بِسۡمِ اللّٰہِ الرَّحۡمٰنِ الرَّحِیۡمِ

(In the Name of Allah, the Most Compassionate, the Most Merciful.)

GENERAL SCIENCE

7

Based on Single National Curriculum 2022

ONE NATION, ONE CURRICULUM

PUNJAB CURRICULUM AND TEXTBOOK BOARD, LAHORE

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Experimental Edition

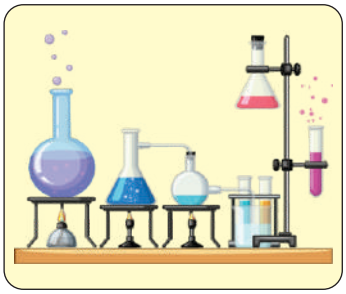
Publisher: Punjab Curriculum And Textbook Board,Lahore.
Printer:

Date of Printing
February, 2023

PMIU	PEF	PEIMA	MLWC	Total Quantity

Contents

A WINDOW INTO LEARNING SCIENCE AND TECHNOLOGY



Science is research-based knowledge, practice-based skill and inquiry-based approach to investigate and learn further through scientific method. The key activities involved in scientific method are observation, experimentation and deduction. Technology is application of scientific knowledge for solving daily life problems, making arduous works easy and improving quality of life. In order to meet the globally recognized standards, we need to broaden our educating horizons and adopt scientific method to learn science.

The inquiries and activities of scientific method involve observations, experimentations and conclusions. Hypothesis, theory and principle, etc., are the developmental stages in scientific research.

General Science for Grade 7 is the second annual course of studies designed in Single National Curricula for Elementary Level Students. This manuscript is an attempt to be proved as the best Textbook for the said course of studies. Use of scientific method in the teaching-learning approach equipped therein the textbook makes it entirely different from the textbooks in the subjects of humanities group.

It has been developed as a source of information and tools for applying scientific method in research based studies.

Students' interest has been engaged in process based learning, in-depth studies and inquiries for making observations and conclusions through experiments, child-centered and teacher-guided activities and in doing science and technology.

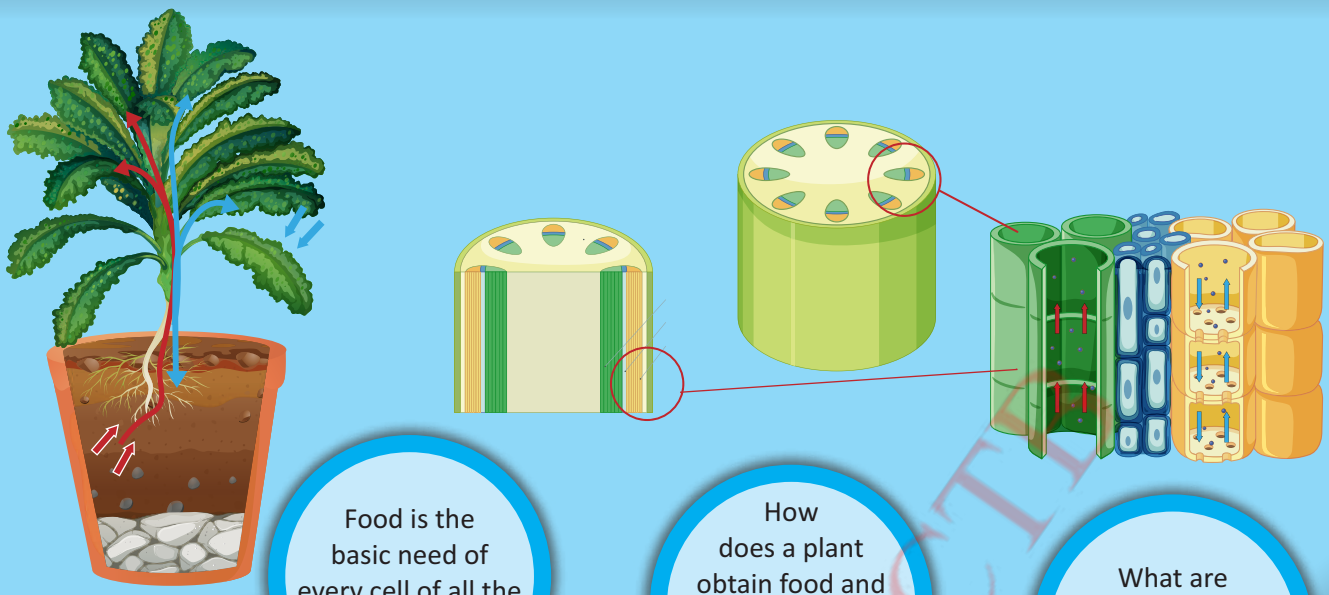
Acknowledgment

Honourable Prof. Muhammad Ali Shahid, Director Technical (Rtd.), Punjab Textbook Board and Prof. Javed Mohsin Malik, Principal (Rtd.), Federal Ministry of Education are acknowledged with thanks for using their ideas and content given in PCTB General Science Textbooks.

Appeal

Valuable suggestions for the improvement of this book are cordially invited.

(Author)



Food is the basic need of every cell of all the organisms

How does a plant obtain food and transport it to every cell of its body?

What are vascular bundles and their function in plants?

01 Plant Systems

Students' Learning Outcomes

After studying this chapter, students will be able to:

- Explain the root and shoot system in plants. Label different parts of leaf, stem and root (external and internal structure).
- Predict the role of xylem and phloem in transport of water and food in plants by observing the cross section of the stem.
- Define the process of photosynthesis and derive word equations for it.
- Know that plants require minerals to maintain healthy growth and life processes (limited to magnesium to make chlorophyll and nitrates to make proteins).
- Explain that the structure of leaves is adapted to the process of photosynthesis.
- Describe the process of respiration and write word equations for it. Compare and contrast the processes of photosynthesis and respiration.
- Investigate the phenomena of transpiration and its importance in a plant (wind, temperature, light, humidity affecting rate of transpiration in plants).
- Explore and apply natural raise of water based on the principle of transpiration.

