra water by transpiration. There are three types of transpiration: stomatal transpiration, cuticular transpiration, and lenticular transpiration.

###### b At Night

At night, transpiration usually does not occur because most plants have their stomata closed. If there is high water content in soil, water enters the roots and is accumulated in xylem vessels.





**Figure 9.9: Type of Transpiration**

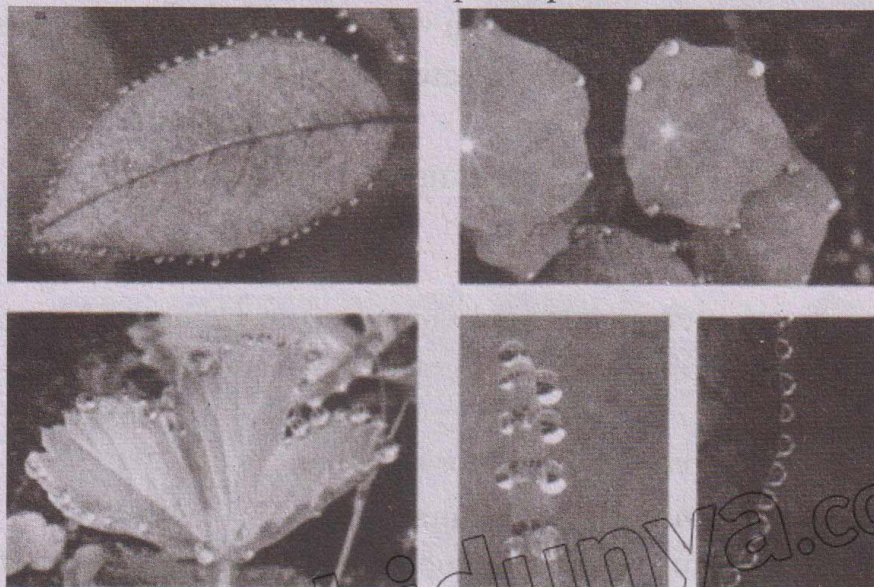
## 2. Guttation

### At Night

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

### Dew Formation

Guttation is different from dew formation. Dew means the water drops on the surface of leaves formed by the condensation of water vapours present in the air.



**Figure 9.10: Guttation in different leaves**

### c- Excretion of other Metabolic Wastes

Plants adopt different methods to remove other metabolic wastes from their bodies.



- i. Some plants can store wastes in the form of harmless crystals.
- ii. Some plants keep their wastes in their leaves. When their leaves fall, plant body also gets rid of these wastes.
- iii. Some plants excrete their wastes through special pores by applying force. For example, rubber plant excretes latexes, keekar tree excretes gums, coniferous trees excrete resins, and ladyfinger excretes mucilage.



Latex from Rubber plant

Gum from Keekar tree

Resins from coniferous tree

**Figure 9.11: Excretion in Plants**

**Q.14 Explain osmotic adjustments in hydrophytes, Xerophytes and hydrophytes.**

09409014

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

### 1. Mesophytes

#### Introduction

Mesophytes are the terrestrial plants which live in lands where medium quantity of water is available. They absorb water through roots.

#### Osmotic Adjustments

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

#### Examples

Maize (corn), clover and rose etc. are examples of mesophytes.

### 2. Hydrophytes

#### Introduction

Hydrophytes live in freshwater (ponds, and lakes etc.) or in wet soil. In these plants, the absorption of water occurs through the whole surface.

#### Osmotic Adjustments

They use different ways to remove extra water from their bodies.

#### • Broad Leaves and large number of Stomata

- i. For example, many hydrophytes have broad leaves which float on the surface of water.
- ii. These leaves have large number of stomata on their upper surfaces. Water moves out through these stomata.

#### Example

The most common example of such plants is water lily.



### 3. Xerophytes

#### Introduction

Xerophytes live in extremely dry environments (deserts).

#### Osmotic Adjustments

- They have deep roots to absorb water from almost dry soil. Their body surface has very few stomata.
- Few Stomata and Waxy Cuticle:** 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.

#### Example

Example of xerophytes include Cacti (singular. Cactus).

