Morphology of Flowering Plants

Very Short Answer Questions

1. Differentiate fibrous roots from adventitious roots?

A: When primary root is short lived and is replaced by a large number of roots, originating from the base of the stem, are called as fibrous roots.

If roots arise from parts of the plant other than the radical are called as adventitious roots.

2. Define modification. Mention how root is modified in banyan tree and mangrove plants?

A: Change in shape and structure to perform functions other than the absorption, and conduction of water and minerals is called modification.

In banyan tree --- prop roots or pillar roots.

In mangrove plant --- pneumatophores or breathing roots.

3. What type of specialized roots are found in epiphytic plants? What is their function?

A: In epiphytic plants specialized roots are velamin roots.

They absorb moisture from the atmosphere.

4. How does the sucker of *Chrysanthemum* differ from the stolon of jasmine?

A: Suckers are lateral branches that grow obliquely upwards from underground stems and come out of the soil.

Whereas stolons arise as lateral branches from aerial main axis and grow obliquely downwards and touch the soil to produce adventitious roots.

5. What is meant by pulvinous leaf base? In members of which angiospermic family do you find them?

A: Swollen leaf base is called as pulvinous leaf base.

They are found in Fabaceae members.

6. Define venation. How do dicots differ from monocots with respect to venation?

A: The arrangement of veins and veinlets in the leaf lamina is called venation.

Dicots show reticulate venation.

Monocots show parallel venation.

7. How is a pinnately compound leaf is different from a palmately compound leaf? Explain with one example each?

A: In pinnately compound leaf a number of leaflets are present on a common axis called rachis.

Eg: Neem.

In palmately compound leaf the leaflets are attached at a common point ie at the tip of the petiole. Eg: *Bombax ceiba* (silk cotton).

8. Which organ is modified to trap insects in insectivorous plants? Give two examples?

A: Leaf is modified to trap insects.

Eg: *Nepenthes, Dionea.*

9. Differentiate between racemose and Cymose inflorescences?

A: In racemose inflorescence peduncle growth is continuous and flowers born laterally in an acropetal succession.

In cymose inflorescence main axis terminates into a flower. Growth of the peduncle is limited and flowers are born basipetally.

10. What is the morphology of cup like structure in Cyathium? In which family it is found?

A: Cup like structure in Cyathium is involucre of bracts. It is seen in Ephorbeaceae.

11. What type of inflorescence is found in fig trees? Why does the insect *Blastophaga* visits the inflorescence?

A: Inflorescence in fig trees is Hypanthodium. *Blastophaga* insects visit the inflorescence to lay its eggs in the gall flowers.

12. Differentiate actinomorphic from zygomorphic flower?

A: When a flower can be divided into two equal radial halves in any radial plane passing through the centre, it is called actinomorphic.

When the flower can be divided into two similar halves only in one particular plane, it is called zygomorphic.

13. How do the petals in pea plant are arranged? What is such type of arrangement called?

A: Out of the five petals, the largest (standard) overlaps the two lateral petals (wings) which in turn overlap the two smallest anterior petals (keel).

This type of arrangement is called vexillary or papilionaceous or descendingly imbricate aestivation.

14. What is meant by epipetalous condition? Give an example?

A: When stamens are attached to petals it is epipetalous. Eg: *Datura*, Brinjal.

15. Differentiate between apocarpous and syncarpous ovary?

A: If many carpels are present in a flower and they are free it is called apocarpous ovary. If they are fused they are syncarpous.

16. Define placentation. What type of placentation is found in *Dianthus*?

A: The arrangement of ovules within the ovary is called as placentation.

In *Dianthus* it is 'free central'.

17. What is meant by parthenocarpic fruit? How is it useful?

A: If fruit is formed without fertilization of the ovary it is called parthenocarpic fruit. The fruit is without seeds and pericarp is juicy.

18. What is the type of fruit found in mango? How does it differ from that of coconut?

A: Fruit in mango is Drupe. The mesocarp is fleshy and edible. In coconut fruit is also drupe but mesocarp is fibrous.

19. Why certain fruits are called false fruits? Name two examples of plants having false fruits?

A: In false fruits the edible fleshy portion does not develop from the ovary. Eg: Apple and Cashew.

20. Name any two plants having single seeded dry fruits?

A: Rice, cashew, *Tridax*.

21. Define schizocarpic dry fruits? Give an example?

A: Dry fruits which break into single seeded mericarps are called as schzocarpic fruits.

Eg: *Acacia*, castor.

22. Define mericarp? In which plant you find it?

A: The single seeded bits if schizocarpic fruits are called as mericarps.

In Acacia and castor we find mericarp.

23. What are aggregate fruits? Give two examples?

A: The bunch of fruitlets developing from a flower with apocarpous gynoecium is called aggregate fruit.

Eg: Custard apple, *Rubus* (rasp berry).

