

Chapter 5

Morphology of Flowering Plants

NCERT Exercise

Question 1:

What is meant by modification of root? What type of modification of root is found the

- (a) Banyan tree (b) Turnip (c) Mangrove trees

Solution 1:

Roots in some plants change their shape and structure and become modified to perform functions other than absorption and conduction of water and minerals. This is known as the modification of root.

Modification of roots in the following plants are described below –

- (a) Banyan Tree – Banyan trees have prop roots. These roots are massive and pillar like and provide support to the tree.
- (b) Turnip – In turnip the root gets modified for storage of food.
- (c) Mangrove Trees – In mangrove and other trees growing in the swampy areas, many roots come out of the ground and grow vertically upwards. Such roots are called pneumatophores and help to get oxygen for respiration.
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Question 2:

Justify the following statements on the basis of external features

- (i) Underground parts of a plant are not always root
- (ii) Flower is a modified shoot

Solution 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.

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

Solution 3:

Pinnately compound leaf	Palmately compound leaf
The leaflets are attached to the common axis, called rachis.	The leaflets are attached at a common point on the leaf stalk.
Examples include neem and <i>Cassia fistula</i> (also called golden shower plant)	Examples include silk cotton (<i>Bombax</i> and <i>cannabis</i>).

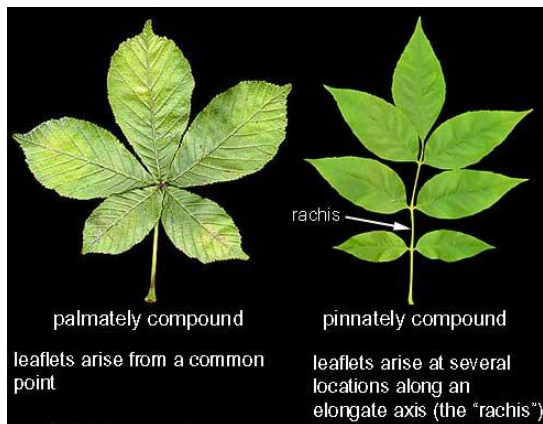


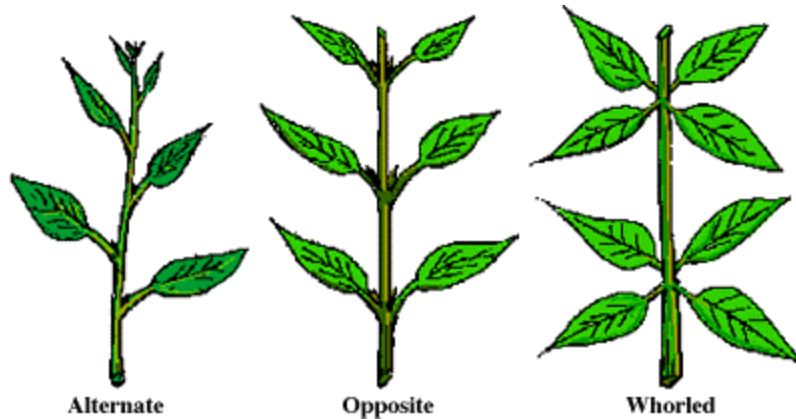
Fig: Diagram showing pinnately and palmately compound leaves.

Question 4:

Explain with suitable examples the different types of phyllotaxy?

Solution 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*.



Question 5:

Define the following terms

- (a) Aestivation
- (b) Placentation
- (c) Actinomorphic
- (d) Zygomorphic
- (e) Superior ovary
- (f) Perigynous flower
- (g) Epipetalous Stamen

Solution 5:

- (a) **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.