VOCABULARY

Root hairs	Vascular bundles	Mesophyll cells	Chlorophyll	Stomata	Transpiration
Outgrowths of epidermal cells in plant roots which absorb water and nutrients from the soil	A system consisting of xylem and phloem for conduction of water and transport of food in plants	Cells which are rich in chloroplast and specialized for preparation of food during photosynthesis	Green coloured pigment in chloroplast which absorbs light photosynthesis	Tiny openings in plant leaves for gaseous exchange and removal of extra water	Loss or removal of extra water from aerial parts of plants

Recall what you have learnt

We have learnt about:

- Organs and organ systems in plants **(Figure 1.1)**
- Root and shoot system in plants
- Xylem and phloem
- Chloroplasts

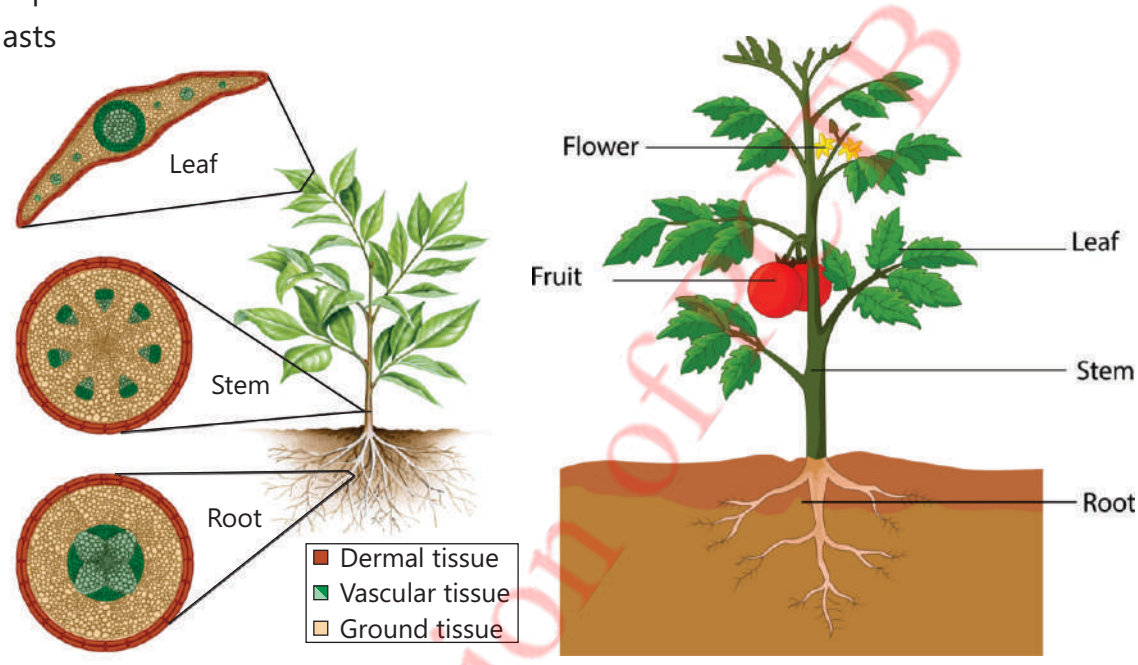


Figure 1.1 Organs and organ systems in plants

Activity 1.1 Assessment

Write **'C'** against the correct and **'I'** against the incorrect statement in the middle column. Also correct the incorrect statement and write it in the next column.

Correct/Incorrect	C/I	Correct statement
Leaves in plants absorb water and nutrients from soil.		
Photosynthesis takes place in the underground parts of the plants.		
Xylem tissue conducts water from roots to leaves.		
Phloem transports food from leaves to other parts of the plant.		

In this chapter we will learn the following systems in plants:

- Root and shoot system
- Respiration
- Photosynthesis
- Transpiration

1.1 ROOT AND SHOOT SYSTEM IN PLANTS

1.1.1 Root System

Roots are the underground parts of the plants forming a system specialized for absorption of water and minerals from the soil **(Figure 1.2)**.

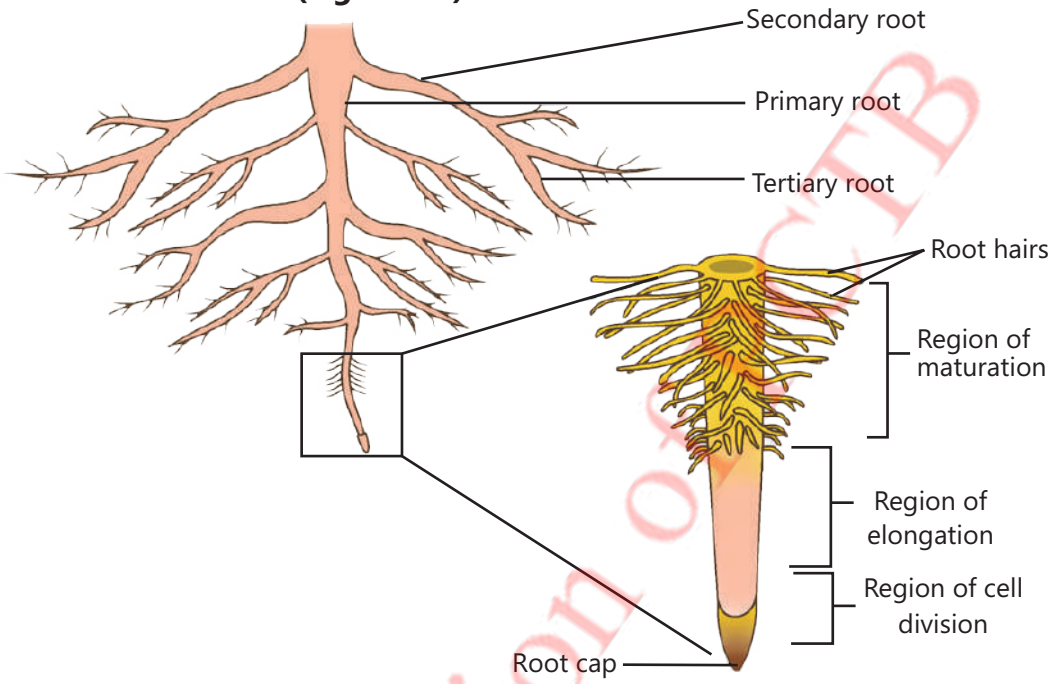


Figure 1.2 Parts of root

Recall

- Zygote is the first cell formed by the fusion of reproductive cells (male and female gametes) during sexual reproduction of plants and animals.
- The initial stage of development of multicellular organisms formed by the cell divisions and growth of zygote is called embryo.

The initial root which grows from radicle of the embryo is the **primary root or tap root**. Its further branches form **secondary** and **tertiary** root system. The tips of roots and shoots in plants consist of tissues formed by the cells called meristematic tissues. These cells are specialized for growth. These cells increase in number by rapid cell division.

Root tip is covered by hard and protective structure called **root cap**. It protects the newly born soft cells from being damaged and environmental stresses. It enables root tip to grow through soil. More and more cells are formed by rapid cell divisions in this region causing the root to grow deep into the soil and elongate the root behind. The **region of maturation** has root hairs. **Root hairs** are thread like outgrowths of epidermal cells which increase the surface area for absorption of water. Plants, like grasses and strawberry have thread like roots spread in soil but not growing deep. Such roots are called **fibrous roots (Figure 1.3)**.