24. Name a plant that has single fruit developing from the entire inflorescence. What is such a fruit called?

A: Pineapple and Jack fruit. They are called 'Compound fruits'.

25. What is meant by scutellum? In which type of seeds is it present?

A: In grass family, the cotyledon is called as scutellum. It is present in monocots seeds of grass family.

26. Define with examples endospermic and non-endospermic seeds?

A: Before maturation if endosperm is completely consumed by the developing embryo they are non-endospermic seeds.

In a mature seed if endosperm is present to be used by the embryo during germination, such seeds are endospermic.

Short Answer Questions

1. Explain different regions of the root with neat labeled diagram?

A:

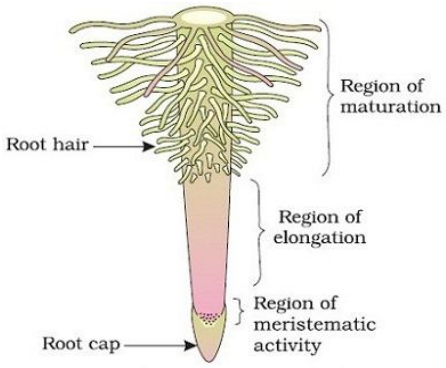


Figure 3. The regions of the root-tip

The root shows four different zones

1. Root cap
2. Region of meristematic activity
3. Region of elongation
4. Region of maturation

1. Root cap: The root is covered at the apex by a thimble-like structure called the **root cap.** It protects the tender apex of the root as it makes its way through the soil.

2. Region of meristematic activity: A few millimeters above the root cap is the **region of meristematic activity**. The cells of this region are very small, thin-walled and with dense protoplasm. They divide repeatedly.

3. Region of elongation: The cells proximal to the region of meristematic activity undergo rapid elongation and enlargement and are responsible for the growth of the root in length. This region is called the **region of elongation**. The cells of the elongation zone gradually differentiate and mature. Hence, this zone, proximal to region of elongation, is called the **region of maturation**.

4. Region of maturation: From this region some of the epidermal cells form very fine and delicate, thread-like structures called **root hairs**. These root hairs absorb water and minerals from the soil.

2. Justify the statement: "Underground parts of plants are not always roots"?

A: Generally roots grow below the surface of the soil. It is an underground part of the plant. Stems are the ascending part of the axis bearing branches, leaves, flowers and fruits.


Potato


Colocasia


Zingiber


Onion(bulb)

The stem may not always be typically like what they are expected to be. They are modified to perform different functions. In some plants the stem grows into the soil and is called as underground stem modifications.

They are **Rhizome, Corm, Stem tuber** and **Bulb**.

They store food material and become succulent. They also act as perennating structures and tide over the unfavorable conditions. When favourable conditions return they sprout up. They also help in vegetative propagation.

Examples for these modifications are:

Rhizome: *Zingiber* (ginger), *Curcuma* (turmeric).

Corm: *Amorphophallus* (zamikhand), *Colocasia* (colocasia).

Stem tuber: *Solanum tuberosum*(Potato).

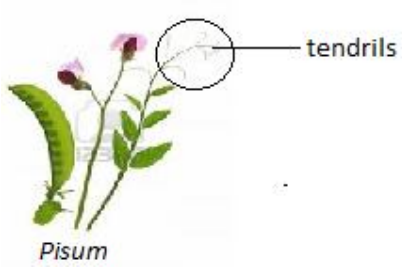
Bulb: *Allium* (onion).

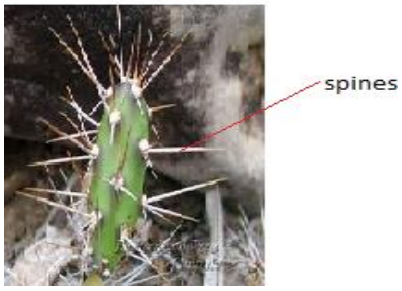
3. How does leaf modification help plants?

A: Depending on the environment different parts of the leaf may undergo modifications to perform special functions and help the plant to survive in that specific environment.

Some of the leaf modifications are:

Tendrils, Spines, Phyllodes, Insectivorous leaves and Reproductive leaves.

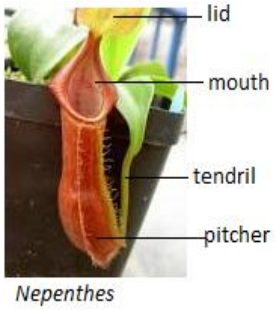


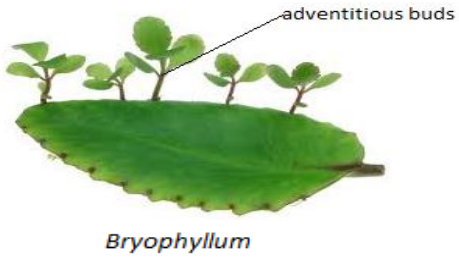


Tendrils: Entire leaf or part of the leaf modify into wire like structure. They help in climbing. Weak stemmed plants show this modification. E.g: Pea.