### 4. Halophytes

#### Introduction

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

#### Osmotic Adjustments

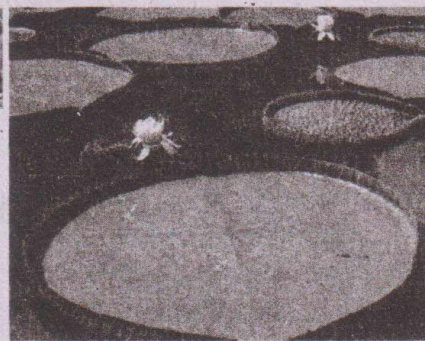
- Water tries to move out from their hypotonic bodies into the hypertonic environment. Such plants absorb salts from outside and make their bodies hypertonic. In this way, water does not move out of cells. The excess salt can be stored in cells or excreted out from salt glands on leaves.

#### Example

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)

**Figure 9.12: Osmotic Adjustments in Plants**



## Multiple Choice Questions (Exercise)

1. Which of the following plant nutrients is required in large amount? 09409015  
 (a) Iron (b) Zinc  
 (c) Potassium (d) Boron
2. Which element is required by plants for the formation of chlorophyll? 09409016  
 (a) Phosphorus (b) Calcium  
 (c) Magnesium (d) Sulphur
3. The primary function of root hairs is: 09409017  
 (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; 09409018  
 (a) Diffusion  
 (b) Osmosis  
 (c) Active transport  
 (d) Filtration
5. Water moves from the soil into root cells by: 09409019  
 (a) Osmosis  
 (b) Active transport  
 (c) Facilitated diffusion  
 (d) Bulk flow
6. The transpiration is regulated by; 09409020  
 (a) Mesophyll  
 (b) Guard cells  
 (c) Xylem  
 (d) Phloem
7. Under which condition, there will be high rate of transpiration? 09409021  
 (a) High humidity  
 (b) Low light intensity  
 (c) Wind  
 (d) Water-logged soil
8. Which ion plays a role in the opening of stomata? 09409022  
 (a) Sodium ( $\text{Na}^+$ )  
 (b) Potassium ( $\text{K}^+$ )  
 (c) Calcium ( $\text{Ca}^{2+}$ )  
 (d) Magnesium ( $\text{Mg}^{2+}$ )
9. In most plants the food is transported in the form of: 09409023  
 (a) Glucose (b) Sucrose  
 (c) Starch (d) Maltose
10. What is TRUE according to the pressure flow mechanism of food transport? 09409024  
 (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: 09409025  
 (a) Xerophytes  
 (b) Hydrophytes  
 (b) Mesophytes  
 (d) Halophytes

## Multiple Choice Questions (Additional)

### Nutrition in Plants

12. Which of the following elements are micronutrients for plants? 09409026  
 (a) Nitrogen  
 (b) Zinc  
 (c) Carbon  
 (d) Phosphorus
13. What roles does magnesium play in plants? 09409027  
 (a) Aids in water transport  
 (b) Is a component of chlorophyll  
 (c) Promotes early root formation  
 (d) Involved in enzyme functions



### Transport in Plants

14. Absorption of water molecules through root hairs is due to: 09409028

- (a) Active transport
- (b) Diffusion
- (c) Osmosis
- (d) Pressure flow

15. When you suck a cold drink using drinking straw. It resembles with: 09409029

- (a) Diffusion
- (b) Flow of material in xylem
- (c) Flow of material in phloem
- (d) Root pressure

16. Which component is not the part of the plant's vascular system? 09409030

- (a) Xylem
- (b) Phloem
- (c) Root hairs
- (d) Stomata

### Transportation

17. The rate of transpiration is increased when: 09409031

- (a) Light is low
- (b) Temperature decreases
- (c) Humidity increases
- (d) None of these

18. The loss of water in the form of drops from tips of leaf is called: 09409032

- (a) Excretion
- (b) Guttation
- (c) Transpiration
- (d) Evaporation

19. What are the roles of stomata in plants? 09409033

- (a) Gaseous exchange
- (b) Water absorption
- (c) Transpiration
- (d) Nutrient uptake

