5 Morphology of Flowering Plants

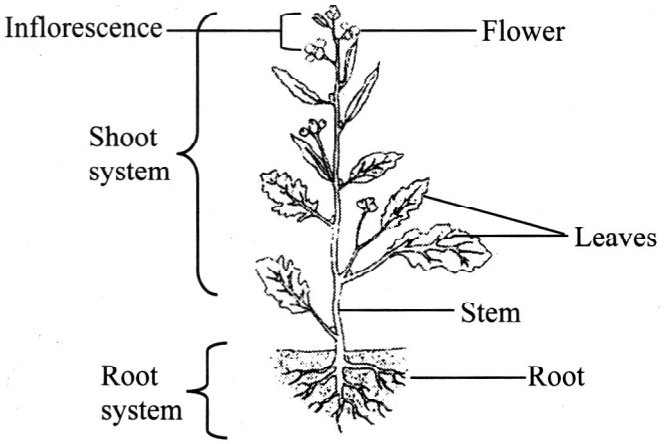
5.0 : Introduction :

Q.1. Which is the most evolved and dominating member of Kingdom Plantae?
Ans: Flowering plants or Angiosperms are the most evolved and dominating members of Kingdom Plantae.

Q.2. How many species of flowering plants are present?
Ans: There are about 3,00,000 species of flowering plantspresent.

Q.3. Define the following terms.
i. Morphology ii. Anatomy
Ans: i. Morphology: The study of external structure of an organism or organ is called external morphology.
ii. Anatomy: The study of internal structure of an organism or organ is called anatomy.

Q.4. Describe various parts of an angiospermic plant with a well labelled diagram.
Ans:



A Typical Flowering Plant

i. The body of a typical angiosperm plant is divided into an underground root system and an aerial shoot system.
ii. The root system is homogenous and consists of a main root and its lateral branches.
iii. The shoot system is heterogenous and consists of stem, branches, leaves and flowers.
iv. The parts such as root, stem and leaves are called vegetative parts. They are concerned with growth and nutrition of the plant.
v. Flowers are the reproductive parts of the plant and are concerned with sexual reproduction.

Q.5. What is root system and shoot system?
Ans: The adult plant body of angiosperms is sporophyte, and it is divided into two systems, as-
Root system: The descending axis of the plant body which is positively geotropic and negatively phototropic is called root system. The root system consists of the main root and its lateral branches.
The function of the root system is absorption and anchorage.
Shoot system: The ascending axis of the plant body which is positively phototropic and negatively geotropic is called shoot system. The shoot system has stem, branches, leaves, flowers and fruits.
The function of the shoot system is to bear leaf, flower and fruit.

5.1.1 Morphology and functions of root

Q.6. Give the characteristics of root.

Ans: Characteristics of root:

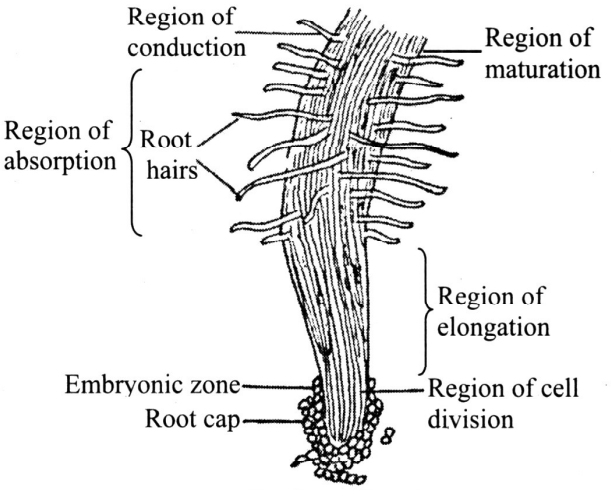
i. Root is produced from radicle.
ii. Root is descending part of the plant axis which grows downward in the soil.
iii. Root is positively geotropic i.e. grows towards soil, negatively phototropic i.e. grows away from light, positively hydrotropic i.e. grows towards water.
iv. The root is undifferentiated into nodes and internodes.
v. Roots are non green and cylindrical.
vi. They produce only similar organs, i.e. secondary and tertiary roots, endogenously, i.e. from inner layer of pericycle.

Q.7. Describe various regions of a typical root with the help of a neat labelled diagram.

Ans: A typical root possesses the following regions from root apex upwards:

i. Root cap:

The apex of the root is protected by root cap. The cells of root cap secrete mucilage, which lubricates the passage of root through the soil, als,o facilitates the absorption of Region of nutrient ions. In aquatic plants, like Pistia, absorption Eichhornia instead of root cap, root pockets are present.



Regions of root

ii. Meristematic region or region of cell division:

It is a region present beneath the root cap.
It is made up of meristematic cells which possess the power of division. Thus, this region adds new cells and is responsible for longitudinal growth of the root.

iii. Region of elongation:

It is present just above the meristematic region
and the cells produced by the meristem elongate rapidly and start differentiation.
The cells of this region help in absorption of water and minerals from the soil.

iv. Region of root hair or region of absorption:

This region is characterized by having epidermal cells with unicellular outgrowths called root hair.
Most of the water absorption takes place through this region.
The cells of outer layer is known as epiblema or piliferous layer, produce root hairs.
It is also called region of absorption.
Region of maturation/region of differentiation:
It is the uppermost major part of the root.
It consists of mature cells.
The cells do not undergo any further change but are differentiated into tissues like cortex, endodermis, xylem and phloem. The cells of outermost layers are covered by thick cuticle so that water is not absorbed.
It provides mechanical support to the aerial part of the plant.
Lateral roots also develop from this region.

Q.8. Give normal functions of root.

Ans: Normal functions of root are:

i. **Anchorage:** They fix the plant to the soil firmly and provide mechanical support to the aerial shoot system.

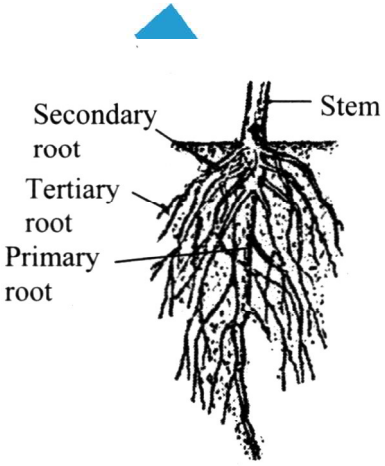
ii. **Absorption:** They absorb mineral nutrients and water from soil.
iii. **Transport of nutrients:** Sugar produced in the leaves by photosynthesis is transported upto the root tip.
iv. **Conduction of water and minerals:** The root brings about upward movement of absorbed water and minerals from the soil.
v. **Prevention of soil erosion:** The roots hold the soil particle firmly together and thereby prevent soil erosion.

Q.9. Name the plants whose roots produce food by photosynthesis.
Ans: Tinospora, Trapa

Q.10. Name the plants whose roots help in exchange of gases.
Ans: Rhizophora, Sonneratia

Q.11. Mention the types of root system.
Ans: The two main types of root systems are:
i. Tap root or true root system. ii. Adventitious or fibrous root system.