Spines: Spines are sharp structures**.** Any part of the leaf may modify into a spine. This reduces the rate of transpiration and help in protection of the plant from animals. E.g: Cacti.

Phyllodes: Petioles of some plant become into expanded green structures. They are persistent. They help in photosynthesis when leaf lamina is reduced in xerophytic conditions. E.g: Australian acacia.





Insectivorous leaves: Certain plants growing in wet and nitrogen deficient soils get their nitrogen requirements from insects and small animals. They show leaf modifications to trap and digest the insect. E.g: *Nepenthes* (pitcher plant).

Reproductive leaves: In certain leaves adventitious buds develop on the leaf. When detached they develop into new plants. E.g. *Bryophyllum.*

4. Explain with examples different types of phyllotaxy.

A: Phyllotaxy is the pattern of arrangement of leaves on the stem or branch**.**

This is usually of three types – 1.**Alternate** 2. **Opposite** 3. **Whorled**

1. **Alternate**: In **alternate** type of phyllotaxy**,** a single leaf arises at each node in alternate manner, as in China rose, mustard and sun flower plants. This also called as spiral phyllotaxy


Alternate


Opposite


Whorl

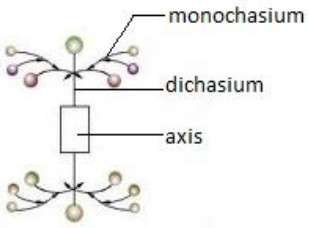
2. **Opposite**: In **opposite** type, a pair of leaves arise at each node and lie opposite to each other as in *Calotropis* and guava plants.

3. **Whorl**: If more than two leaves arise at a node and form a whorl, it is called **whorled,** as in *Alstonia*.

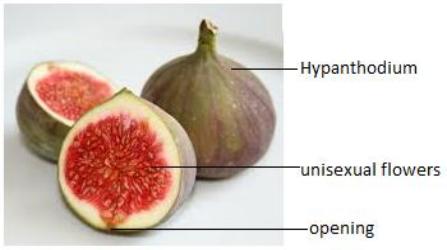
5. Describe any two special types of inflorescences.

A: The two special types of inflorescences are 1**. Verticillaster** 2. **Hypanthodium.**

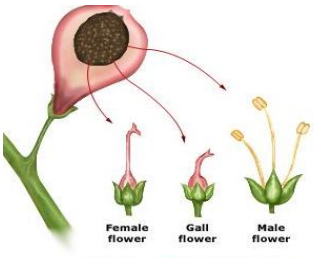

Verticillaster



1. **Verticillaster:** In the members of Lamiaceae (Labiatae) at each node two leaves are present. In the axil of each leaf inflorescence develops. The inflorescence begins as a dichasial cyme but after single dichasium each branch of the inflorescence ends in monochasial cyme. Both these inflorescences cover the internode above giving a false appearance of single inflorescence.



Ficus

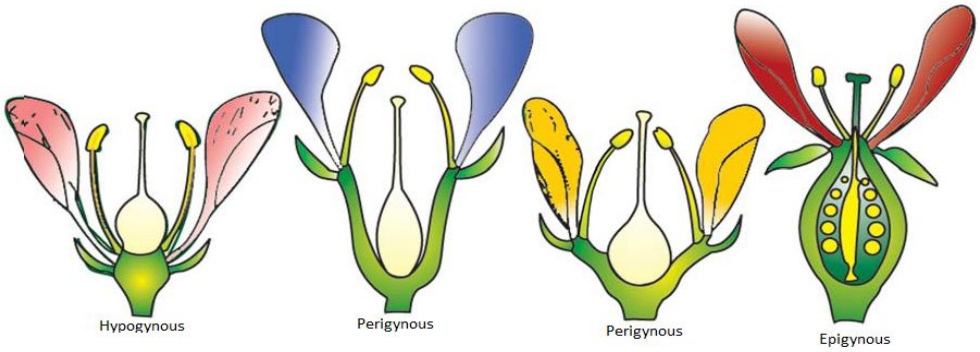


Hypanthodium inflorescence (ficus)

2. Hypanthodium: In the members of *Ficus* (Fig tree) the inflorescence develop on mature stems. They look like fruits. The peduncle is modified into fleshy cup like structure enclosing unisexual, sessile flowers. The cup shows at its apex an opening. Male flowers are located near the opening and female flowers at the bottom. In between sterile female flowers are present called gall flowers. Flowers open irregularly. Pollination in these flowers takes place by the insect *Blastophaga* which lays eggs in the gall flowers. After fertilization the entire inflorescence becomes the fig fruit.

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

A: Based on the position of calyx, corolla and androecium in respect of the ovary on thalamus, the flowers are described as 1.**Hypogynous** 2. **Perigynous** 3.**Epigynous**.