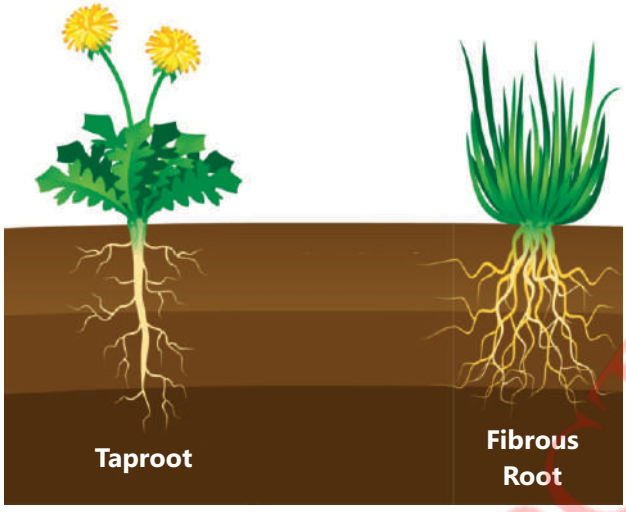


Figure 1.3 Taproot and fibrous roots

Internal structure of root

The main parts in the internal structure of root are epidermis, cortex, endodermis vascular bundles, i.e., xylem and phloem **(Figure 1.4)**. The arrangement of these parts are shown in a transverse section (TS) of the root. **(Figure 1.5)**.

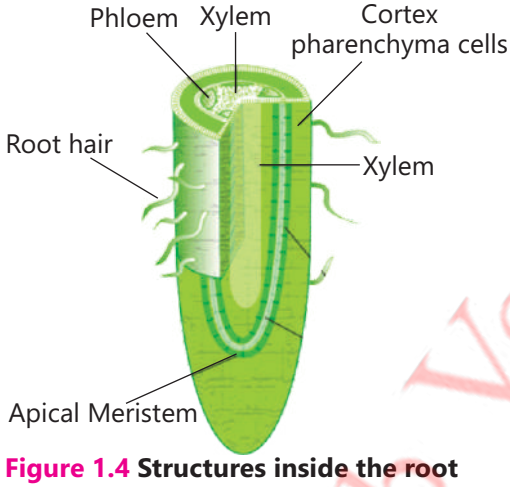


Figure 1.4 Structures inside the root

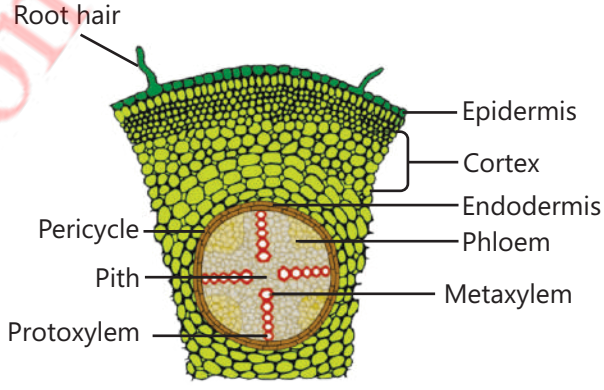


Figure 1.5 Internal structure of root

Epidermis

Epidermis is an outermost layer of thin walled cells having unicellular outgrowths called **root hairs**. Epidermis provides protection and helps in absorption of water and minerals from the soil.

Cortex

Inside the epidermis, many layers of thin walled and rounded cells form cortex. Water and minerals absorbed by root hairs in epidermis are transported towards xylem through cortex for onward conduction to leaves.

Endodermis

The innermost layer of cortex which consists of barrel shaped cells is called endodermis. It

regulates the movement of water and hormones, etc., into and out of the vascular system.

Vascular system

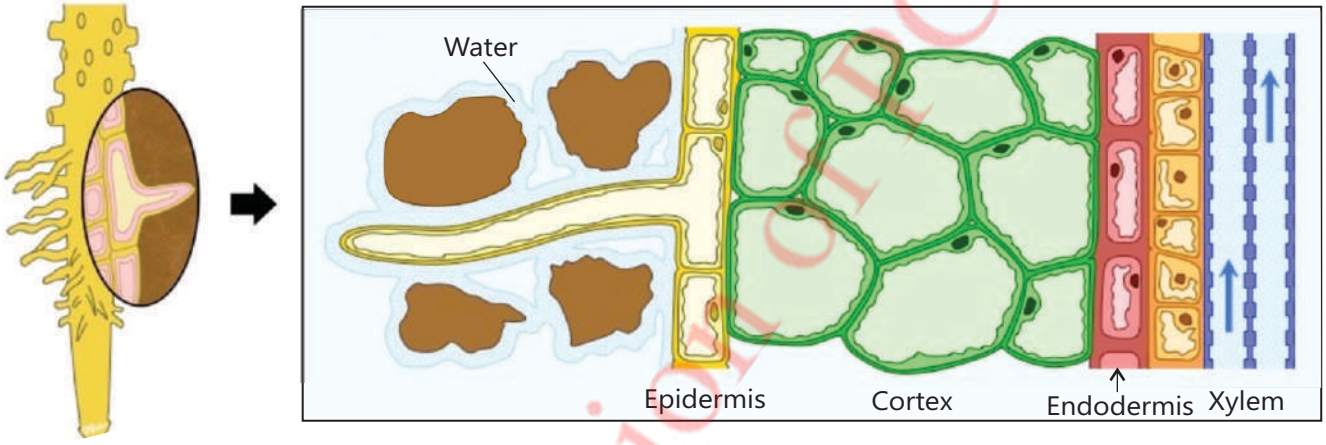
Xylem and phloem form vascular system. Xylem conducts water and minerals absorbed from roots to leaves through stem. Phloem transports food from leaves to roots and other parts of the plants.

Inquiry 1.1

Teacher Guide

Facilitate students conduct an interactive discussion of the following:

- Absorption of water and nutrients (minerals, etc.) by root hairs from soil and their diffusion towards xylem present in the centre of root.
- Conduction of water and dissolved minerals by xylem tissue from roots to leaves through stem.



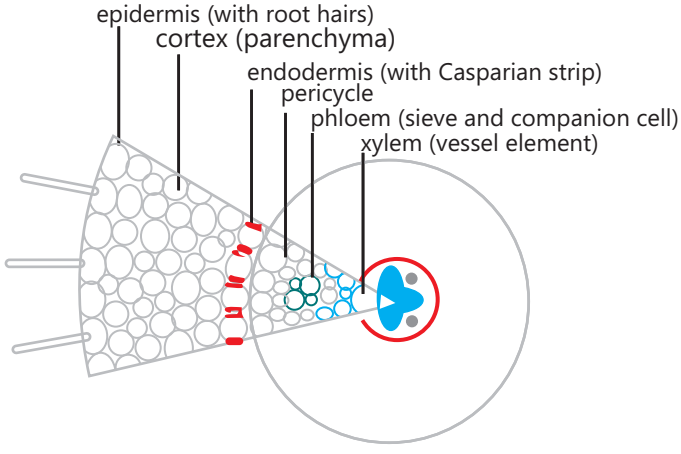
- Recall what you have learnt about diffusion.
- Do water and dissolved minerals (nutrients) move from soil to xylem tissue in the roots following the principle of diffusion through membranes of the cells in epidermis, cortex and endodermis, etc.?