Q.12. Describe tap root or true root system.
Ans: Tap root or True root: Root which develops, usually from the radicle of an embryo of seed is called tap root and the system is called tap root system.
The first formed root or the main root is known as the primary root or tap root and it bears branches known as secondary roots.
The branches of secondary roots are known as tertiary roots.
The finer branches are called as rootlets.
The older branches are present near the base, whileyounger ones are found near the apex showing acropetalous succession.
The primary, secondary, tertiary roots and rootlets together form tap root system. The tap root normally grows vertically downwards to a lesser or greater depth, while secondary or tertiary roots grow obliquely downwards or some grow horizontally outwards.
e.g Mustard (Brassica), Sunflower (Helianthus), etc.



Tap Root System

Q.13. Describe adventitious or fibrous root system.
Ans: Adventitious or fibrous root system: Roots developing from any part of the plant body other than the radicle are called adventitious roots or fibrous 'roots and the system is called adventitious root system or fibrous root system.


Fibrous Roots

In fibrous root system, the radicle from a germinating seed is short lived.
It degenerates after few days of germination.

It is replaced by adventitious roots.
These adventitious roots are fibrous and roughly all are of the same size. Fibrous roots do not grow very deep into soil.
Most mono cots have fibrous root systems.
e.g. Grass, maize, wheat, rice, etc.

Q.14. Differentiate between Tap root system and Adventitious root system.
Ans:

No.	Tap root system	Adventitious root system
i.	It arises from radicle.	It arises from any part other than radicle.
ii.	Primary root persist throughout the life of a plant.	Primary root is short lived.
iii.	It is always underground.	It is underground or aerial.
iv.	The main root is very thick as compared to other roots.	All roots are generally fibrous.
v.	It is differentiated into primary, secondary and tertiary roots.	There is no such differentiation.
vi.	It is usually found in dicotyledons. e.g. mango, mustard, sunflower.	It is usually found in monocotyledons. e.g *Zea* (maize), *Oryza* (rice)

Q.15. Differentiate between: Fibrous root and Adventitious root.
Ans:

No.	Fibrous root	Adventitious root
i.	Roots which develop from base of stem and fibre like are called fibrous roots.	The roots which appear from parts of plant other than radicle are called adventitious roots.
ii.	e.g.Wheat	e.g. Grass.

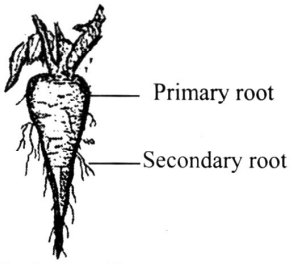
Q.16. What is modification of roots? Explain the modification of tap roots for food storage.
Ans: When roots have to perform some special function in addition to or instead of their normal functions, they make some structural changes which are described as modification of root.

Tap Roots: Modifications for food storage
Tap roots in some plants show modification for storage of food. These roots become swollen and fleshy due to the stored food. The swollen tap root acquires some typical shape and is accordingly classified into following three types:

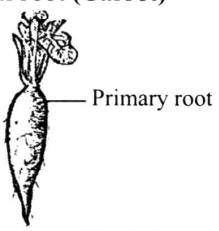
i. **Conical root:** When the root is broad at the base and gradually tapers towards the apex looking like a cone, it is called conical root. Secondary roots are present all over the swollen part of roots. e.g, Daucus carota (carrot).
Function: It helps in storage of food, "perennation and vegetative propagation.

ii. **Fusiform roots:** When the root is swollen in the middle and gradually tapers towards both the ends resembling a spindle, it is known as fusiform root. e.g. Raphanus sativus (Radish).
Function: Storage of food, perennation and vegetative propagation.

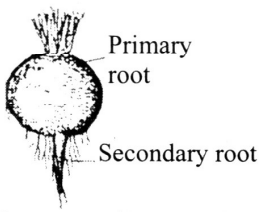
iii. **Napiform roots:**
In this case, the root is nearly globular or spherical in shape. The basal portion of the root is much swollen and suddenly tapers towards the narrow apex. e.g. Beta vulgaris (beet root)



Conical root (Carrot)



Fusiform root (Radish)



Napiform root (Beet root)

Function: It helps in storage of food, perennation and vegetative propagation.

Q.17. Write a short note on Pneumatophores.

OR

Describe the modification of root for breathing.

Ans: Pneumatophores are also called as breathing roots.

Such roots are formed in plants growing in saline swamps, marshy places and salts lake.

Such plants are called halophytes.

Under such conditions, normal aeration becomes impossible. Roots of halophytes do not get air for respiration as soil is water logged.

Such plants produce special roots from under ground roots of the plant near the soil and called as pneumatophores.

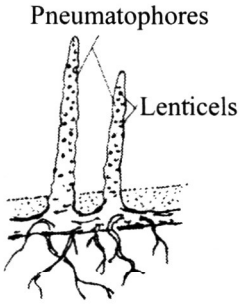
Pneumatophores grow vertically upwards and come out of soil. Thus, they are negatively geotrophic.

These roots are provided with small pores called lenticels.

The lenticels help in gaseous exchange required for respiration.

These roots are elongated, cylindrical, thick, hard and dark brown to black.

e.g. Sonneratia, Avicennia, Heritiera (Sundri) and Rhizophora.



Pneumatophores

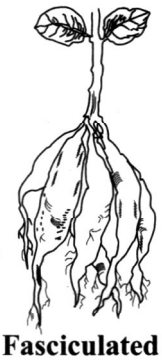
Q.18. Explain the modification of adventitious roots for food storage.

Ans: The adventitious roots are modified for food storage as:

i. **Simple tuberous roots:** These roots become swollen and do not assume a definite shape. These roots arise from the nodes of stem and enter in the soil. e.g. Sweet potato or shakarkand (Ipomoea batatasy.

ii. **Fasciculated tuberous roots:** Fasciculated roots are a cluster of adventitious roots of some plants which become thick and fleshy due to food storage. Many tuberous roots are present at the base of the stem. e.g Dahlia and Asparagus.


Simple tuberous root


Fasciculated tuberous roots

Q.19. Explain various types of adventitious roots which are modified for mechanical support.

Ans: i. Prop roots:

These roots arise from horizontal branches of trees like banyan tree. (Ficus benghalensis)

They grow vertically towards the soil and penetrate the soil.

Secondary growth takes place in these roots so, they become thick and look like pillars. .

They provide mechanical support to the heavy branches.


Prop roots

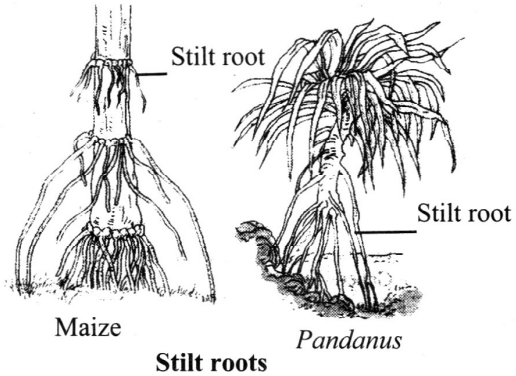
ii. **Stilt roots:**

These roots give additional support to the plant.

In plants like maize, sugar-cane, jowar, these roots grow in whorls.