1. **Hypogynous:** In the **hypogynous** flower the gynoecium occupies the highest position while the other parts are situated below it. The ovary in such flowers is said to be **superior,** e.g., Mustard, China rose and Brinjal.

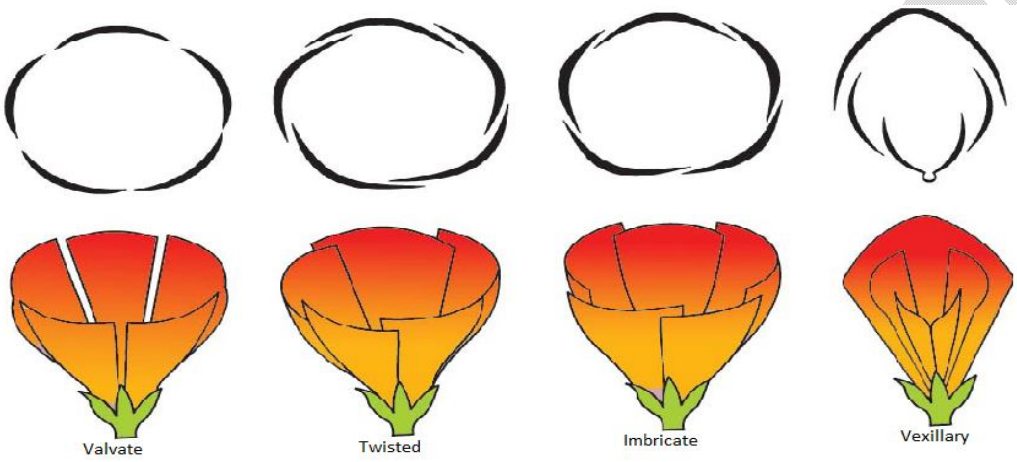
2. **Perigynous** : If gynoecium is situated in the centre and other parts of the flower are located on the rim of the thalamus almost at the same level, it is called **perigynous.** The ovary here is said to be **half inferior,** e.g., Plum, Rose, Peach.

3. **Epigynous** :In **epigynous flowers,** the margin of thalamus grows upward enclosing the ovary completely and getting fused with it, the other parts of flower arise above the ovary. Hence, the ovary is said to be **inferior** as in flowers of guava and cucumber, and the ray florets of sunflower.

7. 'The flowers of many angiospermic plants which show sepals and petals differ with respect to the arrangement of sepals and petals in respective whorls'. Explain?

A: Sepals and petals together are called as perianth. Sepals form the outer whirl and petals the next inner whorl. Sepals and petals differ in many aspects. One of such difference is their arrangement. The mode of arrangement of sepals and petals in floral bud with is called **aestivation**. In the classification of Angiospermic plants sometimes this criterion also important.

The main types of aestivation are 1**. Valvate** 2.**Twisted** 3. **Imbricate** 4.**Vexillary**



1**. Valvate** : When sepals or petals in a whorl just touch one another at the margin, without overlapping, as in *Calotropis*, it is said to be **valvate.**

2. **Twisted** **:** If one margin of the appendage overlaps that of the next one and so on as in China rose, lady's finger and cotton, it is called **twisted**.

3. **Imbricate**: If the margins of sepals or petals overlap one another but not in any particular direction as in *Cassia* and gulmohar, the aestivation is called **imbricate**.

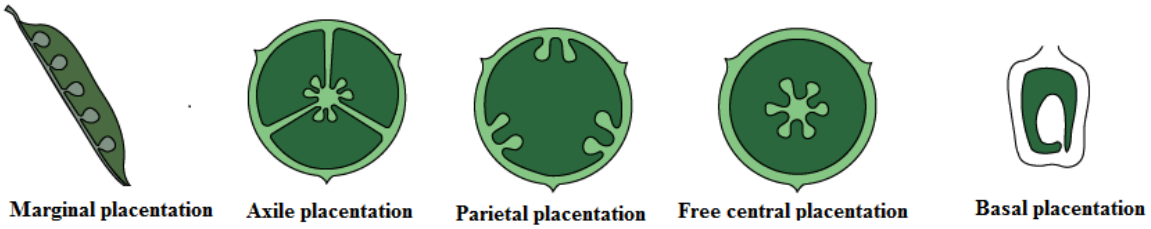
4. **Vexillary**: In pea and bean flowers, there are five petals, the largest (standard) overlaps the two lateral petals (wings) which in turn overlap the two smallest anterior petals (keel); this type of aestivation is known as **vexillary** or papilionaceous.

8. Describe any four types of placentations found in flowering plants?

A: The arrangement of ovules within the ovary is known as placentation.

The placentation are of different types namely, **marginal**, **axile, parietal, basal, central and free central.**

In **marginal** placentation the placenta forms a ridge along the ventral suture of the ovary and the ovules are borne on this ridge forming two rows, as in pea.



