

KNOWING ABOUT PLANTS



Concepts Covered

- Introduction to Plants
- Leaf, Root, Stem

Introduction

Plants are living things that grow in the soil and remain fixed at a place through their roots. The plants make their food by the process of photosynthesis. Plants are of different shapes and sizes.

Extended Learning

The study of the physical form and external structure of plants is known as plant morphology.

Plant Systems

Plants are composed of various parts- a fact similar to human beings who are also made up of different body parts. Just like each body part of a human being has a different role to play, each part of a plant exhibits a unique role that stimulates the growth of plants.

There are mainly 2 systems in plants:

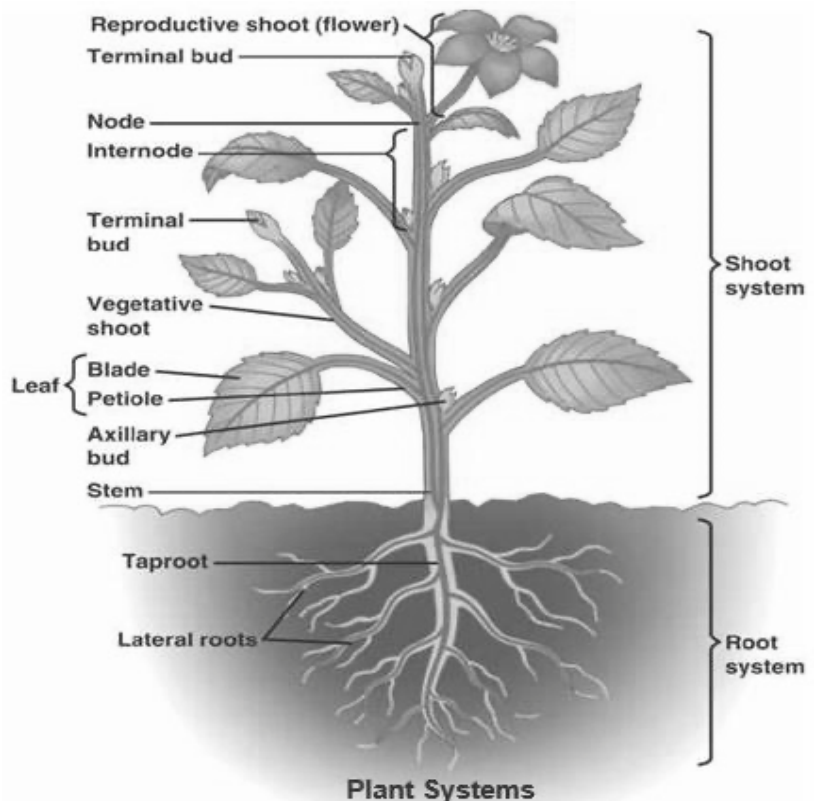
- (1) Shoot System
- (2) Root System.

Let us observe and study each part of a plant step by step:

Shoot System

All parts of a plant that are above the ground form the shoot system. The aerial part of the plant is called the shoot system. It consists of two regions.

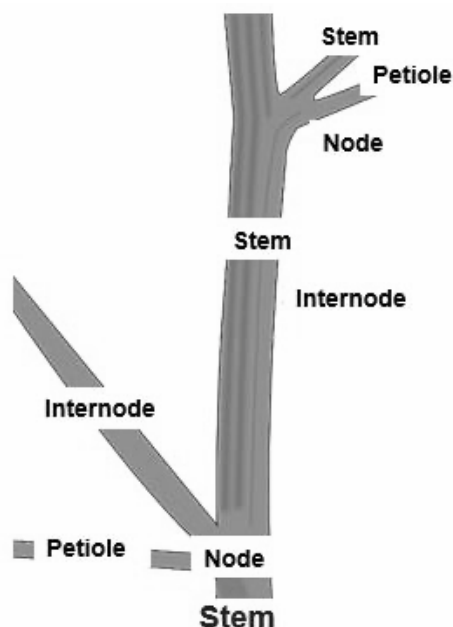
- (1) The vegetative organs comprise the stem and leaf.
- (2) The reproductive organs, namely the flower.