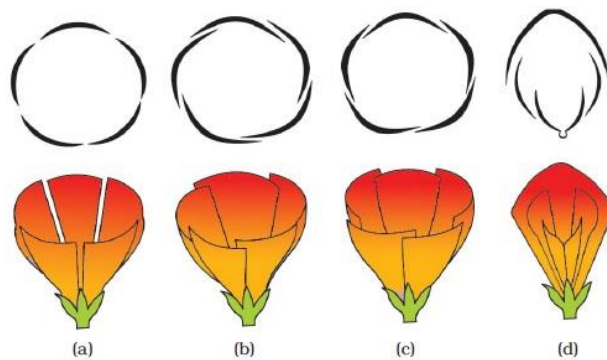


Figure 5.15 Types of aestivation in corolla : (a) Valvate (b) Twisted (c) Imbricate (d) Vexillary

- (b) **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.

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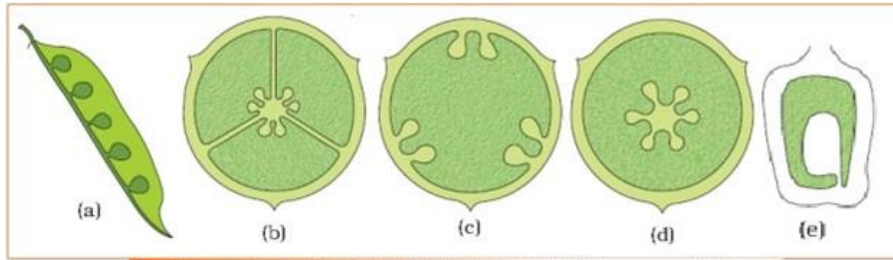
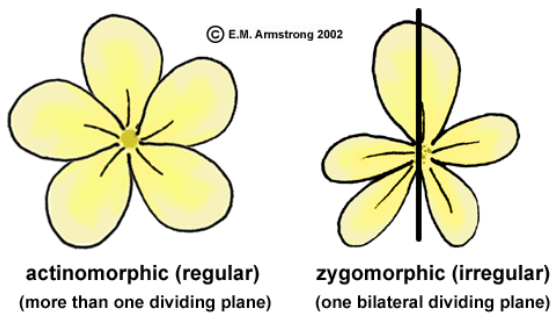


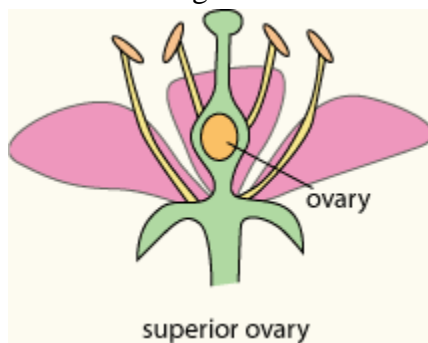
Fig: Placentation: (a) Marginal (b) Axile (c) Parietal (d) Free central (e) Basal

- (c) **Actinomorphic:** Actinomorphic flowers can be divided into two radial halves by any radial plane passing through its centre. Examples of these flowers include chilly and mustard.

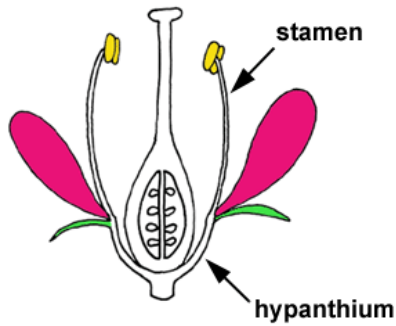


- (d) **Zygomorphic:** Zygomorphic flowers are those flowers which can be divided into two similar halves by a single vertical plane. In other words zygomorphic flowers have bilateral symmetry. Examples include pea and beans.

- (d) **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 include brinjal and mustard.