When the placenta is axial and the ovules are attached to it in a multilocular ovary, the placentaion is said to be **axile**, as in China rose, tomato and lemon.

In **parietal** placentation, the ovules develop on the inner wall of the ovary or on peripheral part. Ovary is one-chambered but it becomes two chambered due to the formation of the false septum, e.g., mustard and *Argemone*.

When the ovules are borne on central axis and septa are absent, as in *Dianthus* and *Primrose* the placentation is called **free central.**

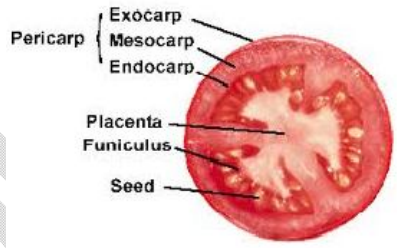
In **basal** placentation, the placenta develops at the base of ovary and a single ovule is attached to it, as in sunflower, marigold.

9. Describe in brief fleshy fruits you studied.

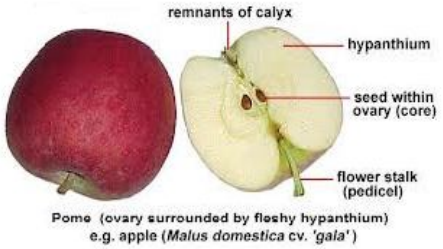
A: Fleshy fruits are simple fruits with pericarp showing three distinct layers- outer epicarp, middle mesocarp and inner endocarp.

Fleshy fruits develop from unicarpellary or multicarpellary syncarpous condition.

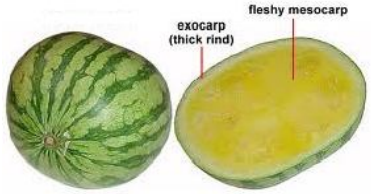
Fleshy fruits can be classified as **Berry, Pome, Pepo, Hesperidium and Drupe.**



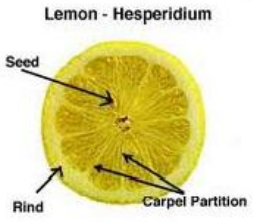
Berry

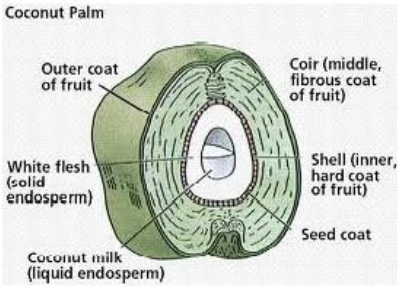


Pome (ovary surrounded by fleshy hypanthium)
e.g. apple (*Malus domestica* cv. *'gala'*)



Pepo
e.g. watermelon (*Citrullus lanatus* var. *lanatus*)





Berry: It develops from bicarpellary or multicarpellary ,syncarpous gynoecium. The mesocarp and endocarp are fused to form the pulp, and seeds are hard. E.g. Guava, tomato.

Pome: The fruit develops from inferior ovary of bi- or multicarpellary gynoecium and is surrounded by fleshy thalamus. The endocarp is cartilaginous. E.g.Apple.

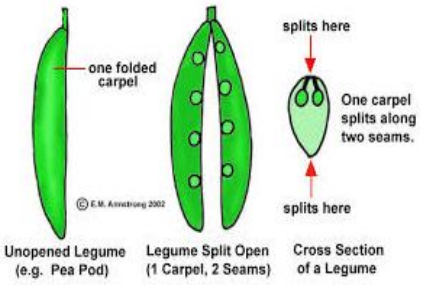
Pepo: The epicarp is like rind. The mesocarp is fleshy and endocarp is smooth. It develops from a tricarpellary unilocular ovary. E.g. Cucumber.

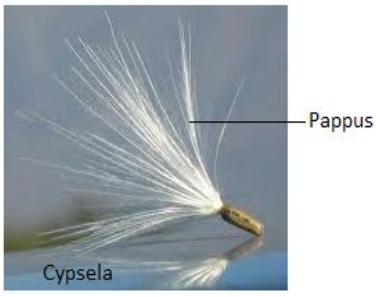
Hesperidium: It is characterized by leathery epicarp with many volatile oil glands, papery mesocarp and endocarp wall bears juicy hairs. It develops from multicarpellary, syncarpous ovary with ovules on axile placentation. E.g. Citrus.

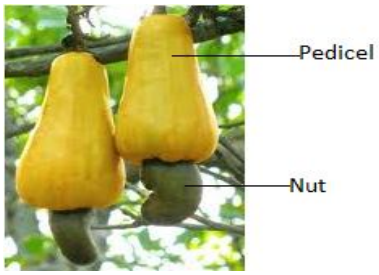
Drupe: It develops from unicarpellary condition. Endocarp is stony. E.g. Coconut, Mango.