In Pandanus, these roots arise only from lower surface of the obliquely growing stem to provide support.

Stilt roots arise from a few lower nodes of a weak stem in some monocots, shrubs and small trees.



Stilt roots

EduBull

They grow obliquely downwards and enter the soil.
They provide mechanical support.

iii. **Climbing roots:** Climbing plants like Piper produce roots from their nodes by means of which they attach themselves to some support and climb over it. e.g Money plant (Pothos), pan (Piper betel), kalimirch (Piper nigrum).

Q.20. Why stilt roots are present in monocots like maize and jowar?

Ans: Stilt roots are present in monocots like maize and jowar as the roots arise from a few lower nodes and provide support to the weak stem of the plant.

Q.21. Write a note on epiphytic roots.

Ans: Epiphytic Roots:

The plant which grows upon branches of big trees to get sunlight is called epiphytic plant.
Epiphytic plants have green leaves, thus they can perform photosynthesis.
Epiphytes develop special aerial, hanging roots called epiphytic roots.
Epiphytic roots are spongy due to presence of a special type of tissue called velamen, situated outside the cortex.
Cells of velamen tissue are hygroscopic, they absorb moisture from atmosphere and provide it to the plant.
e.g. Vanda, Dendrobium.

Q.22. Why epiphytic roots are also caUed as assimilatory roots?

Ans: Epiphytic roots are greenish white in colour and have chloroplast. Due to this, epiphytic roots can photosynthesize upto certain extent. Thus, epiphytic roots are also called as assimilatory roots.

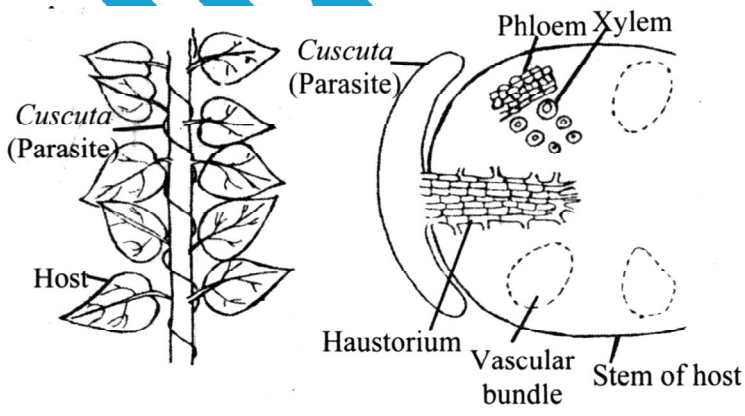
Q.23. Give an account of roots modified for absorption.

OR

Write a note on Parasitic roots / Sucking roots/ Haustoria.

Ans: Parasitic roots / Sucking roots / Haustoria:

Sucking roots or Haustoria are highly specialized roots present in parasitic plants.
Sucking roots being non-green, cannot manufacture or prepare food.
These roots penetrate the host tissue and suck food and water from them.
In partial parasites like Viscum album, the sucking roots penetrate only the xylem elements of the host and absorb water and minerals.
In total parasites like Cuscuta, the sucking roots penetrate the host and establish connection with both xylem and phloem.



(a) *Cuscuta* habit (b) T.S. of host with parasite

Haustorial / sucking roots (*Cuscuta*)

Q.24. What are the normal functions of root?

Ans: The normal.functions of root are fixation and absorption of water and minerals.

Q.25. What is meant by modification of root? What type of modification of root are found in

i. Banyan tree ii. Turnip iii. Mangrove trees

Ans: Modification of root: When roots have to perform some special function, in addition to or instead of their normal functions, they make some structural changes which are described as modifications of root.

i. **Banyan tree:** Prop roots.
ii. **Turnip:** Napiform tap root.
iii. **Mangrove trees:** Pneumatophores or respiratory roots.

5.1.2 Morphology and functions of stem

Q.26. Define the following terms:

i. Stem

Ans: Stem is the ascending axis of a plant and develops from the plumule of the embryo.

ii. Bud

Ans: It is a compact young shoot consisting of a condensed stem, overlapped by young, immature leaves.

iii. Apical bud

Ans: Bud at apex of stem in a plant which results into increase in length of stem is the apical bud.

iv. Axillary bud

Ans: Bud located in the axils ofleaves are called axillary bud.

v. Adventitious bud

Ans: Buds that appear at places other than nodes are called adventitious buds.

vi. Node

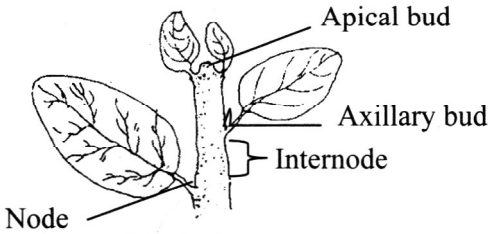
Ans: Small swollen part of a plant stem from which one or more leaves emerge is known as node.

vii. Internode

Ans: A part of a stem between two successive nodes is the internode.

Q.27. Sketch and label a typical stem.

Ans:



Typical stem

Q.28. What are the primary functions of stem?

Ans: Primary functions of stem are to produce and support branches, leaves, flowers and fruits, conduction of water and minerals to different parts of shoot and transportation of food to all plant parts.

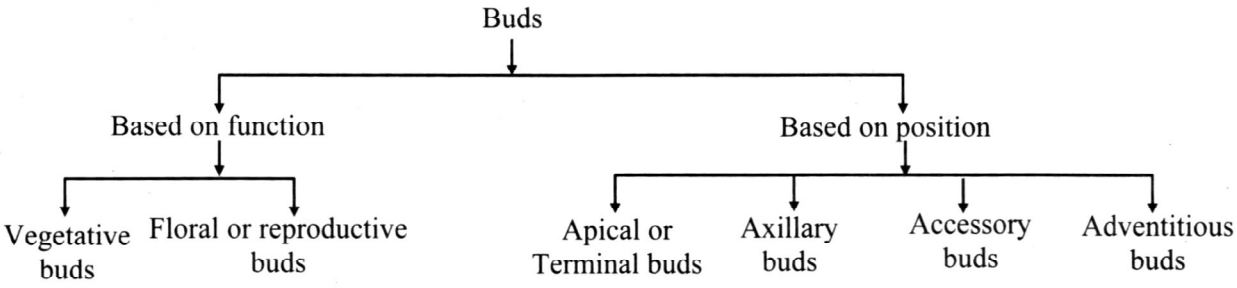
Q.29. Write the important characteristics of the stem.

Ans: Important characteristics of stem:

i. Stem is the ascending axis of the plant and develops from the plumule and epicotyl of the embryo.
ii. It is generally erect and grows away from the soil, i.e. towards light. Therefore, it is negatively geotropic, negatively hydrotropic and positively phototropic.
iii. It bears distinct nodes and internodes.
iv. The branches and leaves appear exogenously on the stem.
v. In mature plants, stem and its branches bear flowers and fruits.

Q.30. Give an account of various types of buds.

Ans: Buds are of the following types:



Based on function:

i. **Vegetative buds:** Vegetative buds are the buds which develop into branches.

ii. **Floral buds or reproductive buds:** Floral buds or reproductive buds are the ones which develop into flowers.