Activity 1.2 Examining internal structure of root

Teacher Guide

Facilitate students:

- Take some herbaceous plant.
- Cut the transverse section (TS) of its root.
- Prepare a glass slide of the TS.
- Examine the TS under microscope.
- Identify different parts of the root.
- Draw an explanatory sketch of the TS.



1.1.2 Shoot System

The areal parts of the plants such as stem, its branches, leaves, flowers and fruit, etc., specialized for different functions make the **shoot system**. Here we will discuss stem and leaves.

Stem

Stem is usually the aerial part of the plant. It provides support to its branches, leaves, flowers and fruit, etc. Vascular bundles (xylem and phloem) run through stem to leaves for transport of material within the plant body. A sketch of internal structure of stem **(Figure 1.6)** is self-explanatory with regards to the arrangement of different tissues in the plants.

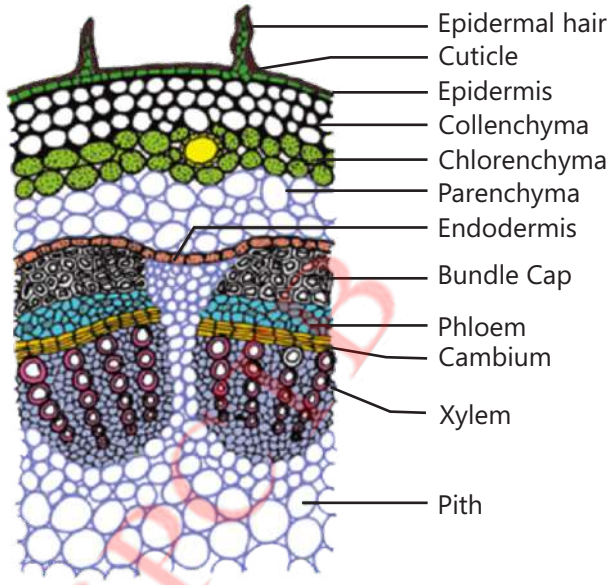


Figure 1.6 Internal structure of stem

Leaf

Stem and its branches bear leaves. Leaves are the organs which are well exposed to light and well adapted for preparation of food during photosynthesis. A leaf is provided with the stalk called **petiole**. Its flat green part is called **blade or lamina**, which has many veins. The middle strong vein is called **midrib (Figure 1.7)**.

Different shaped cells, as shown in the cross section of a leaf **(Figure 1.8),** perform different functions.

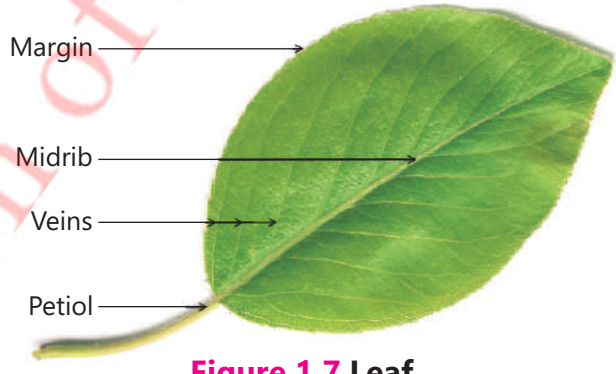


Figure 1.7 Leaf

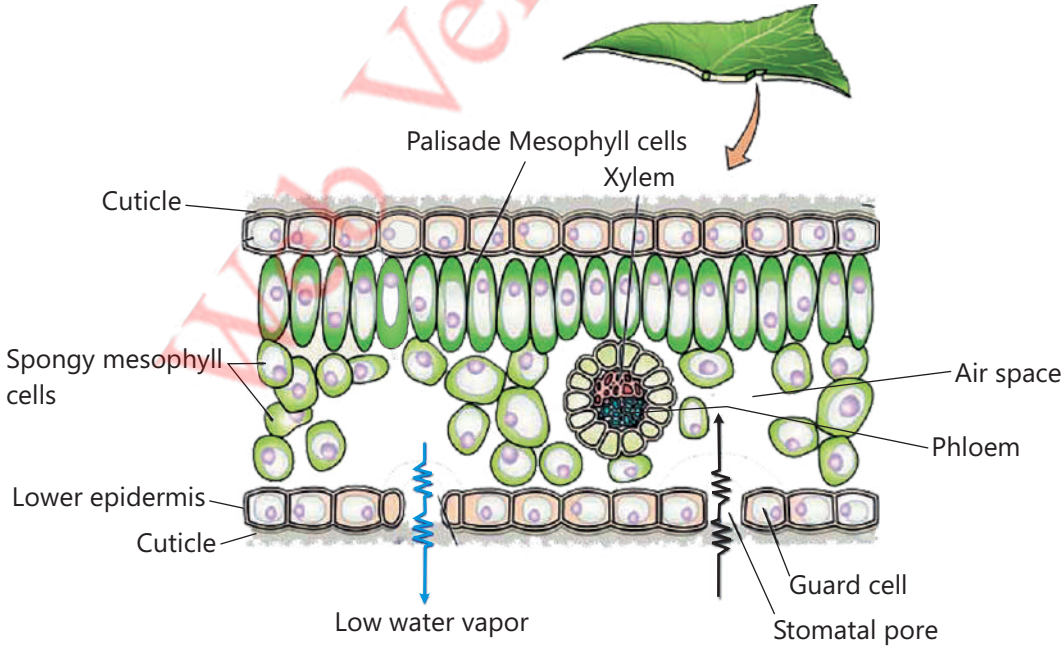


Figure 1.8 Internal structure of leaf

Epidermal cells are tile-like and forming protective layers (upper epidermis and lower epidermis). Palisade mesophyll cells are elongated, spongy mesophyll cells are irregularly shaped having air spaces among them. Their function is to prepare food. Xylem tissue consists of tubular shaped cells used to conduct water. Phloem cells are also tubular in shape and used for transport of food. There are openings in the lower epidermis called stomata (sing. stoma). Each pore is surounded by a pair of guard cells. They allow exchange of carbon dioxide and oxygen. They also diffuse out water vapour.

1.1.3 Role of Xylem and Phloem in transport of water and food

Water and minerals diffuse from soil to roots and are conducted towards leaves through stem by xylem and the food prepared in leaves is transported to different parts of the plant through phloem **(Figure 1.9)**.

