Chapter- 5

Morphology of Flowering Plants

NCERT Back Exercises:

Ques 1: What is meant by modification of root? What type of modification of root is found in the

(i) Banyan tree

(ii) Turnip

(iii) Mangrove trees

Ans 1: Primarily, there are two types of root systems found in plants, namely the tap root system and fibrous root system. The main function of the roots is to absorb water and minerals from the soil. However, roots are also modified to perform various other functions. The roots of some plants act as storage sites for food, some provide support to massive plant structures, while others absorb oxygen from the atmosphere.
Roots and its modifications in various plants:

(i) Banyan tree: The banyan tree (*Ficus benghalensis*) has massive pillar-like adventitious roots arising from the aerial part of the stem. These roots grow towards the ground and provide support to the tree. Such roots are called prop roots.

(ii) Turnip: The roots of turnip (*Brassica rape*) help in the storage of food. Similar food-storing roots are found in radishes, carrots, and sweet potatoes.

(iii) Mangrove tree: The roots of mangrove plants grow vertically upwards from the soil for the absorption of oxygen from the atmosphere as the soil is poorly aerated. These types of roots are called pneumatophores.

Ques 2: Justify the following statements on the basis of external features

(i) Underground parts of a plant are not always roots

(ii) Flower is a modified shoot

Ans 2:

(i) Various parts of plants are modified into underground structures to perform various functions such as stems, leaves, and even fruits.

The stems in ginger and banana are underground and swollen due to storage of food. They are called rhizomes. Similarly, corm is an underground stem in *Colocasia* and *Zamin-khand*. The tips of the underground stem in potato become swollen due to the accumulation of food and forms tuber. Tubers bear eyes, which are subtended by a leaf scar. Basal leaves in onions become fleshy because of the accumulation of food. In peanuts, the flower after fertilization gets pushed inside the soil by growing a flower stalk. The formation of fruits and seeds takes place inside the soil.

(ii) During the flowering season, the apical meristem gives rise to the floral meristem. The axis of the stem gets condensed, while the internodes lie near each other. Instead of leaves, various floral appendages arise from the node. Therefore, it can be said that the flower is a modified shoot.

Ques 3: How is pinnately compound leaf different from palmately compound leaf?

Ans 3:

Pinnately compound leaf	Palmately compound leaf
Many numbers of leaflets are present on a common axis	Several leaflets are attached to a common point.
Leaflets are attached to common axis called rachis	Leaflets are attached to a common point on the leaf stalk.
Leaflet bearing axis is the continuation of the petiole	Leaflet bearing axis is very short.
Ex: Neem leaves	Ex: Cotton leaves

Ques 4: Explain with suitable examples the different types of phyllotaxy?

Ans 4: Phyllotaxy refers to the pattern or arrangement of leaves on the stem or branch of a plant. It is of three types, alternate, opposite, and whorled phyllotaxy.
In alternate phyllotaxy, a single leaf arises from the node of a branch. This type of phyllotaxy is observed in the sunflower, mustard, and peepal. Plants with opposite phyllotaxy have two leaves arising from the node in opposite directions. It is found in guava and *jamun* plants. Plants with whorled phyllotaxy have three or more leaves arising from the node. It is found in *Alstonia.*

Ques 5: Define the following terms:

(i) Aestivation

(ii) Placentation

(iii) Actinomorphic

(iv) Zygomorphic

(v) Superior ovary

(vi) Perigynous flower

(vii) Epipetalous Stamen

Ans 5:

(i) Aestivation: The term 'aestivation' refers to the mode in which sepals or petals are arranged in a floral bud with respect to other floral members. There are four types of aestivation in plants i.e., valvate, twisted, imbricate, and vexillary.

(ii) Placentation: The term 'placentation' refers to the arrangement of ovules within the ovary of a flower. It is primarily of five types, namely marginal, basal, parietal, axile, and free central.

(iii) Actinomorphic: Actinomorphic flowers can be divided into two radial halves by any radial plane passing through its centre. Examples: chilly and mustard.