Based on position:

i. **Apical or Terminal buds:** These buds are located at the tip or apex of the stem.

ii. **Axillary buds:** The buds which lie in the axils of leaves are called axillary buds.

iii. **Accessory buds:** Accessory buds are the additional buds which develop either on the sides or above the axillary buds.

iv. **Adventitious buds:** Adventitious buds appear occasionally at places other than nodes, like from roots and leaves.

Q.31. What are the various modifications shown by stem?

Ans: The various modifications of stem are as follows:

i. Underground modifications ii. Sub-aerial modifications iii. Aerial modifications

Q.32. Describe the underground modifications of stem.

Ans: In many plants, the stem becomes underground, i.e. develops below the soil and is known as underground stem.

Such stem remains dormant during unfavourable conditions and gives off aerial shoots under favourable conditions.

These underground stems often store food.

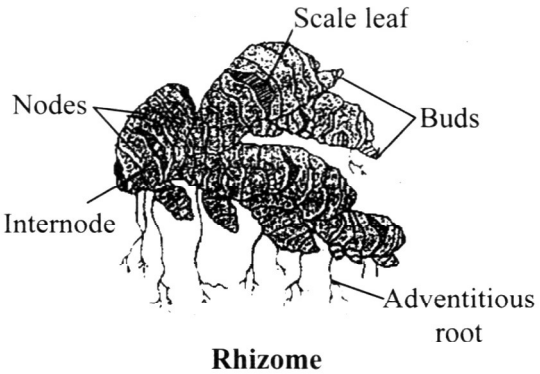
These stems perform three functions: storage of food, perennation and vegetative propagation.

There are four types of underground stems: Scale leaf

i. **Rhizome:**

Rhizome, a prostrate, dorsiventral, thickened brownish stem which grows horizontally under the surface of the soil. It is with distinct nodes and internodes.

It possesses a terminal bud and axillary bud in the axil of each scale leaf present at the node. If growth of the rhizome takes place with the help of lateral buds, it is described as sympodial rhizome. e. g. Ginger, turmeric and Canna. In some plants, growth of rhizome occurs with the help of terminal bud. These are called monopodial rhizomes. e.g Pteris (a fern).



Rhizome

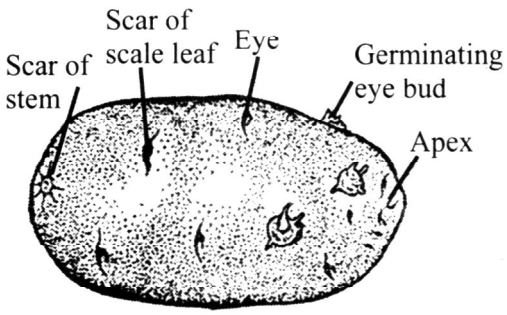
Rhizome does three functions: storage of food, vegetative propagation and perennation.

ii. **Tuber:**

The stem tubers are swollen ends of specialized underground stem branches due to storage of food material.

The nodes and internodes of branches get scattered on the swollen surface. The leaves are modified

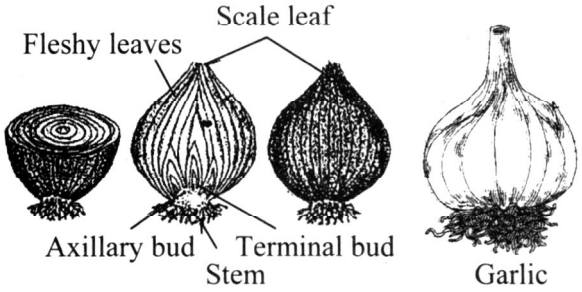
into scales for protecting the axillary buds.
Nodes bear 1 – 3 buds borne in the axis of small scale like leaves and are called as eyes.
e.g Potato (Solanum tuberosum).
The tuber stores starch as reserve food material.
Its 'eyes' can be used for vegetative propagation.



Tuber (Potato)

iii. Bulb:

Bulb is a condensed, disc like underground stem, which itself does not store food material.
The disc like stem is slightly conical with centrally placed apical bud and many concentrically arranged overlapping scale leaves.
Inner leaf bases are fleshy due to storage of food, while outer few are thin and dry and are protective in function.
Adventititous roots are produced from lower surface of disc like stem.
The disc like stem along with concentrically arranged leaves and fibrous roots below is called as bulb.

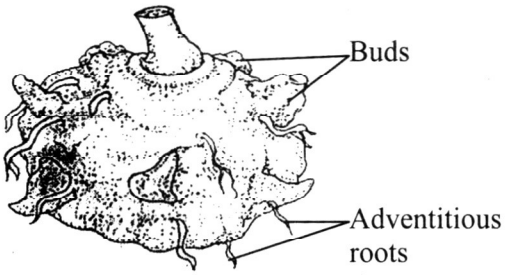


Bulb

When the fleshy scale leaves surround the apical bud in the form of concentric rings, it is called tunicated bulb. e.g. onion.
When fleshy scale leaves partially overlap each other by their margins only, such bulbs are called scaly bulbs. e.g. garlic.

iv. Corm:

It is a solid stout, fleshy and thickened underground stem. It grows vertically downward.
It bears number of buds in the axil of scale leaves which develop into daughter corms.
Adventitious roots develop from the base and its sides.
Corm is a condensed form of rhizome growing vertically, i.e. Amorphophallus, Colocasia.



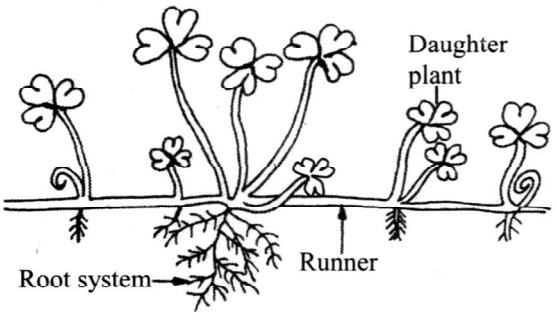
Corm

Q.33. Explain various sub-aerial modifications of stem.

Ans: In sub-aerial type of modification, stem trails on the soil or is found partially beneath the soil in such a way that it remains in contact with both, the soil and the air. Stem is modified for perennation and vegetative propagation. There are four modifications:

i. Runner:

Runners are thin, green, prostrate branches which develop at the base of erect shoots called crowns.
Many such runners are produced by the mother plant and they spread out on the ground in all directions. Each runner has one or more nodes and each node bears scale leaves and an axillary bud.
After travelling some distance, a runner produces a new individual plant above and tufts of adventitious roots below. They may break off from the mother plant and grow as independent daughter plants.
The runner helps in vegetative reproduction.



Runner (e.g *Oxalis*)

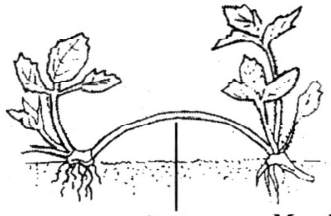
e.g. Lawn grass (Cynodon dactylon), Oxalis, Hydrocotyl, etc.

ii. Stolon:

It is a slender lateral branch that arises from the base of the main axis.

Stolon first grows upwards and then bends down and touches the soil where terminal bud gives rise to a new shoot and adventitious roots.' e.g Mentha,

Strawberry and Colocasia.