20. Which of the following are not types of transpiration? 09409034

- (a) Stomatal
- (b) Cuticular
- (c) Lenticular
- (d) Root

### Transport of Water and Salts in Plants

21. Most of the uptake of water and minerals from soil takes place through: 09409035

- (a) Epidermal cells
- (b) Root cap
- (c) Root
- (d) Root hair

22. Which of the following is not function of roots in plants? 09409036

- (a) Absorption of water
- (b) Photosynthesis
- (c) Anchor the plant
- (d) Nutrient absorption

23. Which process is not involved in water transport in plants? 09409037

- (a) Transpiration
- (b) Photosynthesis
- (c) Root pressure
- (d) Capillary action

### Gaseous Exchange

24. 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: 09409038

- (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

25. What is produced during respiration? 09409039

- (a) CO<sub>2</sub>
- (b) H<sub>2</sub>O
- (c) CO<sub>2</sub> and H<sub>2</sub>O
- (d) N<sub>2</sub>

26. What are not the functions of leaves in plants? 09409040

- (a) Photosynthesis
- (b) Water storage
- (c) Waste storage
- (d) Gas exchange



### Osmotic Adjustments in Plants

27. Which category of plants stores a small amount of water and has a thin cuticle? 09409041  
(a) Hydrophytes  
(b) Xerophytes  
(c) Mesophytes  
(d) Succulents
28. What is a key role of leaves in managing waste in plants? 09409042  
(a) Storing waste materials  
(b) Producing chlorophyll  
(c) Absorbing water from the soil  
(d) Converting waste into energy
29. Which of the following is not a characteristic of xerophyte? 09409043  
(a) Have deep roots  
(b) Presence of parenchyma  
(c) Have broad leaves  
(d) Less number of stomata is present
30. Maintenance of internal body temperature is called: 09409044  
(a) Osmoregulation (b) Excretion  
(c) Thermoregulation (d) Transpiration
31. The plants, which live completely or partially submerged in fresh water are: 09409045  
(a) Xerophytes (b) Halophytes  
(c) Mesophytes (d) Hydrophytes
32. All of the following are the adaptation of xerophytes except: 09409046  
(a) Thick cuticle  
(b) Large number of stomata  
(c) Sunken stomata  
(d) Deep root system
33. Which of the following are ways hydrophytes adapt to osmotic conditions? 09409047  
(a) Developing deep roots  
(b) Having thick cuticle  
(c) Producing large leaves  
(d) Developing sunken stomata

### Translocation of Food

34. The sugar moves through phloem is mostly in the form of: 09409048  
(a) Glucose (b) Sucrose  
(c) Maltose (d) Lactose
35. What is the role of companion cells in the translocation process? 09409049  
(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
36. What drives the translocation of organic solutes in plants? 09409050  
(a) Differences in sugar concentration  
(b) Differences in leaf size  
(c) Differences in root structure  
(d) Differences in stem length
37. Pressure flow mechanism is about: 09409051  
(a) Translocation of food  
(b) Transport of water  
(c) Opening of stomata  
(d) Transpiration
38. According to pressure-flow theory one of the following is not a sink: 09409052  
(a) Root (b) Leaves  
(c) Stem tubers (d) Fruits



## Answer Key

1	C	2	C	3	C	4	C	5	A
6	B	7	C	8	B	9	B	10	D
11	A	12	B	13	B	14	C	15	B
16	D	17	D	18	B	19	A	20	D
21	D	22	B	23	B	24	D	25	C
26	B	27	C	28	A	29	C	30	C
31	D	32	B	33	C	34	B	35	C
36	A	37	A	38	B				

## Short Answer Questions (Exercise)

**Q.1. Define mineral nutrition in plants.**

09409053

**Ans.** Plants get their food from a process called photosynthesis. But for the synthesis of other biomolecules, they need other materials from soil. Such materials are called mineral nutrients and the process through which these special chemicals absorbed from soil that are essential for the plants to grow is called mineral nutrition.