Stem

It forms the main axis on which leaves, buds, flowers, branches, and fruits arise.

- Stem develops from the Plumule of the embryo of the seed.
- Unlike roots, the stem has distinct regions called nodes from which the leaf arises.
- The region between two successive nodes is called an internode.
- The angle between the stem and leaf is known as the axil.
- Axil has a bud called an axillary bud.
- Bud grows into a branch or a flower.
- At the tip of the stem is the terminal bud which is responsible for the elongation of the plant.



Main differences between Root and Stems

Root	Stem
It is descending non-green part of the plant that grows towards the soil and water and away from sunlight.	It is ascending portion of the axis of the plant. It grows away from soil and water but towards sunlight.
It is not differentiated into nodes and internodes.	It is not differentiated into nodes and internodes.
Root has rootlets and root hair and does not bear leaves, buds, and flowers.	The stem bears leaves, buds, and flowers.

Functions of Stems

- It holds leaves in position and keeps the plant upright.
- It bears flowers, fruits, buds, leaves, etc., and leaves are arranged in such a way that they are exposed to sunlight.
- Green stem has chlorophyll and can carry out food manufacturing by photosynthesis.
- It conducts water and minerals from roots to leaves. It also carries food made by leaves to other parts of the plant. Xylem tissue carries water and minerals and phloem tissue carries prepared food.

Stem Modifications

(a) Storage of Water: Stems of plants like cactus swell up to store water in them. They also have a waxy layer for protection from the sun.

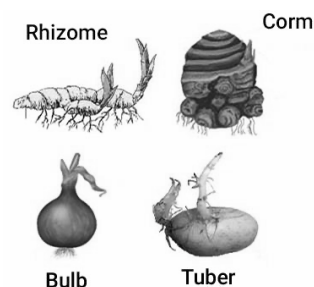
(b) To Manufacture Food: Stems of cactus become leaf-like and flattened to perform photosynthesis.

(c) For Protection: Stems may be modified as thorns (as in Bouganvillea), or prickles (as in rose), to protect the plant from being eaten by animals.

(d) For Support: Stems of some climbers like grapes are modified to form special structures called tendrils. These help the climber plant to coil around the support.



Cacti can gather and hold a lot of water in their stems. The water is not pure and clear but is thick viscous liquid.



(e) For Storage of Food: Potato, onion, and ginger are modified stems that store food. There are three kinds of underground stems: Bulbs of onions & garlic, the tuber of potato, and rhizome of ginger. Modification of root for storage of food.

(f) For Multiplication of the Plant: Rhizomes, bulbs, and tubers also help in the multiplication of plants. Some plants like roses multiply by stem cutting.

Activity:

Aim: To demonstrate that stem (shoot) conducts water.

Procedure:

- Take a glass and put some water in it.
- Put a few drops of red ink in the water.
- Cut the stem from the base of an herb plant.
- Place the stem in the glass.
- After some time observe the result.



Observation:

On the cutting stem, we can spot colored ink inside the cut stem.

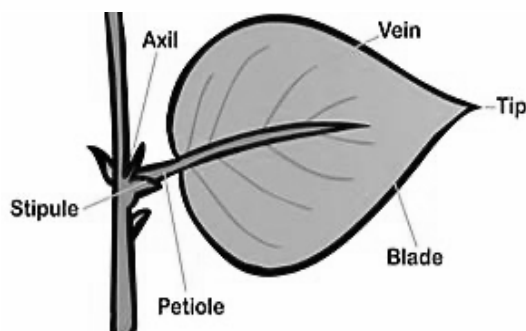
Conclusion:

Results are observed, some parts of the stem become red and they indicate that water is being conducted through the stem.

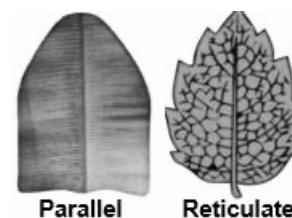
The Leaf

The leaf is a flat, green lateral outgrowth of the stem, arising from the node.