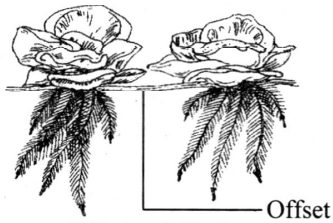
Stolon e.g. *Mentha*

iii. Offset:

It is commonly called the runner of aquatic plants.

It is shorter and thicker than runner.

It helps in the vegetative propagation in aquatic plants. e.g Pistia, Eichhomia.



Offsets of *Pistia*

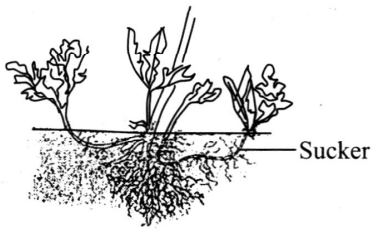
iv. Sucker:

It is a runner like non-green branch developing from underground part of stem.

It grows horizontally below the soil initially and comes above the soil obliquely.

It produces aerial shoot. The sucker can also be called as underground runner.

e.g Chrysanthemum.



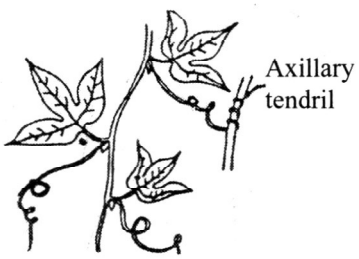
Sucker of *Chrysanthemum*

Q.34. Describe various aerial modifications of stem.

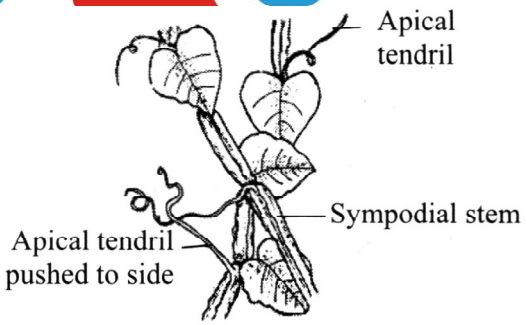
Ans: Sometimes, aerial stems or their vegetative or floral structures like tendril, thorn, phylloclade or bulbil.

Following are the examples of such stems:

i. Stem tendril:



Axillary tendril in Passion flower



Apical tendril in *Vitis*

Axillary tendril in Passion flower

This type of modification of stem is generally found in the plants with weak stem.

For e.g in Passion flower, some axillary buds instead of developing into branches, produce spring like structures called tendrils.

Tendrils are thin, elongated, cylindrical, coiled, mostly green structures sensitive to touch.

When they come in contact with some object, they coil around it and take the support.

The tendrils may develop from apical bud (as in grapes), or from extra-axillary bud as found in Cucurbita, while in Antigonon floral bud is tendrillar.

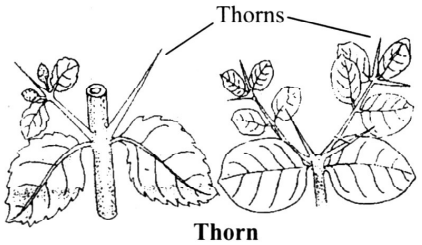
In Vitis, apical bud is .modified into tendril and further growth takes place by axillary bud. Such growth is called sympodial growth.

It gives support to the plant due to which it climbs up and exposes the leaves to maximum sunlight for photosynthesis.

ii. Thorn:

Axillary or apical buds sometimes instead of developing into branches, get metamorphosed into hard and pointed structures, called thorns. It provides protection against grazi~g animals.

e.g Duranta, Citrus.



Thorn

iii. Phylloclade:

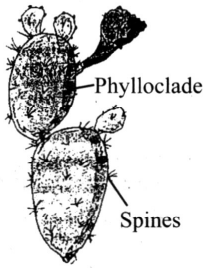
Phylloclade or cladophyll is a stem which becomes green leaf like structure for photosynthesis.

It is green, flattened structure with distinct nodes and internodes.

It is thick, fleshy and succulent in Opuntia, cylindrical in Casuarina and Euphorbia and ribbon like in Muehlenbeckia.

In Xerophytes, leaves get modified into spines or get reduced in size to check the loss of water due to transpiration.

As the leaves are modified into spines, the stem becomes green in colour to do the function of photosynthesis.



Phylloclade

iv. Cladode:

These are green branches of limited growth which perform the function of photosynthesis.

True leaves are reduced to scales or spines.

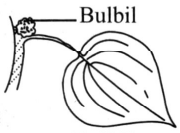
e.g. Asparagus.


Cladode

v. Bulbil:

When axillary bud becomes fleshy and round due to storage of food, it is called bulbil.

It gets detached from the plant, falls on the ground and, develops into a new plant. e.g. Dioscorea.



Bulbil

Q.35. Why phylloclade of Opuntia is thick and fleshy?

Ans: The phylloclade of Opuntia is thick and fleshy as it contains mucilage for water retention.

Q.36.What are tendrils?

Ans: Tendrils are thin, wiry and highly sensitive structures which help the plant to attach itself to the support and climb.

Q.37. What are cladodes?

Ans: Cladodes are green branches oflirnited growth whichperform the function of photosynthesis.

Q.38. Potato is a stem and sweet potato is a root'. Justify the statement.

Ans: Potato and sweet potato are underground. Both are fleshy due to storage of food material but the presence of nodes and internodes, scale leaves and axillary buds shows that potato is a stem. On the other hand, sweet potato does not show these characters, hence it is a root.

Q.39. Differentiate between root and stem.

Ans:

No.	Root	Stem
i.	It is the descending axis of a plant.	It is the ascending axis of a plant.
ii.	It is negatively phototropic, i.e. grows away from light.	It is positively phototropic, i.e. grows towards light.
iii.	It is positively geotropic, i.e. grows towards soil.	It is negatively geotropic, i.e. grows away from soil.
iv.	It develops from radicle.	It develops from plumule.
v.	It does not bear nodes and internodes.	It bears nodes and internode.
vi.	It does not terminate into bud.	It terminates into a bud.
vii.	Root apices are protected by root cap.	Stem apices are not protected by cap.
viii.	It bears unicellular root hair.	It bears multicellular hair.
ix.	It is non green and non photosynthetic.	It is green and photosynthetic.
x.	It does not bear leaves and bud.	It bears leaves and bud.

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5.1.3 Morphology and functions of leaf

Q.40. Give the characteristics of leaf.

Ans: Characteristics of leaf:

i. Leaf is a green, flat, thin, expanded, dissimilar lateral appendage of the stem.
ii. Leaf is always borne at the node of the stem.
iii. Generally, there is an axillary bud in the axil of a leaf.
iv. It is exogenous in origin and develops from the swollen leaf primordium of the growing apex.
v. Growth of the leaf is limited.
vi. The leaves do not possess any apical bud or a regular growing point.
vii. It consists of petiole, leaf lamina and sometimes two lateral outgrowths at the base called stipules.