**Q.2. Define macronutrients and micronutrients and give examples.**

09409054

**Ans.** The minerals which are required in larger quantities are called macronutrients e.g. carbon, hydrogen, oxygen, phosphorus, potassium, nitrogen, sulphur, calcium, and magnesium. While, the minerals which are required in lower quantities are called micronutrients e.g. iron, molybdenum, boron, copper, manganese, zinc, chlorine, and nickel.

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

09409055

Nitrogen	Magnesium
i. Nitrogen is a necessary part of all proteins, enzymes.	i. Magnesium is part of the chlorophyll.

- |   |   |
|---|---|
| <p>nucleic acids and chlorophyll.</p> <p>ii. Nitrogen helps plants for rapid growth, increasing seed and fruit production and improving the quality of leaf.</p> <p>iii. Plant roots absorb nitrogen in the form of nitrates.</p> <p>iv. Carnivorous plants fulfil their needs of nitrogen from the prey animals.</p> | <p>ii. It also activates many plant enzymes needed for growth.</p> <p>iii. It also helps in fruit formation and germination of seeds.</p> <p>iv. Plant roots absorb magnesium in ionic form (<math>Mg^{+2}</math>).</p> |
|---|---|

**Q.4. Define transpiration and its types.**

09409056

**Ans. Definition**

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

**Types:**

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

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

09409057

**Ans.** Transpiration creates a pull called transpiration pull which is principally



responsible for the conduction of water and salts from roots to the aerial parts of the plant body.

**Q.6. Transpiration is the loss of water from plants. Is it a harmful phenomenon? If no, what is its importance?** 09409058

**Ans.** Transpiration is a necessary evil. It is harmful during the condition of drought. As water loss cause wilting of the plant.

But at the same time it is important for plant as it cause cooling effect, generates transpirational pull and helps in gaseous exchange.

**Q.7. Differentiate between:** 09409059

**i. Xylem and phloem**

Xylem	Phloem
1. Xylem conducts water and mineral salts and provide support and strength.	1. Phloem conducts prepared food from leaves to stem and roots etc.
2. Xylem consists of two main types of cells namely tracheids and vessel elements.	2. Two main types of cells in the phloem namely sieve tube element and companion cells.

**ii. Transpiration and guttation**

Transpiration	Guttation
i. Plants absorb water from the soil by the roots. This absorbed water moves in the aerial parts of the plant from where the most of this water (approx. 99%) has been lost in	i. The appearance of drops of water on the tips or edges of leaves is called guttation. ii. Guttation is not to be confused with dew, which condenses from

the form of vapours into the atmosphere.

This loss is called transpiration.

ii. Transpiration always occur against the gravity.

iii. Transpiration involves mainly the xylem cells.

the atmosphere on to the plant surface.

iii. Some plants such as sea grasses and strawberry force this water through special pores present at leaf tips or edges and form drops.

**iii. Hydrophytes and Halophytes**

Hydrophytes	Halophytes
i. These plants live in water-rich environments.	i. These plants live in sea water and are adapted to salty environments.
ii. Rate of transpiration is highest.	ii. Salts enter in the bodies of such plants due to their higher concentration in sea water, water tends to move out of their cells into the hypertonic sea water.
iii. Stomata are present on the upper surface of leaf.	
iv. These plants have thin cuticle.	
	<b>Examples</b> Many sea grasses are included in this group of plant.

**iv. Hydrophytes and xerophytes**

Hydrophytes	Xerophytes
i. They live in water-rich environments.	i. These plants are adapted to extreme dry conditions.
ii. Rate of transpiration is highest.	ii. They exhibit lowest rate of transpiration.



iii. Stomata are present on the upper surface of leaf.	iii. Xerophytes possess sunken stomata.
iv. These plants have thin cuticle.	iv. Thick cuticle is present in them.
v. The most common example of such plants is water lily.	v. Cacti etc.

#### v. Lenticular transpiration and stomatal transpiration

Stomatal Transpiration	Lenticular Transpiration
Most of the transpiration occurs through stomata	This is the water loss of plant in form of vapours by the

and is called stomatal transpiration. In leaves, water moves from the xylem into the cell walls of mesophyll cells.	lenticels present on the bark of woody stems.
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#### Q.8. How do the plants of rubber and keekar excrete their wastes?