- (e) **Perigynous flower** In perigynous flowers, the thalamus forms a cup shaped structure and from the rim of the cup floral parts arise. In this condition the position of the ovary is said to be half superior and half inferior. Examples include plum and rose.



perigynous
petals, sepals & stamens
on the rim of hypanthium

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



Question 6:

Differentiate between

- (i) Racemose and cymose inflorescence
- (ii) Fibrous roots and adventitious roots
- (iii) Apocarpous and syncarpous ovary

Solution 6:

Racemose inflorescence	Cymose inflorescence
(1) Younger flowers are present at the tip while older flowers are arranged at the base of this inflorescence. Such an arrangement is called acropetal succession.	(1) Younger flowers are present at the base of the inflorescence, while older flowers are present at the top. Such an arrangement is called basipetal succession.
(2) The main axis in racemose inflorescence continues to grow produce flowers laterally.	(2) The main axis in cymose inflorescence has limited growth, which later terminates into a flower.

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Fibrous root	Adventitious root
(1) In monocots, the primary root which develops from the radical of the seed is short-lived and is replaced by a large number of roots arising from the base of the stem. (2) It is characteristic of cereals like wheat and is found in family Poaceae.	(1) These roots arise from any part of the plant other than the radical of seeds. (2) It is found in banyan, Monstera, and other plants.

Apocarpous ovary	Syncarpous ovary
(1) It is a multi-carpellary condition, where carpels are free. (2) It is found in lotus and rose flowers.	(1) It is a multi-carpellary condition with fused carpels.(2) It is found in the flowers of tomato and mustard.

Question 7:

Draw the labeled diagram of the following (i) Gram seed (ii) V.S. of maize seed

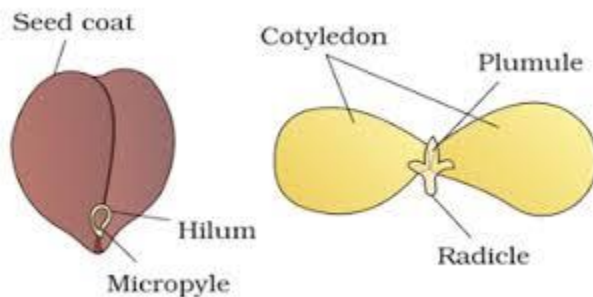
Solution 7:

Fig. Diagram showing Gram seed.

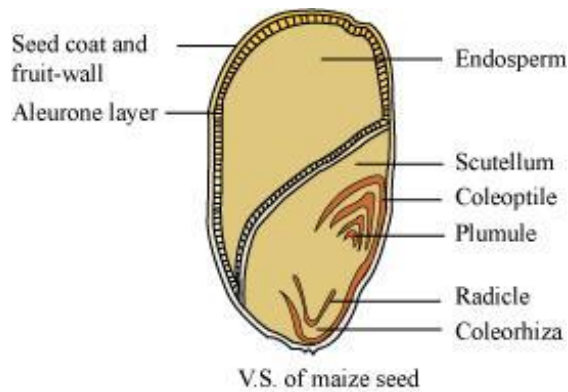


Fig.: Showing V.S. of maize seed

Question 8:

Describe modifications of stem with suitable examples

Solution 8:

Stems of various plants have undergone modification 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 propagation of these plants. Potato is a tuber that helps in the storage of food and bears eyes on it. Subtended by a leaf scar, these eyes bear axillary buds that give rise to new plants.

Supportive stems

Example: tendrils

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

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.

Photosynthetic stems:**Example:** Opuntia

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

Others stem modifications:

In some plants, underground stems such as grasses spread in the soil and help in perennation. 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

Question 9:

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

Solution 9:**(1) Family Fabaceae/Papilionaceae (pea plant):**

Fabaceae/Papilionaceae is a sub-family of the Leguminosae family.

Vegetative features:

Leaves -pinnately compound, alternately arranged with leaf tendrils with the pulvinus present at the leaf base along foliaceous stipules

Root: Tap roots system with root nodules.

Floral features: Inflorescence: Racemose, generally axial seldom terminal

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Flower: Zygomorphic and bisexual flowers

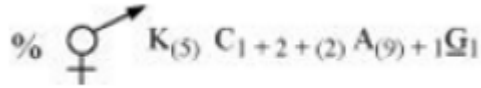
Calyx: It contains five sepals which are gamosepalous while aestivation is imbricate.