(iv) Zygomorphic: Zygomorphic flowers are those flowers which can be divided into two similar halves by a single vertical plane. Examples: pea and beans.

(v) Superior ovary: Superior ovary flowers are those flowers in which the gynoecium is present at the highest position, while other floral parts are arranged below it. A flower with this arrangement is described as hypogynous. Examples: brinjal and mustard.

(vi) Perigynous flower: In perigynous flowers, the gynoecium is present in the centre and the rest of the floral parts are arranged at the rim of the thalamus at the same level. Examples: plum and rose.

(vii) Epipetalous Stamen: Epipetalous stamens are stamens attached to the petals. They are found in brinjal.

Ques 6: Differentiate between

(i) Racemose and cymose inflorescence

(ii) Fibrous roots and adventitious roots

(iii) Apocarpous and syncarpous ovary

Ans 6:

(i) Racemose and cymose inflorescence

Racemose inflorescence	Cymose inflorescence
Inflorescence in which young flowers are present at the tip and older flowers are arranged at the base	Inflorescence in which old flowers are present at the tip and young flowers are arranged at the base
Main axis continues to grow and produce flowers laterally.	The main axis has limited growth which terminates into flower.

(ii) Fibrous roots and adventitious roots

Fibrous roots	Adventitious roots
The primary root is short-lived and is replaced by a large number of roots in monocotyledons	Roots arise from parts of the plants other the radicle.
Example: Wheat	Example: Banyan tree

(iii) Apocarpous and syncarpous ovary

Apocarpous ovary	Syncarpous ovary
In apocarpous ovary, two or more carpels are free	In syncarpous ovary, two or more carpels are fused
Example: Lotus	Example : mustard

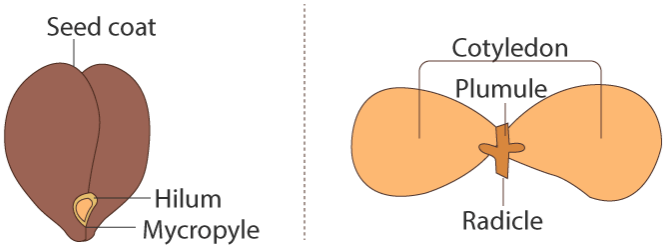
Ques 7: Draw the labelled diagram of the following:

(i) Gram seed

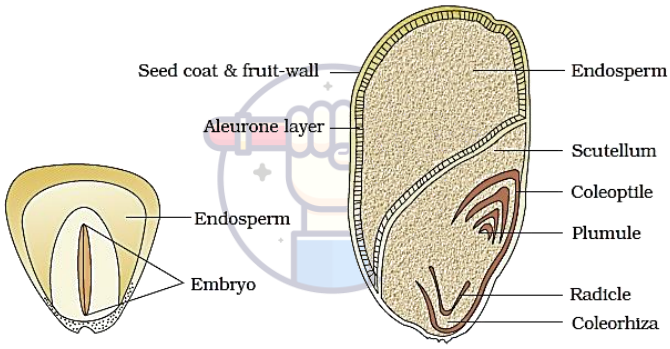
(ii) V.S. of maize seed

Ans 7:

(i) Gram Seed



(ii) V.S. of Maize Seed



Ques 8: Describe modifications of stem with suitable examples

Ans 8: Stems of various plants have undergone modifications to perform different functions**.**

Underground stems or storage stems:

Examples: Rhizomes, Corms, tubers

In ginger and banana, the underground stem is called a rhizome. The underground stem in *Colocasia* (*arvi*) is known as corm. Rhizomes and corms are underground stems, modified for the storage of food. Also, these stems help in vegetative reproduction of these plants. The tips of the underground stem in potato plants become swollen due to the accumulation of food. The potato is a tuber that helps in the storage of food and bears eyes on it. Subtended by a leaf scar, these eyes bear buds that give rise to new plants.

Supportive stems:

Example: Tendril

The stem in some weak plants bear thin, slender, and spirally-coiled structures called tendrils that help the plant get attached to nearby structures for support. Tendrils are found in cucumbers, melons, and other members of the family *Cucurbitaceae.*

Tendrils

Protective stems:

Example: Thorns

The stem in *bougainvillea* and citrus plants (like lemon and orange) bear sharp, pointed structures called thorns, which provide protection to the plant from herbivores.