- **Lamina:** The flat portion of the leaf is called the leaf blade or lamina.
- **Venation:** The pattern of veins and veinlets on the leaves is called venation.
- **Veins:** Thread-like structures in the leaves forming a network.
- **Midrib:** It is the thick vein in the middle of the leaf.
- **Types of Venation:** Two types of venation are found:
 - (a) **Reticulate:** If the venation is in a net-like appearance on both sides of the midrib, it is called reticulate. For example, peepal.
 - (b) **Parallel:** In the leaves of grasses, the veins and veinlets are parallel to one another. Such a venation is called parallel.
- **Node:** Places, where leaves and branches are joined to stem, are called nodes.
- **Internodes:** The part of the stem between two nodes is called the internode.



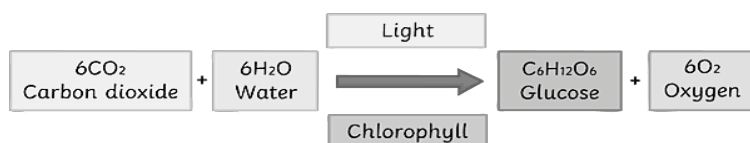
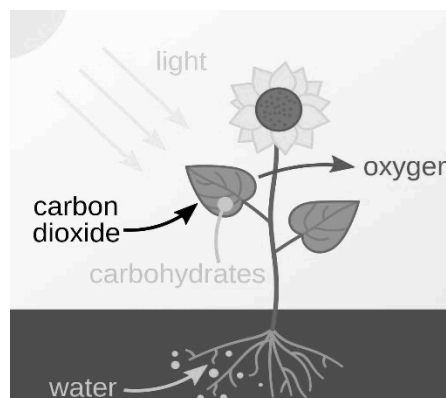
The Leaf



Functions of the Leaf

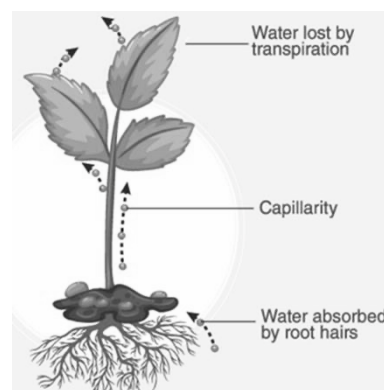
(a) **Photosynthesis:** Leaves make food in the presence of sunlight with the help of water from the soil and carbon dioxide from the air. Chlorophyll traps sunlight and provides energy to the plant for making food by the leaves is called photosynthesis. The sugar (glucose) that is prepared by leaves is converted into starch and is stored in plant fruits, roots, and stems.

Test for starch: When iodine/solution is added to a leaf that has been boiled in water and spirit, show blue-black colouration. This confirms the presence of starch.



Some plants are non-photosynthetic and parasitic, obtaining their food through a host. Some of them are insectivorous means they can digest insects.

(b) **Transpiration:** The pores present on the leaf surface allow excess water from the plant to escape in the form of water vapour. This is called transpiration. It helps in cooling down the plant. Transpiration also exerts a pull on the roots which absorbs more nutrients from the soil. It also plays an important role in the water cycle.



Transpiration

(c) **Protection:** In cactus plants, the leaves are modified into spines. They protect the plant from being eaten by grazing animals.

(d) **Respiration:** There are many small pores called stomata on the leaves. Through these holes, oxygen enters the leaves, and carbon dioxide is released.

Modifications of Leaf

(a) **Leaf Tendril:** Some of the upper portions of leaves are modified into tendrils. These tendrils coil around support.

(b) **Spines:** In the cactus, leaves are modified to form spines. This reduces the loss of water from the leaves. Spines also protect the plant.



Green Pea

(c) Insectivorous Plant: Some plants cannot get enough nitrogen from the soil. So they become carnivorous. They trap the insects and digest them to derive proteins. E.g. Nepenthes and Venus flytrap.



Check Your Concept - 1

- (i) What is Stem? Explain the underground modification of Stem.
- (ii) Describe the functions of leaves.