10. Describe with examples the various dry fruits you studied?

A: When the pericarp is dry and non fleshy, the fruits are called dry fruits eg. Groundnut, Mustard. The dry fruits may be **dehiscent** or **indehiscent. Dehiscent** fruits break, to release the seeds. **Indehiscent** fruits do not break open and liberate the seeds only after disintegration of the pericarp.







The fruits of pea, beans dehisce dorsiventrally into two valves and are called as **Legumes.**

A **Capsule** dehisces in different ways to liberate the seeds. Eg Cotton, *Datura*.

Dry indehiscent fruits are generally single seeded and are of different types like **Caryopsis, Cypsela, Nut.**

The pericarp and seed coat is fused together to form **caryopsis** like in rice and wheat.

Nut develops from multicarpous, syncarpous and unilocular ovary. Pericarp is stony. E.g Cashew.

In **Cypsela** fruit is characterized by pappus like hairs. E.g. *Tridax.*

Long Answer Questions

1. Define root. Mention the types of root systems. Explain how root is modified to perform various functions?

A: Part of the plant developing from the radical and helps in absorption of water and minerals is called as root system.

Different types of root systems are I. **Tap root system** 2. **Fibrous root system**

1. Tap root: Root system that develops from the radical is called tap root system. It is seen in Dicot plants.

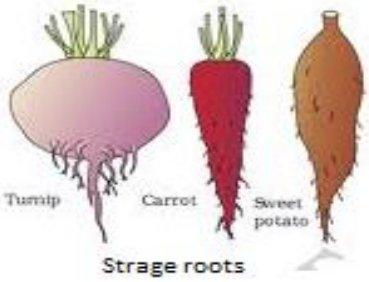
2. In monocots the radical is short lived and is replaced by a large number of roots arising from the base of the stem. These are fibrous root system.

Root also can arise from other parts of the plant other than radical. These are called **adventitious roots**. E.g. *Monstera,* Banyan tree. Fibrous roots are adventitious roots.

Root are modified to different functions. Modifications of the roots are:

1. Storage roots
2. Photosynthetic roots
3. Velamin roots
4. Pneumatophores or Breathing roots.
5. Nodular roots
6. Haustorial or parasitic roots.
7. Prop roots or Pillar roots.
8. Stilt roots

1. **Storage roots**: Some plants store food material in their roots. Stored food is used in later seasons when conditions are not suitable. E.g: Carrot, Beet root, Turnip store food in their tap roots. *Asparagus* stores in their fibrous roots. Sweet potato stores in their adventitious roots.




Photosynthetic roots, *Taeniophyllum*

2. Photosynthetic roots: In some plants leaves may be reduced and plants are epiphytic. In these plants roots become chlorophyllous and perform photosynthesis. E.g: *Taeniophyllum.*

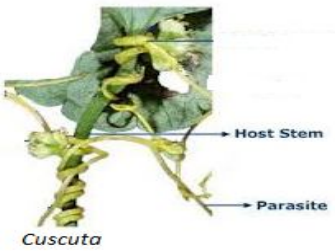
3. Velamin roots: In epiphytic plants that grow on other plants develop adventitious roots which are specialized in absorbing moisture from the atmosphere. These specialized roots are called velamin roots. E.g: *Vanda*.

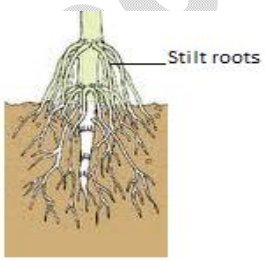
4. Pneumatophores: In mangrove plants as they grow in swampy regions and mud the roots system will not get sufficient amount of oxygen for breathing. In these plants many roots come out of the soil and grow vertically upwards for respiration or breathing. These are called pneumatophores. E.g. *Avicennia, Rhizophora.*


Pneumatophores

5. Nodular roots: In members of Fabaceae *Rhizobium* bacteria inhabit the roots in symbiotic association. As a result roots develop nodules. Such roots are nodular roots. They help in atmospheric nitrogen fixation. E.g. *Arachis.*

6. Haustorial roots: Some angiospermic plants live parasitically on other plants. They send roots into the xylem and phloem of the host plant to absorb food and water. These roots are called haustorial roots. E.g. *Viscum, Striga, Cuscuta.*





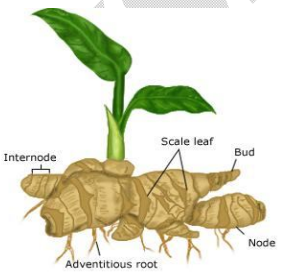
7. Prop roots: These are developing from branches which grow downward and enter into the soil. They provide mechanical support to heavy branches.