Thorns

Photosynthetic stems:

Example: Opuntia

The stem in the *Opuntia* is green. It carries out the process of photosynthesis in the absence of leaves.

Opuntia

Others stem modifications:

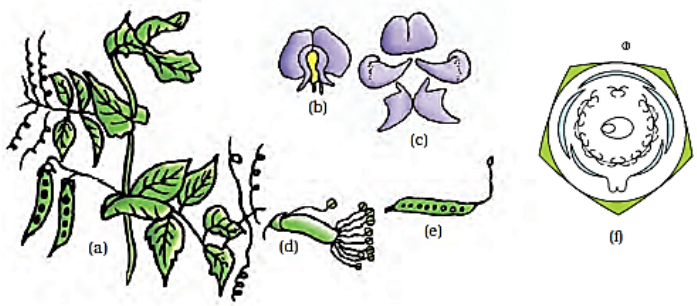
In some plants, underground stems such as grasses spread in the soil and help in perenation. These stems are called runners.
The short lateral stem called the offset in some aquatic plants (such as *Eichhornia)* bears leaves and tufts of roots at the node and gives rise to new plants.

Ques 9: Take one flower each of families Fabaceae and Solanaceae and write its semi technical description. Also draw their floral diagrams after studying them.

Ans 9:

Characters of Fabaceae:

(i) They are trees, shrubs herbs having roots with root nodules.
(ii) Stems are erect or climber
(iii) Leaves are alternate, pinnately compound or simple and leaf base are pulvinate; stipulate with reticulate venation.



Pisum sativum (pea) plant : (a) Flowering twig (b) Flower (c) Petals (d) Reproductive parts (e) L.S.carpel (f) Floral diagram

Floral Characters:

Inflorescence: racemose

Flower: bisexual, zygomorphic

Calyx: sepals five, gamosepalous; valvate/imbricate aestivation

Corolla: petals five, polypetalous, papilionaceous, consisting of a posterior standard, two lateral wings, two anterior ones forming a keel (enclosing stamens and pistil), vexillary aestivation

Androecium: stamens ten in number, diadelphous, anther dithecous

Gynoecium: ovary superior, monocarpellary, unilocular with many ovules, style single

Fruit: legume; seed: one to many, non-endospermic

Economic importance: Plants of these families are pulses used as fodder and sweet pea.

Examples: Peas, trifolium,

Floral diagram:

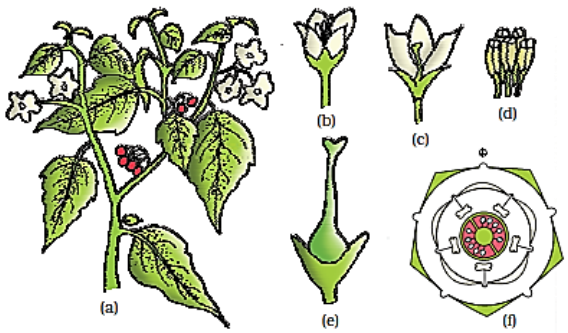
$$\%\,\male\,\female\,K_{(5)}C_{1+2+(2)}A_{(9)+1}\underline{G}_{1}$$

Characters of Solanaceae:

(i) Commonly termed as potato family, Solanaceae are mostly herbs, shrubs and rarely small trees.

(ii) Stems are herbaceous rarely woody, aerial; erect, cylindrical, branched, solid or hollow, hairy or glabrous, underground stem in potato.

(iii) Leaves are alternate, simple, rarely pinnately compound, exstipulate with reticulate venation.