Root system

The root is a very important component of the plant system, as, without the presence of roots the plant ceases to exist. This is because the roots perform three major functions essential to the growth and survival of the plant which are:

- (a) Roots are responsible for absorbing minerals and water from the soil and transferring them to the stem. It's only after the root has transported water and minerals to the stem that the stem becomes capable of transporting these to all parts of the plant.
- (b) Another important function of roots is to firmly anchor the plant in the ground. This is essential to support the upright position of the plants.
- (c) Roots also perform the function of storing important nutrients and food for growth.

Plants need water and minerals to stay alive-suck these from the soil and send them up to the rest of the plant. Roots generally grow in the direction where they find the correct amount of air, water, and minerals needed for the plant.

Extended Learning

- By splitting rocks into smaller pieces, roots contribute to soil-creation.
- Each root is covered with tiny hairs through which water and minerals are absorbed.
- The roots of a South African wild fig tree can exceed depths of 390 feet!
- Eighty percent of all plant disorders are caused by root/soil problems.

There are two main types of root systems:

- (1) Tap Root System
- (2) Fibrous Root System

(1) Tap Root System

In the tap root system, a single root (called the primary root) comes out from the seed after germination. Tap roots are also called true roots.

A typical root consists of the following parts:

- (a) Primary Root
- (b) Secondary Root
- (c) Root cap
- (d) Root Hair (temporary)

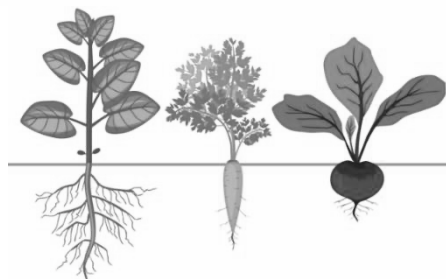
(a) Primary Root: Tap roots are true roots. They generally grow vertically downwards and give off lateral branches from the main root. They develop from the radical of the embryo (germinating seed).

(b) Secondary Root: These are lateral branches of the primary root which hold on to the soil and give mechanical support to the plant.

(c) Root Cap: It covers the tip of the main root. It protects the growing root tip. Plants with tap roots bear leaves that are generally broad and have a crisscross network.

(2) Fibrous Root System

The fibrous roots generally grow in clusters of slender roots from the base of the stem. These do not develop from the radical of the embryo. They develop from any other part of the plant. They do not have any secondary or primary root system. These do not have root caps. Plant with fibrous roots bear leaves that are long and tapering and have parallel venation. E.g. - wheat, rice, corn, grass, barley, etc.



Tap root system



Fibrous root system

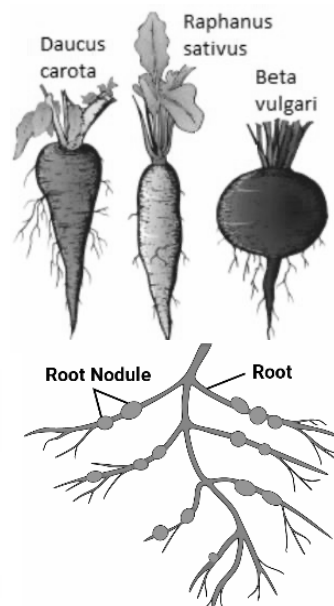
Tap Roots	Fibrous Roots
(1) In this type of root system, there is one prominent and long root and a bunch of smaller roots that grow from this main root called lateral roots.	(1) In this type of root system, a group of similar-sized roots emerges from the base of the plant. They do not have a main root.
(2) It is hard to pull out plants with tap roots as these go deep within the soil.	(2) These plants are relatively easier to pull out as the roots don't go very deep into the soil.
(3) This root system is seen to exist in plants with leaves displaying reticulate venation.	(3) This root system is seen to exist in plants with leaves displaying parallel venation
(4) Examples of plants with tap roots: carrots, turnip, gram, gram, China rose, etc.	(4) Examples of plants with fibrous roots: banana, wheat, maize, onion, bamboo, etc.