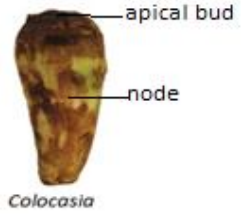
8. Stilt roots: These are adventitious roots develop from lower nodes. They provide mechanical support. E.g: Maize, sugarcane.

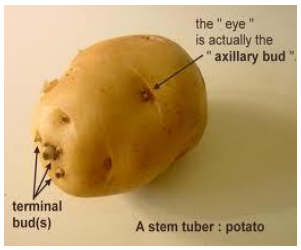
2. Explain how stem is modified variously to perform different functions?

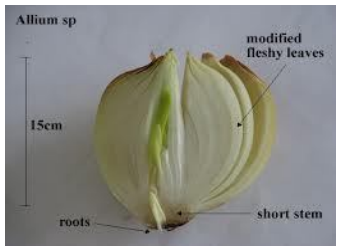
A: Three different types of modifications are seen in stems.

They are **1. Underground stem modifications 2. Aerial stem modifications 3. Sub-aerial stem modifications.**









1. Underground stem modifications: These stems grow underneath the surface of the soil. They store food materials and also act as organs of perennation to tide over

unfavourable conditions for growth. They also help in vegetative propagation. Different underground stem modifications are:

a) Rhizome b) Corm c) Stem tuber d) b) Bulb.

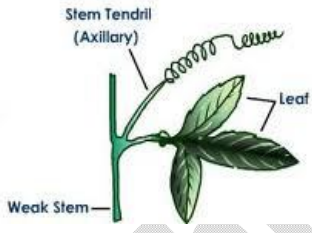
a) Rhizomes grow parallel to the surface. They are brown in colour with normal nodes and internodes like any stem. Leaves at nodes are scaly. Roots are adventitious. They store food material and can propagate vegetatively. E.g. *Zingiber,Curcuma.*

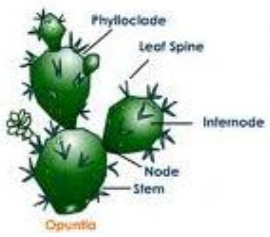
b) Corms grow vertically below the surface of the soil. They store food material, participate in vegetative propagation. E.g. *Colocasia, Amorphophallus.*

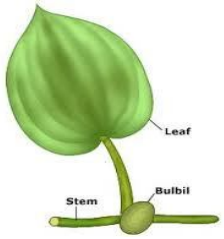
c) Stem tubers are apical portions of lateral branches growing below the surface of the soil. E.g: Potato. In potatoes nodes and internodes are not clear; Nodes are represented by eyes flanked by leaf scar.

d) Bulbs do not store food material and are discoid. Leaves arising from these stems have their leaf bases swollen and succulent. Bulbs may be covered by a dry scaly leaf. E.g Onion.

2. Aerial stem modifications: Aerial parts of the stem also get modified in many ways and can be **a) Stem tendrils b)Thorns c) Phylloclades or cladophylls d) Bulbils.**







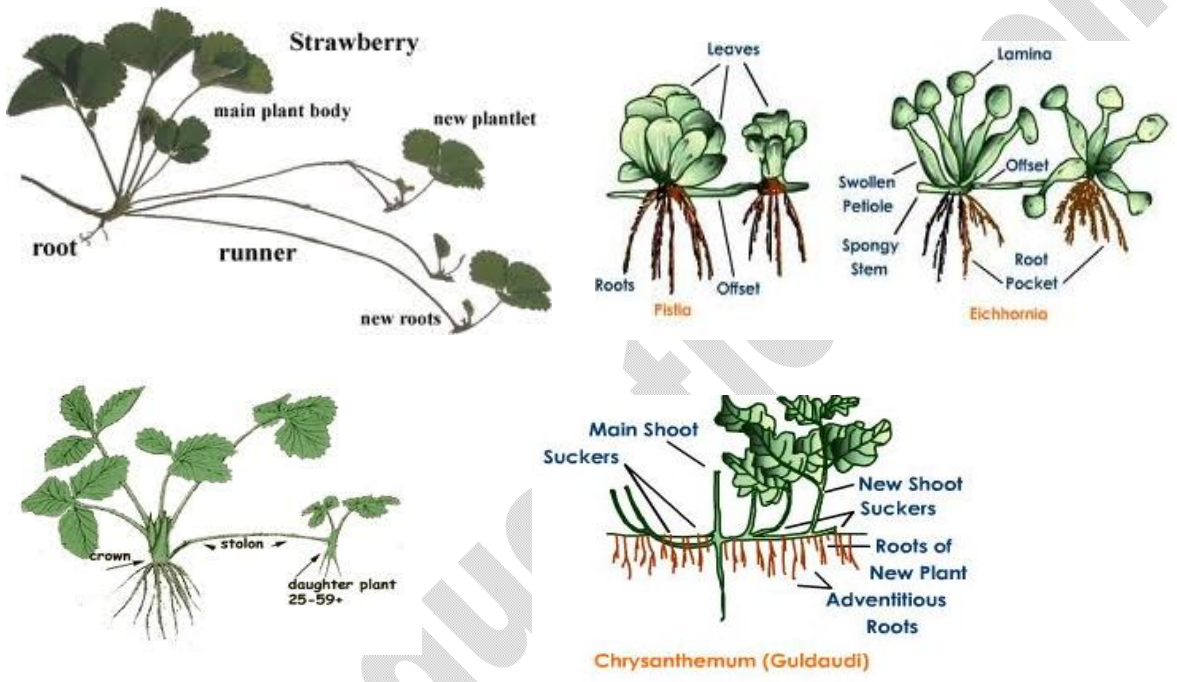
a) Stem tendrils are thin wire like structures that help in climbing of the plant. They may develop either from axillary buds (e.g. cucumber, pumpkins, watermelons) or from terminal buds (grapevines).