Corolla: It contains five petals (Polypetalous) with vexillary aestivation.

Androecium : It consists of ten anthers that are diadelphous with ditheous anthers.

Gynoecium: Monocarpellary superior ovary which is unilocular with marginal placentation.

Fruit: Legume pod with non-endospermic seeds.



Floral formula:

Economic importance: Peas are used as vegetables for making various culinary preparations.



Floral diagram of family Papilionaceae

(2) Flowers of *Solanum nigrum*

Family Solanaceae

Vegetative Features:

Habit: Erect, herbaceous plant

Leaves: Simple, exstipulate leaves with reticulate venation

Stem: Erect stem with numerous branches.

Floral features: Inflorescence: Solitary and axillary

Flowers: Actinomorphic bisexual flowers

Calyx: Calyx is composed of five sepals that are united and persistent. Aestivation is valvate.

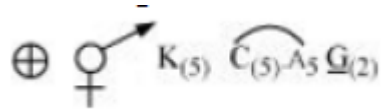
Corolla: Corolla consists of five united petals with valvate aestivation.

Androecium: It consists of five epipetalous stamens.

Gynoecium: It consists of bicarpellary syncarpous superior ovary with axile placentation.

Fruits: Berry

Seeds: Numerous, endospermous



Floral formula:

Economic importance: Used for medicinal Purposes.



Floral diagram of family Solanaceae

Question 10:

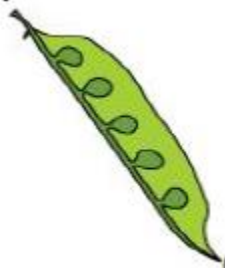
Describe the various types of placentations found in flowering plants.

Solution 10:

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

(A) 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.



(B) Parietal placentation

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

**C) Axile placentation**

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

**(D) 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.



(E) 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.



Question 11:

What is a flower Describe the parts of a typical angiosperm flower?

Solution 11:

A flower can be defined as the reproductive unit of any flowering plant (angiosperms). Flowers carry out sexual reproduction in angiosperms. A typical flower is a modified stem with a condensed axis. A flower has four concentric whorls. From outside towards inside the four whorls are i.e., the calyx, corolla, androecium, and gynoecium. Androecium and gynoecium represent the male and female reproductive whorls of a flower respectively. Bisexual flowers are those which contain both androecium and gynoecium, while unisexual flowers contain either gynoecium or androecium. The corolla and the calyx are generally distinct, but may sometimes be fused (called perianth). A flower that contains all four floral parts is called a complete flower.

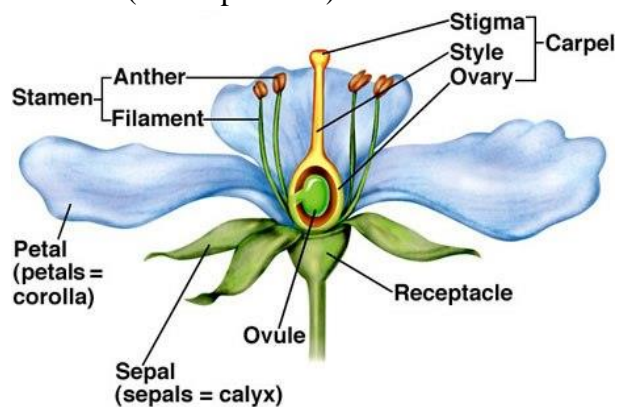


Fig.: Showing parts of a Flower

Parts of flowers:

(A) Calyx: It 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. Since sepals are green, they are also photosynthetic structures.

(B) Corolla: of a flower is the flower whorl lying towards the inner side of the the calyx. Individual units of corolla are called as petals and they are usually very brightly coloured which help in attracting insects for pollination. When the petals are free they are said to be polypetalous, while the condition with fused petals is called gamopetalous.