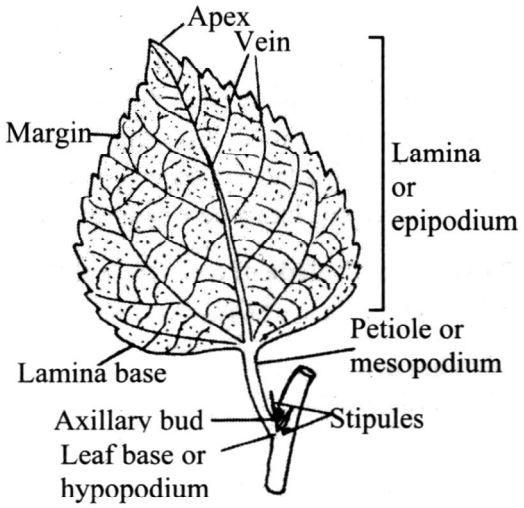
Q.41. Give an account of various parts of a typical dicot leaf.

Ans: A typical dicot leaf (e.g Hibiscus) has following three parts:

i. Leaf base or hypopodium
ii. Petiole or leaf stock or mesopodium
iii. Leaflamina or leaf blade or epipodium

i. Leaf base or Hypopodium:

a. The basal part of the leaf by which it is attached to the stem is called leaf base.
b. In many plants, the leaf base is provided with a pair of small outgrowths called stipules. A leaf with stipules, is termed as stipulate leaf (Rose, China rose, etc) and in the absence of stipules it is termed as exstipulate leaf (Mango). Stipules protect the bud and carry out photoysnthesis. .
c. When leaf base is swollen, it is known as pulvinate leaf base.



Typical leaf

ii. Petiole or leaf Stalk or Mesopodium:

a. Petiole is a long or short, cylindrical or sub-cylindrical part of the leaf, which joins the leaf lamina to the leaf base.
b. Petiole pushes the leaf lamina away from the stem to get optimum sunlight.
c. A leaf with petiole is termed as petiolate leaf (Mango) and the one without petiole is said to be non-petiolate or sessile leaf (Canna).
d. The petiole conducts water and solutes from the stem to the leaf blade. It also transports organic material from leaflamina to stem. In addition, it projects the leaf blade properly to get optimum sunlight.

iii. Leaf lamina or Leaf blade or Epipodium:

a. Leaf lamina is a flat, thin, green, expanded portion of the leaf and constitutes the major part of the leaf.
b. It is a site of photosynthesis, gaseous exchange and transpiration.
c. The lamina may be dorsi-ventral or isobilateral. In case of a dorsi-ventral leaf, the upper surface differs in structure from the lower surface while in isobilateral leaf, both the upper and lower surfaces are identical. Dorsiventral leaf is present in dicot plant and isobilateral leaf is present in monocot plant.
d. Some plants have cylindrical leaves in which there is no distinction between the two surfaces. They are called centric leaves e.g. onion, garlic etc.

Q.42. Define venation.

Ans: The arrangement of veins and veinlets in the lamina is known as venation.

Q.43. Give the different types of venation and add a note on its significance.

Ans: The venation is mainly of two types:

i. Reticulate venation:

When the veins and veinlets form a network, it is called reticulate venation.

Leaf posses is centrally placed midrib with veins and veinlets distributed laterally.

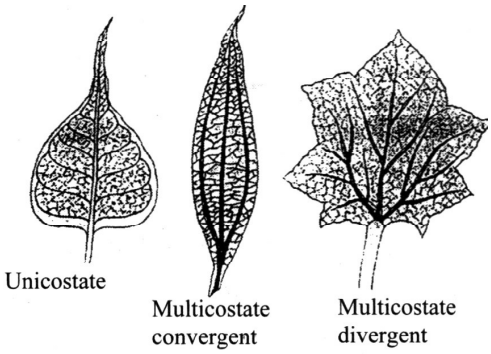
It is found in dicot plants.

On the basis of number of mid-veins, reticulate venation is of two types: Unicostate

a. Pinnate or unicostate: It is with single midrib.

e.g. Mango leaf.

b. Palmate or multicostate: With two or more prominent veins e.g. Zizyphus leaf. It is further divided into convergent or divergent.



Types of venation (Reticulate)

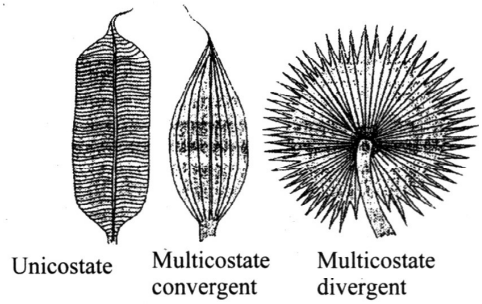
ii. Parallel venation:

In this, veins run almost parallel to one another. It is found in monocotyledonous plants.

It is of two types:

a. Unicostate: e.g. Banana, Canna

b. Multicostate: e.g. Rice, Bamboo. It may be convergent or divergent.



Types of venation (Parallel)

Significance of venation:

Veins form the structural framework of the lamina. They give mechanical support to the lamina.

Veins are responsible for conduction of water, food and mineral salts.

Q.44. Define simple leaf and Compound leaf.

Ans: Simple leaf: Simple leaves are those in which single leaf blade or lamina is present. e.g. mango, peepal.

Compound leaf: The leaf in which the leaf blade or lamina is divided into a number of leaf like segments called leaflets is called compound leaf.

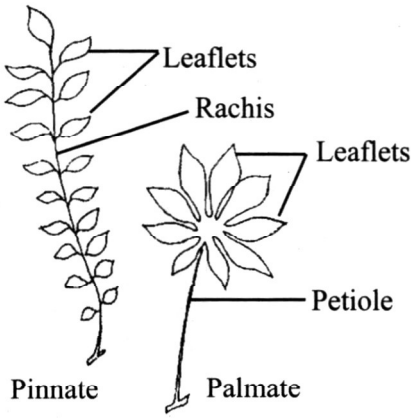
Q.45. What are the two types of compound leaves?

Ans: i. Two types of compound leaves are, pinnately compound leaf and palmately compound leaf.

ii. In pinnately compound leaf (Pinna = feather), the leaf lamina is incised up to the midrib forming pinnae or leaflets. Its rachis bear leaflets laterally. A pinnately compound leaf may be unipinnate (Rose), bipinnate (Gold mo hur) , trip innate (Moringa) and decompound.

iii. In palmately compound leaf, all leaflets are attached at a common point to the tip of petiole. Palmately compound leaf is further divided into five types depending on the number of leaflets:

a. Unifoliate - e.g. Citrus
b. Bifoliate - e.g. Bauhinia
c. Trifoliate - e.g. Trigonella
d. Quadrifoliate - e.g Marsilia
e. Multifoliate - e.g Bombax



Compound leaves

Q.46. How is pinnately compound leaf different from a palmately compound leaf?