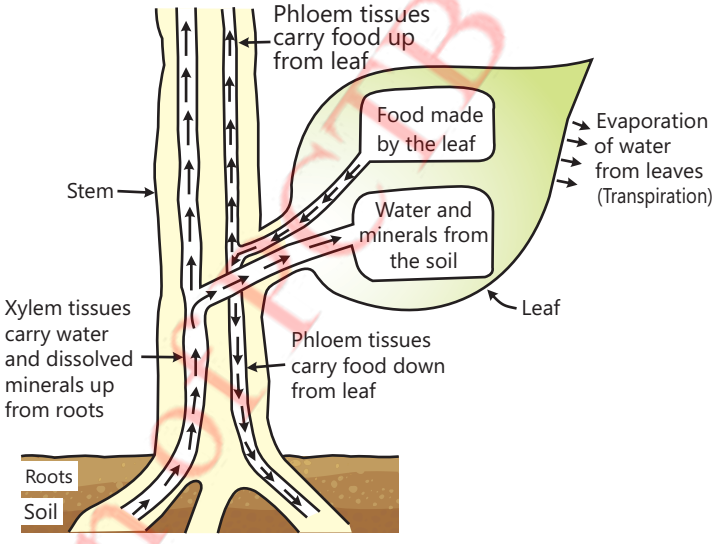


Figure 1.9 Transportation of materials in plants

Do you know?

- Recall what you have learnt about solute, solvent, solution and diffusion of particles.
- The quantity of a solute dissolved in a given quantity of solution is termed as concentration.
- 1L sugar solution containing 3 teaspoonful of sugar dissolved in it, is more concentrated as compared to 1L sugar solution containing 1 teaspoonful of sugar dissolved in it.
- Solvent is the component of a solution which is present comparatively in large quantity.
- Water in the air is solute not solvent.

Conduction of water and dissolved minerals

Movement of material particles from the area where they are more to the area where they are less is called diffusion. The **diffusion** through membranes (like cell membranes) is called **osmosis**. As the concentration of water and dissolved minerals is more in soil as compared to the root cells, they move in the root tissue (osmosis). The xylem is a tissue in plants which forms a system of pipelines **(xylem vessels)** from roots to leaves through stem for the conduction of water, only in one direction **(Figure 1.10)**.

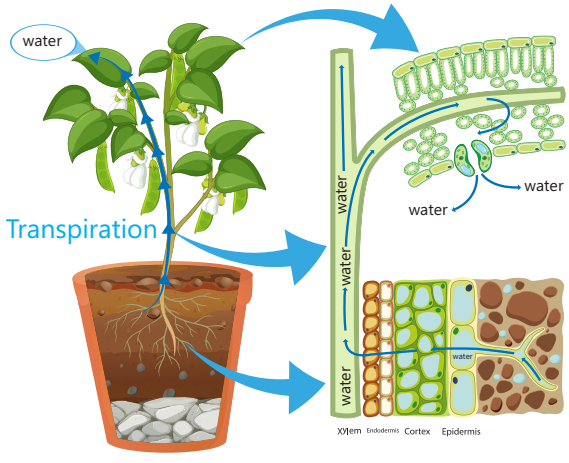


Figure 1.10 Conduction of water in plants

Transport of food (Translocation)

Food prepared by photosynthesis in leaves (carbohydrates, i.e., glucose, sucrose, etc.) enters the phloem **sieve tube elements** in dissolved form through **companion cells**. It is then transported

to all other parts of plant body through phloem **(Figure 1.11)**.

Xylem tissue consists of dead cells joined end to end with no end walls to form a continuous tube. Phloem is composed of living cells called sieve tubes, companion cells and phloem parenchyma. **Parenchyma** is a type permanent tissue forming major part of ground tissue in plants. The main function of parenchyma is to store and assimilate food.

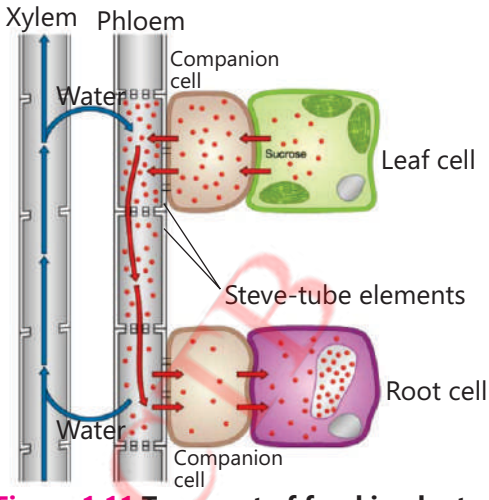


Figure 1.11 Transport of food in plants

Stomata

A large number of stomata **(Figure 1.12)** in lower epidermis of the leaf helps in absorption of carbon dioxide and release of surplus oxygen in the environment.

Figure 1.12 Stomata in leaves

Distribution of chloroplast in mesophyll tissue for maximum absorption of sunlight, regular supply of water through xylem tissue and carbon dioxide through stomata are the features of leaf that facilitate photosynthesis.

1.2 PHOTOSYNTHESIS

Photosynthesis is defined as the process during which carbon dioxide and water combine in the presence of sunlight and chlorophyll to form glucose (food) and oxygen.

Carbon dioxide + Water + Sunlight energy ⟶ Food (Glucose) + Oxygen

The process of photosynthesis depends on the following factors:

Light

Photosynthesis requires energy for combining carbon dioxide and water to form glucose (food). Sunlight provides this energy. The rate of photosynthesis depends upon the intensity of light. There is more light intensity at noon, so, the rate of photosynthesis is fast at the noon. In the evening or morning, the rate of photosynthesis is slower due to less light intensity. Photosynthesis

stops at night, because, there is no sunlight at night.

Do you know?

Light consists of seven colours but chlorophyll absorbs blue and red light.

Carbon Dioxide

Air contains 0.35 to 0.4 % carbon dioxide. If there is more amount of carbon dioxide in the environment, the rate of photosynthesis will be fast, but once the carbon dioxide concentration reaches a certain level, there is no further increase in the rate of photosynthesis. Less quantity of carbon dioxide in an environment slows down the process of photosynthesis.

Water

Besides carbon dioxide, water is also an essential requirement for photosynthesis. If it is not available as much as require, the rate of photosynthesis will be affected and plant will produce less food.

Chlorophyll

The process of photosynthesis cannot take place without chlorophyll. It is only the chlorophyll which absorbs sunlight and makes it usable in the photosynthesis process. Chlorophyll is present in chloroplasts which are present in photosynthetic cells (mesophyll).