Root Modifications

The roots of some plants are modified to perform additional functions. Let us study some of these modifications and their functions.

(i) For storage of food

Roots are modified in some plants for storing reserve food materials. These modified roots usually are swollen and assume different forms such as spindle-shaped, e.g., radish; top-shaped, e.g., beet, turnip; cone-like, e.g., carrot; indefinite shape, e.g., sweet potatoes, dahlia, asparagus, portulaca are some other examples of plants with modified roots for food storage.



(ii) Nodulated roots

The roots of pea and other leguminous plants have numerous swollen nodules on fine branches of roots. These nodules are formed due to the symbiotic association of Rhizobium (bacterium) that live inside the root cortical cells of the roots. They fix nitrogen. An active nodule is pink in colour.



The big banyan tree in the Indian Botanical Garden near Kolkata have more than 900 prop roots.

(iii) For Mechanical Support

Roots are modified to provide mechanical support as seen in the banyan tree which has roots growing vertically/obliquely downwards (prop roots); sugarcane/maize in which roots arise from the nodes in the cluster at the base of the stem (stilt roots) and betel/black pepper in which nodes and internodes bear roots which help in climbing.



Prop Roots

Stilt Roots

(iv) For Gaseous Exchange

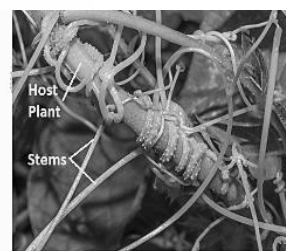
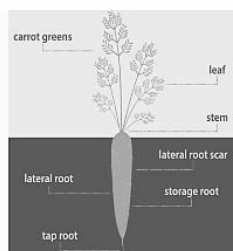
Pneumatophores or breathing roots are found in plants growing in mangroves or swamps with saline water for the exchange of gases. They are erect peg-like structures with numerous pores through which air circulates e.g., Rhizophora mangle.



Pneumatophores are breathing roots seen in mangroves and other plants growing in swampy environment. They grow vertically upward, against gravity and help the plant get oxygen.



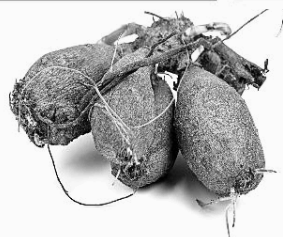
Pneumatophores



For storage of food, the roots of some plants, like radish, carrot, turnip, sweet potato, and beetroot, become fleshy.

For climbing, some plants have climbing roots that help the plant to climb up a support like a wall, rock, or tree, e.g., money plant, black pepper, and betel.

For nutrition, plants like dodder have specialized roots called parasitic roots arising from their stem, which help them to absorb water and nutrients from the host.



For multiplication, roots of plants like dahlia and asparagus can develop into new plants.



For extra support, roots of plants like bamboo, sugarcane, and banyan give out extra roots from their branches. These roots grow downwards and give extra support to the stem of the plant. These are called prop roots.

Solved Examples

Level – 1

(1) **Do all the leaves have petioles?**

Answer: No, all the leaves do not have petioles. Such leaves which lack petioles are called sessile.

(2) **Look at the figure, who do you think is watering their plant correctly, Paheli or Boojho? Why?**



Answer: Paheli is watering the plants correctly. She is sprinkling water on the roots, from where it can travel to all other parts of the plant.

(3) **Name the part of a plant that produces its food. Name this process.**

Answer: The part of a plant that produces its food is the leaf. This process is known as photosynthesis.

Level – 2

(1) **Correct the following statements and rewrite them in your notebook.**

(a) Stem absorbs water and minerals from the soil.

(b) Leaves hold the plant upright.

(c) Roots conduct water to the leaves.

Answer: Correct statements are as follows:

(a) Root absorbs water and minerals from the soil.

(b) Roots hold the plant upright.

(c) Stems conduct water to the leaves.

(2) **What are the functions of a stem in a plant?**

Answer: The functions of a stem in a plant are as follows:

(i) It conducts water from roots to the leaves and other parts.