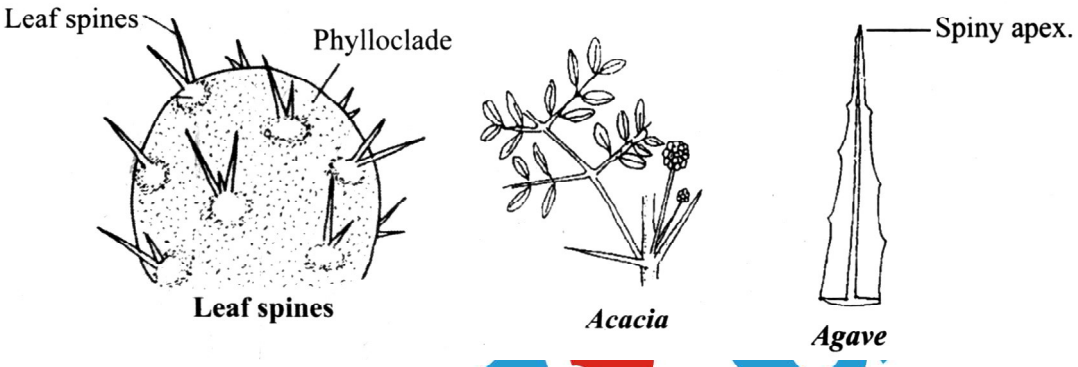
Ans:

No.	Pinnately compound leaf	Palmately compound leaf.
i.	They appear feather like.	They appear like palm of hand.
ii.	Leaflets appear on elongated axis.	Leaflets appear from common point.
iii.	Leaflets appear in two rows.	Leaflets are clustered together.
iv.	e.g. Gold mohur, *Cassia*	e.g. *Aegle, Bombax.*

Q.47. Give an account of leaf spines.

Ans: Leaf spines:

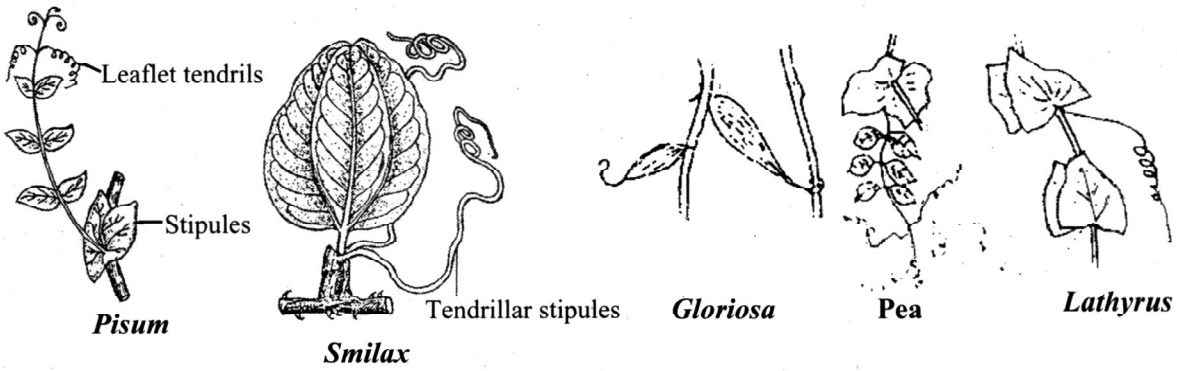
In some plants, the leaves or their parts are modified into small, hard, sharp pointed structures called spines.
A bud is present in the axil of a spine indicates that the spine is a modified leaf.
The spines are defensive organs. They protect the plant from grazing animals.
e.g. In Zizyphus and Acacia, the stipules are modified into spines.
In addition, they also help the plant to reduce the rate of transpiration.
e.g. In Opuntia, the leaves are modified into spines.



Q.48. Write a short note on leaf tendrils.

Ans: Leaf tendrils:

In some plants, the leaf is modified into a slender, often closely coiled spring like structure called tendril.
It is a climbing organ which is very sensitive to touch or contact with any object. It coils around the object and helps the plant to climb on some support.
The leaf may be partially or wholly modified, accordingly the leaf tendrils are of the following types:

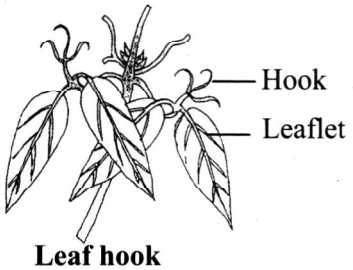


i. **Whole leaf tendrils:** In Lathyrus (wild pea), the entire leaf is modified into tendril, whereas the stipules become leafy or foliaceous to perform the functions of leaves.
ii. **Leaf apex tendril:** In Gloriosa superba (glory lily), the leaf apex is modified into coiled tendril.
iii. **Leaflet tendrils:** In pea (Pisum sativum), the upper leaflets of compound leaf are modified into tendrils.
iv. **Petiolar tendrils:** Sometimes the petiole becomes long and gets modified into a tendril. e.g. Clematis.
v. **Stipular tendrils:** In Smilax, stipules are modified into tendrils.

Q.49. Write a note on leaf hook.

Ans: Leaf hook:

In Bignonia unguis-cati (eat's nail), the terminal three leaflets get modified into three stiff curved and pointed hooks which look like eat's nail. These hooks cling the bark of tree and help the plant for climbing.



Leaf hook

Q.50. Write a note on phyllode.

Ans: Phyllode:

A flat, green, leaf-like modification of petiole or rachis is known as phyllode.

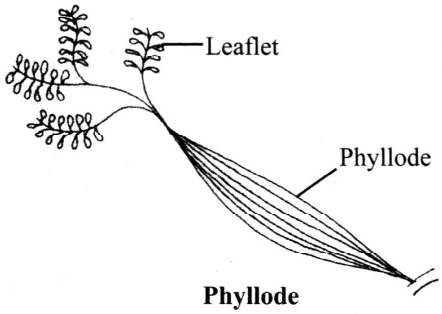
The leaflets either fall off very early (Caducous) or become highly reduced.

In such plants, the phyllode performs photosynthesis.

It is a xerophytic modification in order to reduce the rate of transpiration.

For eg. in Acacia auriculiformis, the normal leaf is bipinnately compound.

The leaflets soon fall off and the petiole gets flattened to form the phyllode.



Phyllode

Q.51. Explain with suitableexamples, the different types ofphyllotaxy. Give significance ofphyllotaxy.

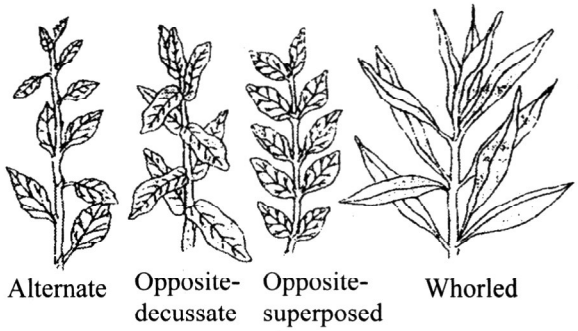
Ans: Phyllotaxy is the arrangement of leaves on the stem and branches in some definite manner.

Phyllotaxy is of three types:

i. **Alternate phyllotaxy:** When single leaf arises at each node on the stem, it is called as alternate phyllotaxy. e.g Sunflower, mango, etc.

ii. **Opposite phyllotaxy:** In this, two leaves arise from each node in opposite directions. It is of two types:

   a. **Opposite decussate phyllotaxy:** When one pair of leaves lie at right angle to the Alternate Opposite- Opposite- Whorled next or lower pair of leaves, It is sarid to be decussate superposed opposite decussate phyllotaxy. e.g Calo trap is, Ocimum.