Solanum nigrum (makoi) plant : (a) Flowering twig (b) Flower (c) L.S. of flower (d) Stamens (e) Carpel (f) Floral diagram

Floral Characters:

Inflorescence: Solitary, axillary or cymose as in Solanum

Flower: bisexual, actinomorphic

Calyx: sepals five, united, persistent, valvate aestivation

Corolla: petals five, united; valvate aestivation

Androecium: stamens five, epipetalous

Gynoecium: bicarpellary obligately placed, syncarpous; ovary superior, bilocular, placenta is swollen with many ovules, axile

Fruits: berry or capsule

Seeds: many, endosperms

Economic importance: Plants belonging to this family are used as food, spices, medicines and ornamentals.

Floral diagram:

$\oplus \male K_{(5)} \overbrace{C_{(5)} A_5} \underline{G}_{(2)}$

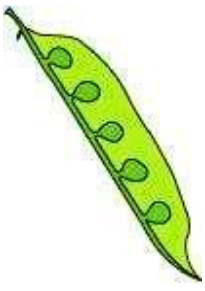
Example: Brinjal, chilli, ashwagandha, petunia

Ques 10: Describe the various types of placentations found in flowering plants.

Ans 10: Placentation refers to the arrangement of ovules inside the ovary.
It is of five basic types.

(i) Marginal placentation:

The ovary in which the placenta forms a ridge along the ventral suture of the ovary and the ovules develop on two separate rows is known to have marginal placentation. This type of placentation is found in peas.



(ii) Parietal placentation

When the ovules develop on the inner walls of the ovary, the ovary is said to have parietal placentation.

(iii) Axile placentation

In axile placentation, the placenta is axial and ovules are attached to it. Examples include China rose, lemon, and tomato.

(iv) Basal placentation

The ovary in which the placenta develops from its base and a single ovule is found attached to the base is said to have basal placentation. It is found in marigold and sunflower.

(v) Free central placentation

In free central placentation, the ovules develop on the central axis while the septa are absent. This type of placentation is found in *Dianthus* and primrose.

Ques 11: What is a flower? Describe the parts of a typical angiosperm flower?

Ans 11:

(i) Reproductive part of an angiosperm is called as the flower. It is a modified shoot wherein the shoot apical meristem changes to floral meristem.

(ii) A typical flower has four different kinds of whorls that are organized successively on the swollen end of the pedicel or stalk known as receptacle or thalamus. These four parts are classified under accessory organs and reproductive organs. When the calyx and corolla are not distinct, they are termed as perianth.

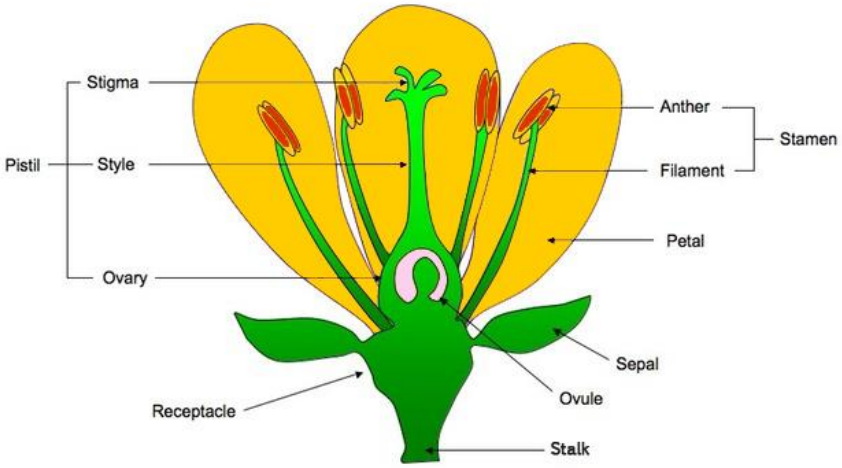
Parts of flowers:

(i) The calyx forms the outermost whorl of a flower, which contains sepals. They are green, leaf–like structures that cover and protect the flowers during the bud stage. When the sepals of a flower are free, they are called polysepalous, while fused sepals of a flower are called gamosepalous.

(ii) The corolla of a flower is a layer that lies inside the calyx. It contains beautifully coloured petals, which help in attracting insects for pollination. When the petals are free, they are called polypetalous, while fused petals are called gamopetalous.