Temperature

Like many other chemical reactions, photosynthesis is also affected by temperature. The suitable temperature for this process is 25 – 35°C. At very high or very low temperatures, the process of

1.2.1 Adaptations in leaf structure for photosynthesis

1. The blades of leaves are flat and absorb maximum light required for photosynthesis.
2. Thin blades of leaves make the light and carbon dioxide reach the internal parts easily.
3. Thick layer of palisade mesophyll containing large number of chloroplasts just beneath the upper epidermis can make maximum absorption of light to make food for the plant.
4. Maximum air spaces among spongy mesophyll near the lower epidermis provide an easy passage for carbon dioxide to diffuse into cells containing chloroplasts to facilitate photosynthesis.
5. Numerous stomata in the lower epidermis absorb maximum carbon dioxide from the air needed for photosynthesis.
6. Division of vascular bundles into small branches spread throughout the leaf makes an easy and maximum water supply needed for photosynthesis.

Do you know?

- Photosynthesis takes place mainly in leaves; but, in some plants it occurs in green stems also. The process actually occurs inside the chloroplasts in the cells of leaves and stem.

Scientific Investigation

Teacher Guide

Facilitate students to prove that photosynthesis occurs in the leaves

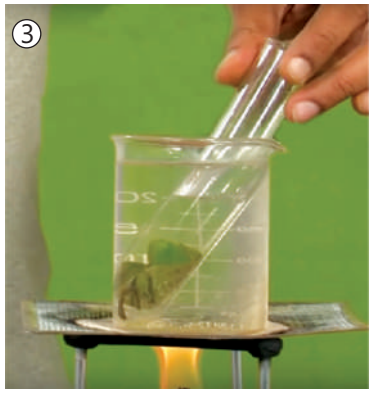
Background Information

Glucose made during photosynthesis is converted into starch which is stored in different parts of the plant including leaves. The presence of starch in a leaf proves that photosynthesis takes place in the leaf. The presence of starch in the leaf can be checked by iodine test.

Iodine Test

Iodine solution is yellow in colour. When one or two drops of iodine solution are added in starch solution, the colour of iodine solution changes to blue.

1. Fill a beaker (500mL) half with water, heat it till boiling and dip a green leaf in boiling water for 2 to 3 minutes.
2. Fill a test tube with alcohol up to its half. Remove the leaf from boiling water and dip it in alcohol .
3. Keep the test tube containing the leaf in boiling water for a few minutes, so that chlorophyll dissolves in alcohol .



4. Remove the leaf from alcohol and again dip it in boiling water so that it becomes soft.
5. Place the leaf in a dish and spread it.

6. Pour a few drops of iodine solution on the leaf with the help of a dropper.
7. You will see that the colour of the iodine solution becomes blue. This will prove that the starch is present in the leaf.

Mineral nutrition in plants

Minerals are the chemical substances required by an organism for growth and other vital functions. Carbon, hydrogen, oxygen, nitrogen, magnesium, etc. are the nutrients required by plants in large quantities. Carbon, hydrogen and oxygen are obtained from carbon dioxide and water. The other nutrients like magnesium and nitrogen are obtained from the soil dissolved in water.

Magnesium

Magnesium is required by plants for the formation of chlorophyll. It is helpful for the functioning of enzymes to produce carbohydrates and fats. Its deficiency causes poor growth, yellowing and wilting of leaves.

Nitrogen

Nitrogen in the form of its compounds, (nitrates) dissolved in soil water, is required by plants for making chlorophyll and amino acids. Amino acids form proteins. Chlorophyll is necessary for photosynthesis. Proteins are necessary for growth, repair and other developments and defensive functions. Deficiency in nitrogen makes the leaves pale green or yellow. It affects the rate of photosynthesis and growth in plants.

1.3 RESPIRATION IN PLANTS

Respiration is defined as the process during which glucose (food) reacts with oxygen to produce carbon dioxide, water and energy required for survival of life.

Food (Glucose) + Oxygen ⟶ Carbon dioxide + Water + Chemical energy

Respiration takes place in all the cells of living bodies. The mitochondria which are found in the cells perform the process of respiration. For this reason, mitochondria **(Figure 1.13)** are called power house of the cell.

Importance of Respiration

Respiration is the only process which provides energy in usable form by living things. This process continues all the time in all kinds of living organisms. Stopping of respiration means death of the organism. In plants, the oxygen required for respiration comes from photosynthesis.

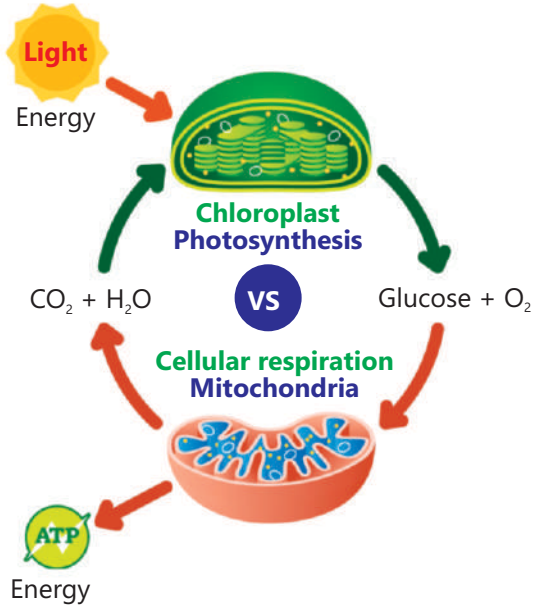


Figure 1.13 Comparison between photosynthesis and respiration

Informative

- Plants absorb carbon dioxide and release oxygen during day time, whereas, at night, they absorb oxygen and release carbon dioxide.
- In plants, exchange of gases takes place through stomata, whereas, in the animals this work is performed by the lungs.

1.3.1 Comparison and Contrast between Photosynthesis and Respiration

1. Photosynthesis takes place in green plants, algae and some bacteria, whereas, respiration takes place in all the living things.
2. Photosynthesis takes place in chloroplasts, whereas, respiration takes place in mitochondria.
3. Photosynthesis uses sunlight energy to prepare food, whereas, respiration releases energy from food which is used for growth and performing all other body functions.
4. The **products** made during photosynthesis, i.e., glucose and oxygen are the **reactants** of respiration.
5. The products of respiration, i.e., carbon dioxide and water are the reactants of photosynthesis.

1.4 TRANSPIRATION

Plants continuously absorb water from soil through roots. The same is being conducted to leaves where it is used in photosynthesis. The excessive water is removed through stomata and from the aerial parts of the plants. The loss of water from aerial parts of the plants is called transpiration **(Figure 1.14)**.