(C) The androecium or the stamen is the male reproductive whorl of a flower. It consists of two parts, the filament and the bilobed anther. The bilobed anther is the site for meiosis and pollen grain production.. The two anther lobes are joined by a connective.

(D) Gynoecium represents the female reproductive whorl 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.

Question 12:

How do the various leaf modification help plants?

Solution 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 other functions as well. Various modifications of leaves are detailed below.

- (a) Tendrils: The leaves of a pea plant are modified into tendrils that help the plant in climbing.
 - (b) Spines: The leaves in cactus are modified into sharp spines that act as an organ of defense.
 - (c) 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.
 - (d) Pitcher: The leaves of the pitcher plant (*Nepenthes khasiana*) are modified into pitcher-like structures, which contain digestive juices and help in trapping and digesting insects.
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Question 13:

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

Solution 13:

Inflorescence is the manner in which the flowers are arranged on the floral axis. During the flowering season, the vegetative apex of the stem gets converted into a floral meristem. Based on whether the floral axis continues to grow or end in a flower, inflorescence is classified into racemose and cymose. In racemose inflorescence, the floral axis continues to grow and produces flowers laterally. On the other hand, in cymose inflorescence, the main axis terminates into a flower. Hence, it is limited in growth.

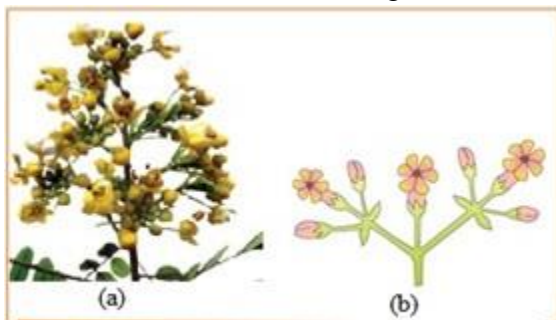


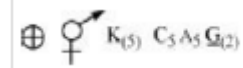
Fig: Inflorescence: (a) Racemose (b) Cymose

Question 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.

Solution 14:

The floral formula of the described flower is represented as:



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 by 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 having axile placentation, which can be represented as G_2

Question 15:

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

Solution 15:

Based on the position of the calyx, corolla, and androecium (with respect to the ovary on the thalamus), the flowers are described as hypogynous, perigynous, and epigynous. In hypogynous flower, the ovary occupies the highest position on the thalamus while other floral parts are situated below it. In such flowers, the ovary is superior e.g., 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 e.g., plum, rose, peach. In epigynous flowers, the thalamus grow 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.

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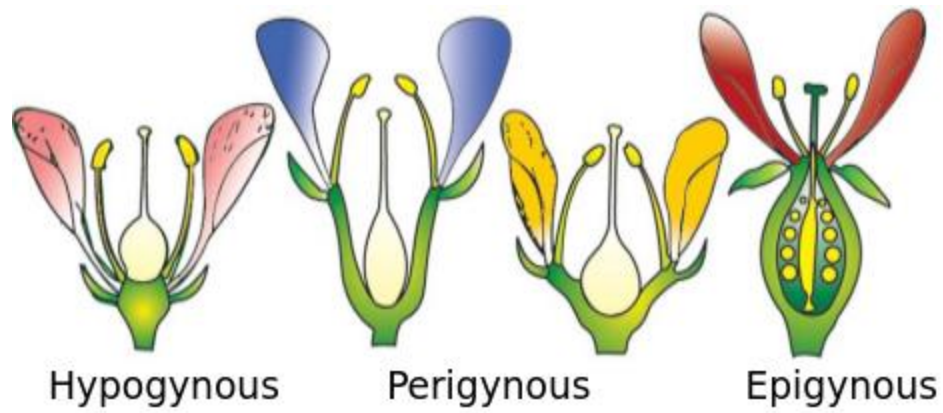


Fig. Showing hypogynous, epigynous and perigynous flowers.