(iii) The androecium or the stamen is the male reproductive part of a flower. It consists of two parts, the filament and the bilobed anther. The bilobed anther is the site for meiosis and the generation of pollen grains.

(iv) Gynoecium represents the female reproductive part of a flower. It consists of an ovary. The ovary is connected by a long tube (called style) to the stigma. The ovary bears numerous ovules attached to the placenta.



Parts of a Flower

Ques 12: How do the various leaf modifications help plants?

Ans 12: The main function of the leaves is to carry out the process of photosynthesis. However, in a few plants, leaves are modified to perform different functions.

(i) Tendrils: The leaves of a pea plant are modified into tendrils that help the plant in climbing.

(ii) Spines: The leaves in cactus are modified into sharp spines that act as an organ of defence.

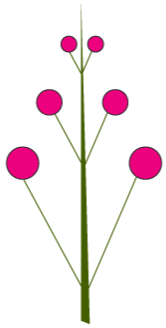
(iii) Phyllode: The leaves of some Australian acacia are short-lived and soon replaced by flattened, green structures called phyllodes that arise from the petiole of the leaves. The petioles in these plants synthesize food.

(iv) Pitcher: The leaves of the pitcher plant are modified into pitcher-like structures, which contain digestive juices and help in trapping and digesting insects.

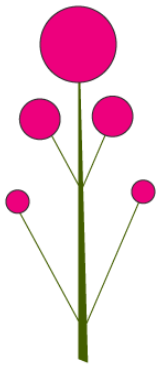
Ques 13: Define the term inflorescence. Explain the basis for the different types of inflorescence in flowering plants.

Ans 13: Inflorescence is the arrangement of flowers on the floral axis.
There are two major types of the inflorescence depending upon whether the apex is converted into a flower or continues to grow, they are:

Racemose: Type of inflorescence in which the flowers are borne laterally in acropetal succession, i.e, newer flowers are near the apex while older flowers are at the base. The main axis continues to grow.



Cymose: is a type of inflorescence in which main axis terminates in a flower and has limited growth. Flowers are borne in a basipetal order where younger flowers are near the base and older flowers are at the apex.



Ques 14: Write the floral formula of an actinomorphic bisexual, hypogynous flower with five united sepals, five free petals. Five free stamens and two united carpals with superior ovary and axile placentation.

Ans 14: The floral formula of the described flower is represented as:

$$\oplus ♀ \; K_{(5)} C_5 A_5 \underline{G}_{(2)}$$

Actinomorphic flowers are represented by the symbol. $\oplus$.

A bisexual flower is indicated by ♀.

The calyx contains five united sepals which can be represented as K(5).

The corolla consists of five free petals and it represented as C_5.

The androecium consists of five free stamens and is represented by A_5.

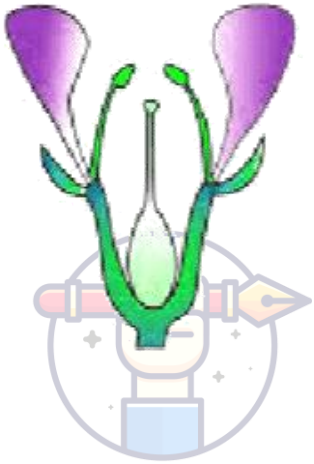
The gynoecium consists of a superior ovary with two united carpels and axile placentations, which can be represented as $\underline{G}_{(2)}$.

Ques 15: Describe the arrangement of floral members in relation to their insertion on thalamus?

Ans 15: Based on the position of the calyx, corolla, and androecium (with respect to the ovary on the thalamus), the flowers are described as hypognous, perigynous, and epigynous.

In hypogynous flowers, the ovary occupies the highest position on the thalamus while other floral parts are situated below it. In such flowers, the ovary is superior
Examples., China rose, mustard etc.

In perigynous flowers, the ovary is situated at the centre and other floral parts are arranged on the rim of the thalamus. The ovary here is said to be half inferior examples, plum, rose, peach



In epigynous flowers, the thalamus grows around the ovary fusing with its wall. The other floral parts are present above the ovary. Hence, the ovary is said to be inferior
e.g., flowers of guava and cucumber.