(ii) It conducts food from leaves to other parts of the plants.

(iii) It bears leaves, flowers, and fruits.

(iv) It provides support to the plant.

(3) **Is it possible for you to find out whether a plant has taproot or fibrous roots by looking at the impression of its leaf on a sheet of paper?**

Answer: Yes, it is possible to find whether a plant has a tap root or fibrous root by looking at the impression of its leaf on paper. If the leaf has parallel venation, the roots of the plant will be fibrous roots and if the leaf has reticulate venation, the root is a tap root. It is an interesting fact that the leaf venation and the type of roots in a plants are always related to each other.

(4) **Read the following sentences about photosynthesis.**

(i) Sunlight, carbon dioxide, chlorophyll, and water are necessary.

(ii) Oxygen is absorbed.

(iii) Leaves carry out photosynthesis.

(iv) Proteins are made during photosynthesis.

Choose the correct pair of sentences that is true to photosynthesis.

Answer: Statement (i) and (iii) are correct. Photosynthesis is the process by which leaves prepare food. Sunlight, carbon dioxide, chlorophyll, and water are necessary.

The other sentences can be corrected as:

(ii) Oxygen is released (not absorbed).

(iv) Carbohydrates (not proteins) are made during photosynthesis.

(5) **Will a leaf taken from a potted plant kept in a dark room for a few days turn to blue-black when tested for starch? Give reasons for your answer.**

Answer: No, a leaf from a potted plant kept in dark will not turn blue-black when tested for the presence of starch. This is because all the stored starch would have been used up by the plant. No starch would be synthesized afresh due to the non-availability of sunlight.

(6) **Can the stem of a plant be compared with a street with two ways of traffic? Give reason.**

Answer: Yes, the stem of a plant can be compared with a street with two ways of traffic because It carries water and minerals from the roots to the leaves and other parts of the plant in the upward direction.

It takes the prepared food from the leaves to other parts of the plant.

(7) **Observe the figure of an activity given, carried out with leaves of plants & polythene bag.**

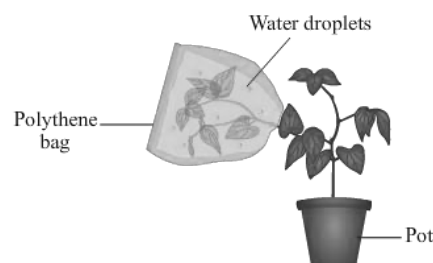
Now answer the following:

(a) **Which process is demonstrated in the activity?**

(b) **When will this activity show better results on a bright sunny day or a cloudy day?**

(c) **What will you observe in the polythene bag after a few hours of setting up the activity?**

(d) **Mention any one precaution you must take while performing this activity.**



Answer: (a) The process demonstrated in the activity is transpiration.

(b) The activity will show the best results on a bright sunny day because transpiration is maximum in sunlight.

(c) After a few hours of setting up the activity, one can observe small droplets of water inside the polythene bag.

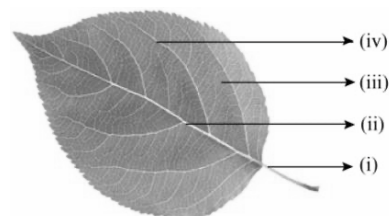
(d) A major precaution one must take while performing the activity is that the polythene bag should be clean and its mouth should be sealed properly. Also, the twig should be fresh with 10-12 leaves.

(8) **Observe the figure and attempt the questions that follow it.**

Label the parts (i), (ii), (iii), and (iv) in the diagram.

What type of venation does the leaf have?

What type of venation is seen in grass leaves?



Answer: (a) In the given figure

(i) Petiole (ii) Midrib (iii) Lamina (iv) Vein

(b) The leaf has reticulate venation, the veins in the leaf occur in an irregular way forming a net-like structure.

(c) Grass leaves have a parallel type of venation. The vein runs parallel to each other on both sides.