**Ans.** Plants deposit many metabolic wastes in their bodies as harmless insoluble materials:

- Latex are removed by rubber plants.
- Gums are removed by keekar.

### Short Answer Questions (Additional)

#### Transport in Plants

**Q.9.** Define following term 09409060

- Osmotic adjustment
- Transpiration
- Translocation
- Micronutrients
- Excretophores
- Vascular bundle
- Xylem
- Adhesion
- Cohesion

**Ans. (i) Osmotic Adjustment**

Osmotic adjustment, also known as osmoregulation, is like, plant's way of maintaining the right balance of water and solutes in its body.

**(ii) Transpiration**

Plants absorb water from the soil by the roots. This absorbed water moves in the aerial parts of the plant from where the most of this water (approx. 99%) has been lost in

the form of vapours into the atmosphere. This loss is called transpiration.

**(iii) Translocation**

The transport of prepared food (organic solutes) to different parts of the plant through the phloem tissue is translocation.

**(iv) Micronutrients**

The seven elements are needed in traces or small amounts (less than 0.05% dry weight) for normal plant growth and development that are known as micronutrients. These include iron, boron, manganese, copper, molybdenum, chlorine, and zinc.

**(v) Excretophores**

Plant cells have large vacuoles that can store useful stuff or waste. Sometimes, these stored substances can build up and form crystals in the vacuoles. Leaves are key players in this process. When the leaves are loaded with large amount of pigmented compounds, they turn yellow.

Remember, this yellowing is not due to lack of chlorophyll as happens in chlorosis.



Such leaves are generally fallen from plants in autumn season. In this way leaves act as organ of excretion, therefore, such leaves are also called excretophores. This is why gardeners like using decomposed autumn leaves as a mineral-rich source for plants.

#### (vi) Vascular Bundle

There are two types of compound tissues in plants: (a) xylem (b) phloem.

Together they form the vascular bundles. Both xylem and phloem are composed of more than one type of cells. Xylem tissue is responsible for the transport of water and dissolved substances from roots to aerial parts. Phloem are responsible for the conduction of dissolved organic matter (food) between different parts of plant body.

#### (vii) Xylem

(1) Xylem tissue is responsible for the transport of water and dissolved substances from roots to aerial parts.

(2) They provide support to plant body because of presence of lignin in its secondary cell walls. Lignin makes these walls thick and rigid.

#### (viii) Adhesion

Adhesion is the attraction between water molecules and other substances. Water is strongly attracted to the walls of the xylem cells because both water and cellulose (in cell walls) are polar molecules. This adhesion helps water move upward in the plant against gravity. It also keeps water in the xylem when transpiration is not happening.

#### (ix) Cohesion

Cohesion is the attraction between nearby water molecules, which is possible because water is a polar molecule.

### Transpiration

**Q.10. What is the effect of temperature on the rate of transpiration?**

09409062

**Ans. (i)** On a sunny day with strong sunlight, the air temperature rises, and this increase in temperature lowers the humidity

in the air. As a result, more water evaporates from the surfaces of plant mesophyll cells, which leads to a higher rate of transpiration.

(ii) For every 10°C increase in temperature, the rate of transpiration roughly doubles.

(iii) However, when the environmental temperature becomes very high, around 40-45°C, it causes the stomata on plant leaves to close. This closure helps the plant conserve its much-needed water because excessive loss can be detrimental.

(iv) If these higher temperatures persist for an extended period and the soil doesn't have enough water, the plants may start to wilt and could eventually die

**Q.11. How is homeostasis maintained in plants?**

09409063

**Ans.** Transpiration provides evaporative cooling. As water leaves the plant tissues, it takes energy with it in the form of heat. Much like when we sweat, this allows the plants to cool and maintain the homeostasis.

### Transport of Water and Salts in Plants

**Q.12. Differentiate between pith and cortex.**

09409064

**Ans.**

Pith	Cortex
Pith is a small area in the centre of vascular bundles of plants.	Cortex consists of many layers of parenchyma cells, inner to epidermis.