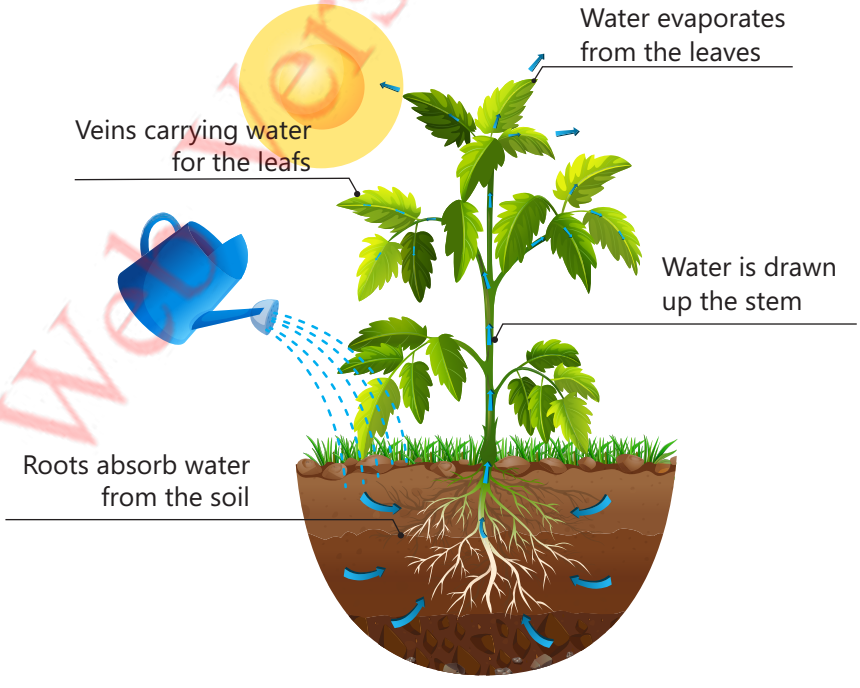
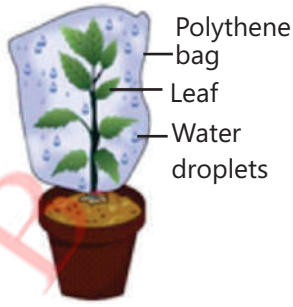


Figure 1.14 Transpiration in plants

Activity 1.3 Transpiration in plants

- Take a potted plant and sprinkle water on the soil in the pot, where the plant is grown.
- Cover the plant with a transparent polythene bag.
- Tie the mouth of the bag around the base of the stem as shown in the Figure.
- Place the plant in sunlight for 4–5 hours.
- You will observe drops of water on the inner side of the polythene bag.
- Where do these water drops come from?



Conclusion:_____

_____

Capillary action

Very narrow glass tubes are called capillary tubes. Water moves up in the capillary tubes due to interaction between water molecules and surface of the tubes **(Figure 1.15)**. This effect is called **capillary action**.

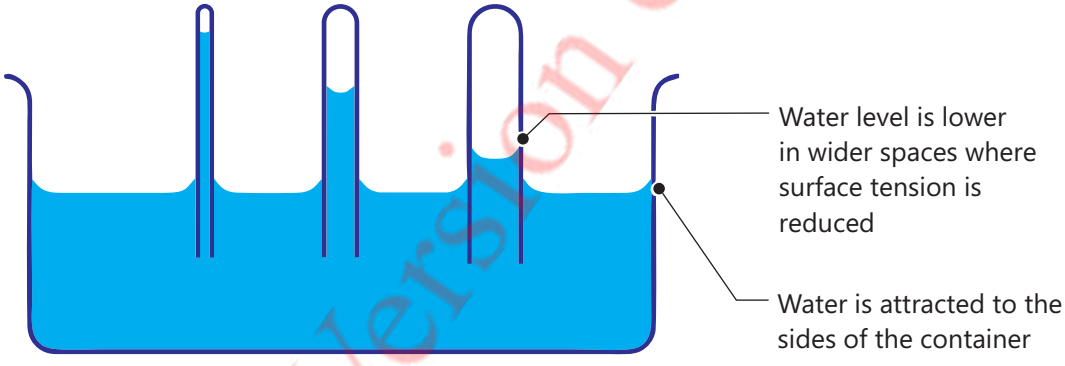


Figure 1.15 Capillary action

Capillary action in narrow xylem vessels in small plants helps water move up towards leaves.

Do you know?

- Water filled in a glass tube faces two types of forces. One is the attractive force between the molecules of water (intermolecular force) and the other is the force between the molecules of water and glass surface.
- The force between the molecules of water is termed as cohesive force, whereas, the forces between the water molecules and glass surface is termed as adhesive force.
- If the adhesive force is greater than the cohesive force, water rises up the tube through capillary action.
- In narrow tubes, the adhesive force becomes greater than the cohesive force which makes the water rise up the tubes through capillary action.
- Water rise up in xylem vessels is a natural example of capillary action.
- In narrow tubes, the adhesive force becomes greater than the cohesive force which makes the water rise up the tubes through capillary action.
- Water rise up in xylem vessels is a natural example of capillary action.

1.4.1 Natural Raise of Water Based on Principle of Transpiration

Transpiration is the water escape from the pores in leaves or stems (stomata). It develops suction force in the xylem bundles, causing the water rise up. Tall trees having more surface area for transpiration cause strong suction force or transpiration pull on water in the xylem bundles. The increased transpiration pull in tall trees causes the plant to absorb more water.

Informative

Capillary action and transpiration pull are the causes of natural raise of water in the materials. Building materials such as bricks and concrete blocks, etc., when come in contact with moisture, water rises into their pores due to capillary action and makes the material damped. Water is also raised in the pores of paper and plaster. Wicking of paint between the hairs of a paintbrush and movement water through sand are also the examples in this regard.

Importance of transpiration

Transpiration pulls the water through air spaces in spongy mesophyll and keeps the mesophyll moist, which is essential for the exchange of gases. Effects of evaporation of water from leaves or stems are:

- cools the surface of the leaves and the surroundings as well,
- allows the movement of minerals from the soil to different parts of the plant,
- helps in growth and development.
- controls the temperature of the plants.

1.4.2 Factors Affecting the Rate of Transpiration

Wind, temperature, light and humidity are the main factors that affect the rate of transpiration.

Wind

The still air surrounding the plant leaves becomes humid and resists the diffusion of water from leaves into the air. It decreases the rate of transpiration. Wind sweeps the humidity away from leaves surroundings and increases the rate of transpiration.

Temperature

Rise in temperature provides more energy to the water molecules for evaporation from the leaves surfaces, hence, increases the rate of transpiration.

Light

In sunlight, the stomata remain open for removal of water through them. At night stomata are closed. In this way light also affects the rate of transpiration.