Types of phyllotaxy

   b. **Opposite superposed:** In this type, all the pairs of opposite leaves are arranged one above the other. e.g Guava.

   iii. Whorled or verticillate phyllotaxy: In this type, more than two leaves arise at each node and form a whorl. e.g Nerium.

Significance of phyllotaxy:

For photosynthesis sunlight is required. Because ofphyllotaxy, all leaves get sufficient sunlight

Q.52. Write the primary functions of leaf.

Ans: Normal functions or primary functions of leaf:

i. **Photosynthesis:** The principal function of the leaf is to manufacture organic food through photosynthesis.

ii. **Gaseous exchange:** The stomata present on leaf are primarily meant for gaseous exchange required for photosynthesis and respiration.

iii. **Transpiration:** Loss of water in the form of vapour through aerial parts of the plant is called transpiration. Most of the transpiration occurs through stomata present on leaf surface. This process

helps to maintain temperature of the plant.

iv. **Protection of bud:** The terminal and axillary buds are protected by leaves from desiccation and mechanical injury.

v. **Conduction:** The vascular bundles of veins and petioles of leaves serve the function of translocation of organic food through phloem and water and minerals through xylem.

Q.53. Distinguish between phylloclade andphyllode.
Ans:

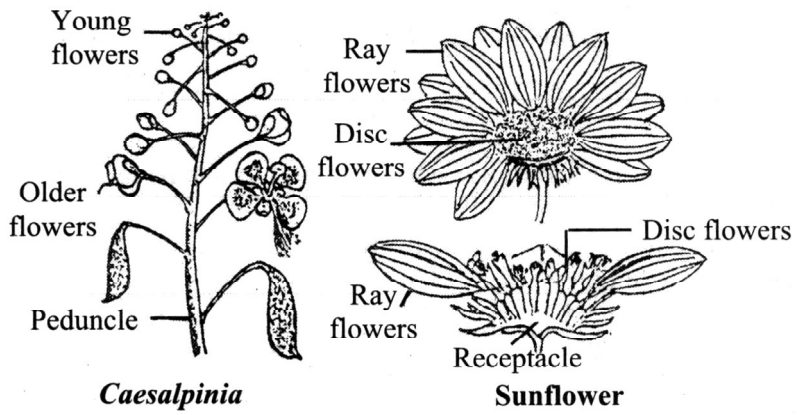
No.	Phylloclade	Phyllode
i.	It is the modification of stem.	It is the modification of petiole into leaf like structure.
ii.	It has nodes and internodes.	Nodes and internodes are absent.
iii.	The leaves are reduced in size or modified into spines.	The leaflet or lamina of the leaf are highly reduced.
iv.	Growth is unlimited.	Growth is limited.
v.	It may take part in vegetative reproduction.	It does not take part in vegetative reproduction.
vi.	It is branched.	It is unbranched.
vii.	It is swollen due to storage of food and water	It does not store food and water.
viii.	*e.g. Opuntia*	*e.g. Acacia auriculiformis*

5.1.4 Inflorescence

Q.54. Define inflorescence and state its types.
Ans: Definition: The mode of arrangement of flowers on the floral axis is known as inflorescence.
The main axis is called peduncle. It may apse terminally or in axil and bears a number of flowers.
Types: There are two major types of inflorescence namely;

i. Racemose or indefinite or indeterminate inflorescence
ii. Cymose or definite or determinate inflorescence.

Q.55. Describe racemose type of inflorescence.
Ans: Racemose Inflorescence:



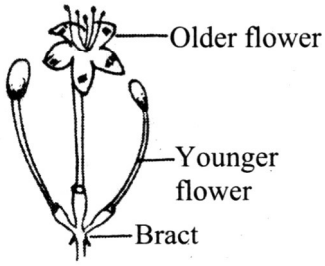
Caesalpinia **Sunflower**

i. The main axis called peduncle possesses terminal bud and therefore, grows. indefinitely.
ii. The flowers are borne laterally in acropetal succession, i.e. older flowers towards the base and younger flowers towards the apex e.g Caesalpinia.
iii. In some plants, peduncle condenses to form a flat rounded structure called receptacle. Flowers are arranged in centripetal succession, i.e. younger flowers are towards the centre and older flowers towards the periphery. e.g Sunflower.

Q.56. Explain cymose inflorescence.

Ans: Cymose Inflorescence:

i. The main axis, peduncle terminates into flower.
ii. Further growth takes place by lateral branches which arise below the terminal flower. The lateral branches also terminates into flower.
iii. In cymose inflorescence, the flowers arise in basipetal succession, i.e. older flowers are at apex and younger towards the base. e.g Clerodendron.
iv. In some plants, the floral axis may get condensed to form a receptacle. Flowers are arranged in centrifugal succession, i.e. older towards the centre and younger towards the periphery. e.g Jasmine, Calotropis, Nerium, etc.



Cymose Inflorescence
(Clerodendron)

Q.57. Write the significance of inflorescence.

Ans: Significance of Inflorescence:

i. Inflorescence makes a flower more conspicuous to attract the insects and birds for pollination.
ii. It provides more chances for cross pollination.
iii. An insect can pollinate many flowers in inflorescence in a single visit.
iv. In an inflorescence, flowers open successively and not simultaneously. This improves chances of pollination as flowering period is longer.

Q.58.Differentiate between racemose and cymose inflorescence.

Ans:

No.	Racemose inflorescence	Cymose inflorescence
i.	It has indefinite growth.	It has definite growth.
ii.	Apical bud never terminates into flower.	Apical bud always terminates into flower.
iii.	Flowers are arranged in acropetal order, i.e. younger flower at the apex and older at the base.	Flowers are arranged in basipetal order, i.e older flowers at the apex and younger at the base.
iv.	Flowers are produced laterally on the floral axis.	Flowers are always produced terminally.
v.	Opening of flowers is from base to apex or from periphery to centre. e.g. Gold mohur, sunflower.	Opening of flower is from apex to base or centre to periphery. e.g. Chinarose, Jasmine.

5.1.5 Flower

Q.59. Define flower. Describe structure of a typical flower and mention important functions of each part.

OR

What is a flower? Describe the parts of a typical angiospermic flower.

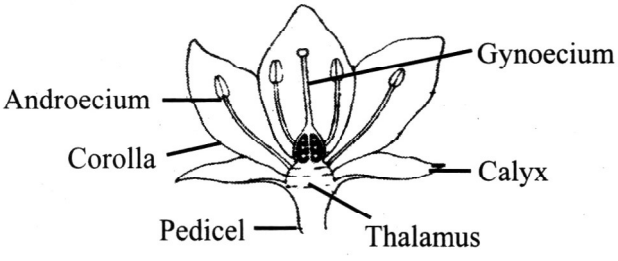
Ans: Flower: Flower is defined as a 'highly modified and condensed shoot with limited growth and specialized for sexual reproduction in higher plants. Sometimes a flower grows in the axil of a leaf-like structure known as the bract.

A typical flower has the following three parts.

i. Pedicel ii. Thalamus
iii. Floral whorls

i. Pedicel:

The stalk of the flower is called pedicel which



Parts of a typical flower