**Q.13. Differentiate between guard cells and epidermal cells.**

09409065

**Ans.**

Guard Cells	Epidermal Cells
A pair of guard cells form a stoma, which is involved in the gas exchange of plants.	Epidermal cells provide a protection to the plant from the external environment.



### Translocation of Food in Plants

**Q.14. Differentiate between sink and source.** 09409066

**Ans.** A location in a plant where sugar is being produced either by photosynthesis or by the breakdown of stored starch is called a sugar source; green leaves and stem.

A location in a plant where sugar is consumed or stored is called a sugar sink e.g., young leaves, fruits etc.

**Q.15. Define endodermis and pericycle.**

09409067

**Ans.** Endodermis refers to the inner layer of cortex that surrounds the vascular bundle. Pericycle is a single ring like layer internal to the endodermis.

### Gaseous Exchange

**Q.16. What is the pattern of gas exchange between plant and environment at the time of dawn and dusk?**

09409068

**Ans.** During dawn and dusk, when light intensity is low, the rates of photosynthesis and respiration become equal. This means the carbon dioxide produced by respiration is enough for photosynthesis, and the oxygen released by photosynthesis is used in respiration. At this point, there's no net exchange of gases with the environment, and we call it the "compensation point of photosynthesis."

**Q.17. Why plants absorb carbon dioxide and release oxygen during daytime?**

09409069

**Ans.** During the day, plants are busy with both photosynthesis (making food) and respiration. The rate of photosynthesis varies throughout the day as it mainly depends upon light intensity.

Generally, the rate of photosynthesis is greater than rate of respiration, therefore, the photosynthesis needs more carbon dioxide than what respiration produces, so plants bring in extra carbon dioxide from the

environment. On the other hand, photosynthesis produces more oxygen than respiration needs, so plants release excess oxygen.

**Q.18. How carbon dioxide and oxygen are removed from plants?** 09409070

**Ans.** As the process of respiration takes place continuously, so carbon dioxide is also produced continuously. Photosynthesis takes place at day time in the plants, during which oxygen is released.

CO<sub>2</sub> produced during respiration at day time is used in photosynthesis. Only a small quantity of oxygen produced during photosynthesis is used by plants for respiration. The rest of the oxygen is released through stomata and lenticels. At night no photosynthesis takes place. So, CO<sub>2</sub> is released as by product and atmospheric oxygen is used for respiration in plants.

### Mechanism for Excretion

**Q.19. Name some waste products of plants.** 09409071

**Ans.**

- |                     |                      |
|---------------------|----------------------|
| (i) CO <sub>2</sub> | (ii) Extra Oxygen    |
| (iii) Excess Water  | (iv) Calcium oxalate |
| (v) Latex           | (vi) Resins          |
| (vii) Gums          |                      |

**Q.20. Define excretion.** 09409072

**Ans.** The process by which metabolic wastes are eliminated from body to maintain the internal conditions at equilibrium is called excretion e.g. urea, salts of uric acid and water are eliminated out of body through excretion.

### Osmotic Adjustment in Plant

**Q.21. Write any three osmotic adjustments in hydrophytes.** 09409073

**Ans.** They have developed mechanisms for the removal of extra water from their cells.

1. Hydrophytes have broad leaves with large number of stomata on their upper surfaces this characteristic helps them to remove the extra amount of water.



- ii. Hydrophytes keep stomata open day and night.
- iii. Hydrophytes almost have no cuticle.

**Q.22. Define osmoregulation.** 09409074

**Ans.** It is defined as the maintenance of the amounts of water and salts in body fluids i.e. blood and tissue fluids, e.g; blood glucose level remains about 1g/L despite eating a meal rich in carbohydrate.

### **Inquisitive Questions**

**Q1. Why do plants transpire more on a windy day compared to humid one?** 09409075

**Ans:** Plants transpire more on a windy day because wind removes the water vapours around the leaves, making it easier for more water to evaporate from the stomata. While on a humid day, the air already has a lot of water vapours, which slow down the rate of evaporation and so reduces rate of transpiration. So, wind increases the evaporation rate, while humidity slows it down.