Humidity

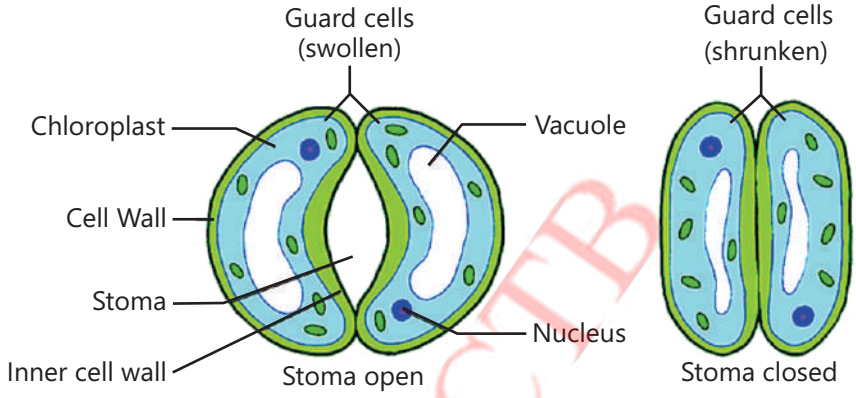
Humid air surrounding the plants contains more amount of water, thus, decreasing the rate of diffusion of water molecules from plants leaves into air. It slows down the transpiration. The rate of transpiration is rapid in dry air.

Point to ponder

- Gravity does not affect the capillary action. Request your teacher to explain why?

Informative

- When guard cells of stomata absorb water, they swell up and make the stomata open.
- When guard cells lose water, stomata are closed.
- Generally, stomata remain open during day time and are closed at night.



KEY POINTS

- Roots are the underground parts of the plants forming a system specialized for absorption of water and nutrients from the soil.
- Root hairs are thread like outgrowths of epidermal cells which increase the surface area for absorption of water and minerals.
- The areal parts of the plants such as stem, its branches, leaves, flowers and fruit, etc., specialized for different functions make the shoot system.
- Xylem and phloem form vascular system. Xylem conducts water from roots to leaves through stem. Phloem transports food from leaves to roots and other parts of the plants.
- Photosynthesis is process during which carbon dioxide and water combine in the presence of light and chlorophyll to produce food (glucose) and oxygen.
- Respiration is a process during which food (glucose) reacts with oxygen to produce carbon dioxide, water and energy.
- The loss of water from aerial parts of the plants is called transpiration.
- Wind, temperature, light and humidity are the main factors that affect the rate of transpiration.
- Capillary action and transpiration pull are the causes of natural raise of water based on the principle of transpiration.

QUESTIONS

1.1 Encircle the correct option.

(i) Water and dissolved salts are conducted from roots to leaves by:

a. root hairs b. xylem c. phloem d. stomata

(ii) The innermost layer of cortex in the root:

a. epidermis b. endodermis c. pericycle d. cambium

(iii) What is required for photosynthesis in addition to light?

a. oxygen and carbon dioxide b. oxygen and water
c. carbon dioxide and water d. nitrogen and water

(iv) Oxygen and ---------- are the products of photosynthesis:

a. water b. carbon dioxide c. glucose d. chlorophyll

(v) The products of respiration are carbon dioxide and:

a. water b. oxygen c. mitochondria d. chloroplast

(vi) The loss of water from aerial parts of the plants:

a. respiration b. photosynthesis c. evaporation d. transpiration

(vii) Chlorophyll is present in:

a. mesophyll cells b. upper epidermis c. lower epidermis d. endodermis

(viii) Mineral required in the formation of chlorophyll:

a. iodine b. iron c. phosphorus d. magnesium

(ix) The force between the molecules of water:

a. adhesive force b. cohesive force c. repulsive force d. magnetic force

(x) Rate of transpiration decreases with the increase of:

a. temperature b. light intensity c. humidity in air d. wind speed

1.2 Give short answers.

1. What is primary root?
2. What is secondary root?
3. State the function of root cap.
4. Write word equation for photosynthesis.
5. Write word equation for respiration

1.3 Differentiate between:

1. Root system and shoot system
2. Xylem and phloem
3. Diffusion and osmosis
4. Epidermis and endodermis
5. Transpiration and evaporation
6. Capillary action and transpiration pull

1.4 Answer the following questions:

1. Describe the following in plants:
   (i) Photosynthesis (ii) Respiration (iii) Transpiration
2. Draw and label the internal structures of the following:
   (i) Root (ii) Stem (iii) Leaf
3. Compare and contrast the process of photosynthesis and respiration.
4. Describe the factors affecting the rate of transpiration.
5. Describe the importance of vascular bundles in plants.

1.5 Constructed Response Questions

1. Photosynthesis does not take place in animals but it is beneficial for animals also. How?
2. Plants produce food and oxygen during photosynthesis, which does not take place

at night. Where do plants get oxygen from for respiration at night?

3. Why should not we sleep under tree at night?
4. How the structure of leaf is adapted to the process of photosynthesis?
5. Why is transpiration important for plants?
6. Describe the role of magnesium and nitrogen in plants nutrition.
7. Explore the natural raise of water based on the principle of transpiration.

1.6 Investigate:

(i) Function of the following in plants:

(a) Root hairs (b) Stomata (c) Spongy mesophyll

(ii) Internal structure and functions of the following in plants:

(a) root (b) stem (c) leaf

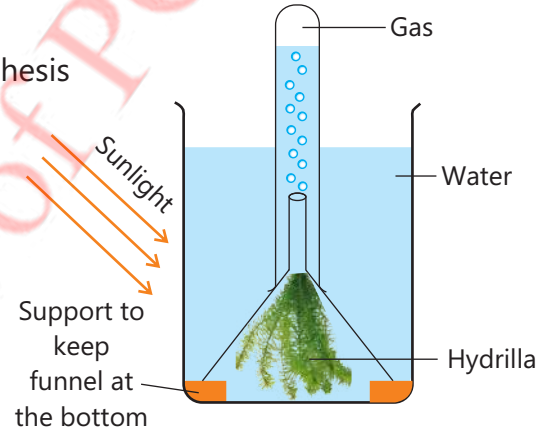
1.7 Project: (Scientific Investigation)

Prove that oxygen is produced by plants during photosynthesis

Teacher Guide

Facilitate students to conduct the experiment as under:

Procedure



1. Take a few twigs of hydrilla plant and insert them in a short stemmed funnel as shown in the Figure.
2. Place the funnel in a beaker containing water and provide support to keep the funnel at the bottom of the beaker.
3. Invert a test tube full of water over the stem of the funnel.
4. Make sure that the inverted test tube over the stem of the funnel remains fixed there.
5. To increase the amount of dissolved carbon dioxide in the water, a little quantity of sodium bicarbonate (backing powder) may be added in the beaker.
6. Carefully, place the apparatus in the sun for 2 to 3 hours.

Observation

- Gas bubbles liberated from the hydrilla plant reach the top of the inverted test tube.
- The gas displaces the water downwards.

Prediction

Gas reached the top of the inverted test tube stem is oxygen which is produced during photosynthesis in hydrilla in the presence of sunlight.

Test

Test the gas produced during the experiment by applying the test for oxygen as under:

Test for oxygen gas

The glowing splint on getting oxygen relights and bursts back into flame.

Conclusion:

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