b) Thorns are sharp structures developing from axillary buds or terminal buds. They help in protection and reduction in transpiration. It is a xerophytic modification. E.g. *Bougainvillia*.

c)Phylloclades are green colour stems performing photosynthesis. In arid regions these kind of modifications are seen. Cladophylls are branches of limited growth which are green in colour. E.g. *Opuntia*, *Casuarinas* , *Euphorbia, Asparagus* (cladophyll).

d) Bulbils are vegetative or floral buds that store food material. They help in vegetative propagation. When these buds get detached they develop adventitious roots and develop into new plants. E.g. *Diascorea* (vegetative), *Agave* (floral).

3. Sub-aerial stem modifications: Partly underground and partly aerial, these stem modifications are helpful in vegetative propagation. These are **a) Runners b) Stolons c) Suckers, d) Offsets.**



a) Runners are stems that spread to new niches and form new plants when older parts die. E.g. Grasses, Strawberry, and *Oxalis*

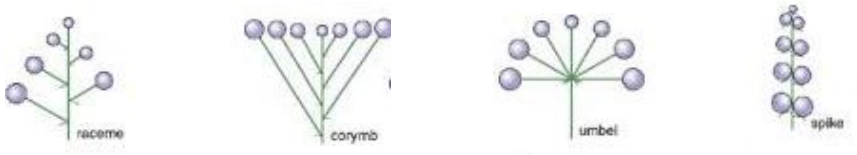
b) Stolons are lateral branches that grow aerially for some time, arches downwards to touch the ground and produce adventitious roots.

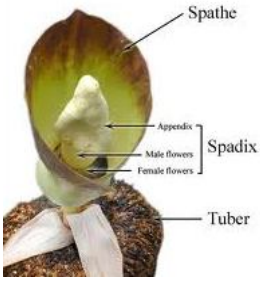
c) Suckers are lateral branches originating below the main axis from underground and grow horizontally beneath the soil and then come out obliquely giving rise to leafy shoots. E.g. Banana, Pine apple, *Chrysanthemum*

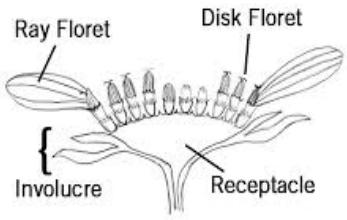
d) Offsets are lateral branch of one internode length which bears rosette of leaves at each node and a tuft of balancing roots arising from the base of the discoid stem. E.g. *Pistia, Eichornia.*

3. Explain different types of racemose inflorescences?

A:







Racemose inflorescence show indefinite growth of peduncles. The number of flowers are indefinite and flowers open acropetally.

Racemose inflorescences can be classified into:

1.Simple raceme 2. Corymb 3. Umbel 4. Spike 5. Spadix 6. Head inflorescence.

1.Simple raceme: On the indefinite growing peduncle pedicellate flowers are arranged acropetally. It is found in *Crotalaria, Mangifera.*

2. Corymb: In this type all the flowers are brought to the same height due to varied lengths of their pedicels even though they are born at different nodes acropetally. E.g. *Cassia* and Cauliflower.

3. Umbel: Peduncle is condensed to a discoid structure. All the flowers appear to have arisen from the same point of the peduncle. It is covered by a whorl of bracts called 'involucre'. It is seen in the family Apiaceae (umbelliferae). E.g. Onion, Carrot.

4. Spike: Acropetal arrangement of sessile flowers on the peduncle. It is seen in the family Poaceae (Graminceae) like grasses E.g. *Achyranthes, Oryza.*

5. Spadix: On a succulent peduncle sessile flowers are arranged in acropetal succession. They are unisexual and neuter flowers. The flowers are protected by a modified bract called spathe . They are seen *in Musa, Colocasia.*

6. Head: Unisexual and bisexual flowers develop centripetally on a condensed peduncle. Flowers are sessile. They are seen in Asteraceae members .E.g. *Tridax*, sunflower.