(9) **Boojho wanted to test the presence of starch in leaves. He performed the following steps:**

a) He took a leaf and boiled it in water.

b) He placed the leaf in a petri dish and poured some iodine over it. He did not get the expected result. Which step did he miss? Explain.

Answer: Boojho did not get the expected results in his experiment because he missed an important step in the procedure.

He did not boil the leaf in spirit to remove chlorophyll. It is necessary to remove the chlorophyll because it interferes with the test for starch. It is also necessary to remove the chlorophyll from leaves so, that the leaves get decolourised.

(10) **Match the parts of the plant given in column I to their respective roles with column II.**

Column I	Column II
a) Flower	(i) Excretion
b) Leaf	(ii) Photosynthesis
c) Stem	(iii) Reproduction
d) Root	(iv) Bears branches
	(v) Anchorage

Answer: The correct matching is

Column I	Column II
a) Flower	(iii) Reproduction
b) Leaf	(ii) Photosynthesis
c) Stem	(iv) Bears branches
d) Root	(v) Anchorage

Exercise

FILL IN THE BLANKS

- (1) The stem of tomato plant is _____.
- (2) In a mango tree, the branches appear _____.
- (3) The lines on the broad green part of the leaf are called _____.
- (4) The part of the leaf by which it is attached to the stem is called _____.
- (5) A tomato plant has stems of _____ colour.
- (6) The food produced in the leaves is in the form of _____.
- (7) _____ part of the plant anchors the plant firmly in the soil.
- (8) _____ is given out during the process of photosynthesis.
- (9) The leaf uses water to make food. The water is supplied to the leaf by _____.
- (10) The part of ginger that we use in cooking is a _____.

TRUE OR FALSE

- (1) In the process of photosynthesis, plants absorb nitrogen and carbon dioxide from atmospheric air.
- (2) Stems anchor the plants firmly in the soil.
- (3) Stems absorb water and minerals from the soil.
- (4) Stems conduct water from the roots to the leaves.
- (5) Stems conduct food from roots to various parts of the plant.
- (6) Roots conduct water to the leaves.
- (7) Leaves produce food for the plant.
- (8) Stem transport the food from leaves to the other parts of the plants.
- (9) Leaves absorb Oxygen in the process of photosynthesis.
- (10) Turnip is a modified root.

OBJECTIVE TYPE QUESTIONS

- (1) Which is not a part of a leaf?
(A) Petiole (B) Lamina
(C) Veins (D) Nodes
- (2) Which one of the following is a function of leaves?
(A) Photosynthesis (B) Transpiration
(C) Both (A) and (B) (D) Support Fruits
- (3) Which of the following has fibrous root?
(A) Peas (B) Wheat
(C) Radish (D) Neem
- (4) The process of loss of water by a plant through leaves is called
(A) Evaporation (B) Condensation
(C) Photosynthesis (D) Transpiration
- (5) Which of the following is not the primary function of the stem?
(A) Conduction of Water (B) Photosynthesis
(C) Formation of Branches (D) Bears Flowers and Fruits
- (6) Which of the following is not a correct match?
(A) Petiole: attaches the leaf to stem (B) Lamina: green flat part of the leaf
(C) Margin: gives shape to leaf (D) Veins: transpiration
- (7) Wheat and maize plants have
(A) Tap Root (B) Fibrous Root
(C) Both of These (D) None of These
- (8) The leaves get rid of excess water from the plant through
(A) Transpiration (B) Photosynthesis
(C) Respiration (D) Pollination

Answer Key

FILL IN THE BLANKS

- | | |
|--------------------------|------------|
| (1) Tender | (6) Starch |
| (2) Higher upon the stem | (7) Root |
| (3) Veins | (8) Oxygen |
| (4) Petiole | (9) Stem |
| (5) Green | (10) Stem |

TRUE OR FALSE

- | | |
|-----------|-----------|
| (1) False | (6) False |
| (2) False | (7) True |
| (3) False | (8) True |
| (4) True | (9) False |
| (5) False | (10) True |

OBJECTIVE TYPE QUESTIONS

- | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| (D) | (C) | (B) | (D) | (B) | (D) | (B) | (A) |