XI
5

MORPHOLOGY OF FLOWERING PLANTS

SYLLABUS

Morphology , Modifications and Functions of different parts of flowering plants: Root, stem, leaf, inflorescence- cymose and recemose, flower, fruit and seed (To be dealt along with the relevant practical of the Practical Syllabus).

KEY CONCEPTS

INTRODUCTION

* **Morphology** – (Morphe = form + logos = study). It deals with the **study of forms and features** of different plant organs like roots, stems, leaves, flowers, seeds, fruits etc.

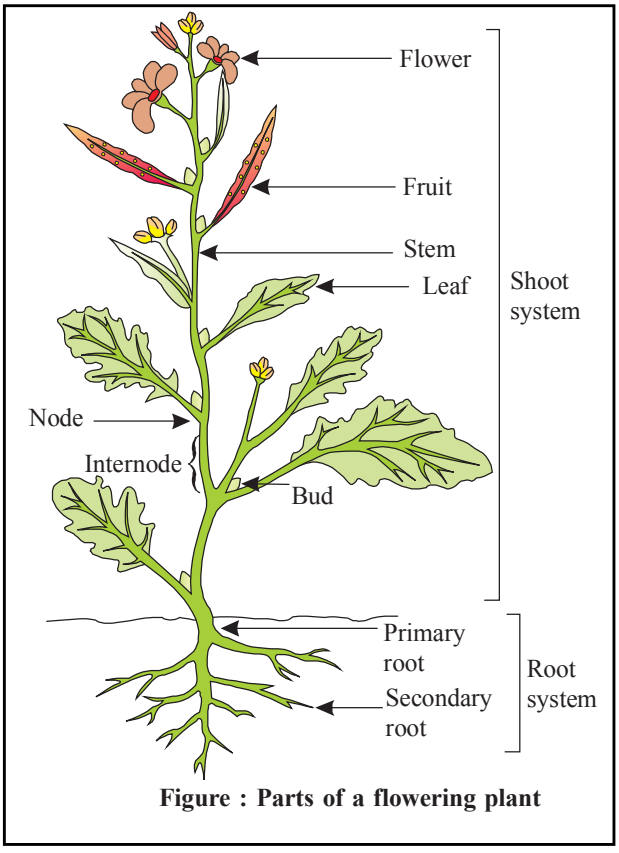


Figure : Parts of a flowering plant

* The body of a typical angiospermic plant is differentiated into :
  - an underground root system
  - an aerial shoot system.
  - The shoot system consists of stem (including branches), leaves, flowers and fruits.
* The roots, stems and leaves are **vegetative parts**, while flowers constitute the **reproductive part**.

ROOT

* Radicle comes out/arise from the seed coat in the form of soft structure and move toward the soil. It develops and forms primary root.
* **General Characters :**
  - Roots are **non green**, **underground**.
  - Roots move in the direction of gravity (geotropism) and against the direction of light (phototropism). Hence, the roots are said to be positively geotrophic and negatively phototropic.
  - Roots do not bear buds.
  - Buds present for vegetative propagation in sweet potato (***Ipomea***) and Indian red wood (***Dalbergia***)
  - Roots lacks **nodes,** leaves, buds but gives rise to endogenous lateral branches.
  - Roots have **unicellular** root hairs.

Types of Roots

* **Tap roots :** In most of the **dicot plants**, the direct elongation of the **radicle** leads to the formation of **primary root**. It bears lateral roots of several orders that are referred to as **secondary, tertiary roots**, etc. The primary roots and its branches constitute the **tap root system**.
  Eg - Mustard plant
* **Adventitious roots :**In some plants, like **grass,** ***monstera*** and the **banyan tree**, roots develop from parts of the plant other than the radicle and are known as **adventitious roots**.
* **Fibrous roots :** In **monocot plants**, the primary root is short lived and is replaced by a large number of roots. These roots originate from the base of the stem and constitute the **fibrous root system**. Eg.: wheat plant.

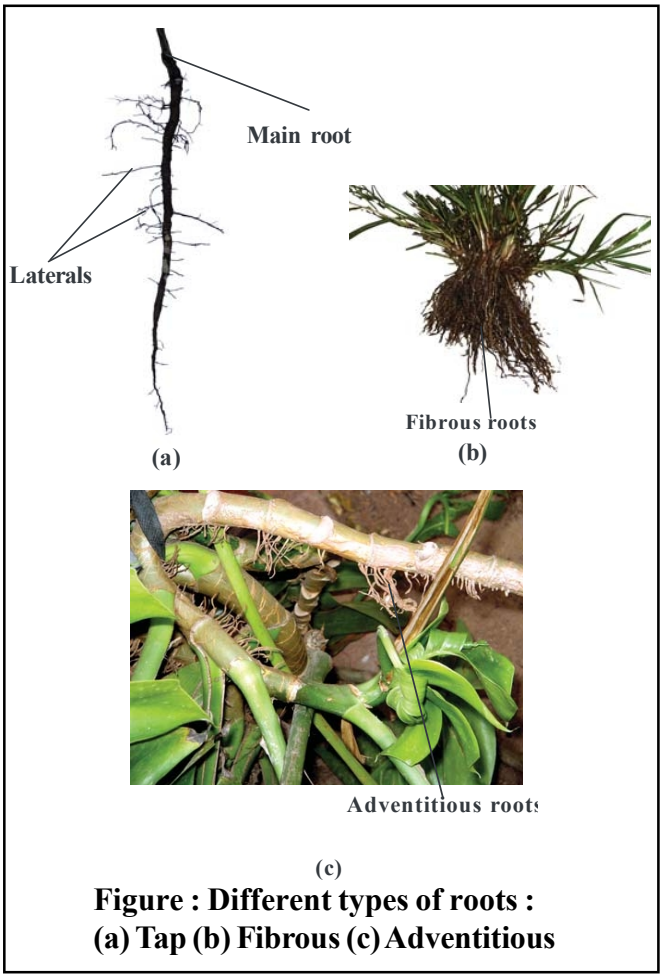


Figure : Different types of roots : (a) Tap (b) Fibrous (c) Adventitious

Function of roots

* Absorption of water and minerals from the soil.
* Provide anchorage to the plant parts.
* Storage of reserve food material.
* Synthesis of plant growth regulators.

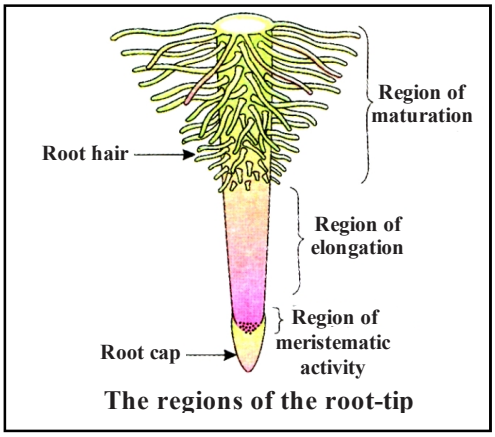
Regions of roots

(i) **Root cap :**The apex of the root is covered by a thimble-like strcture called **root cap**. It is multicellular and is made up of parenchymatous cells. It protects the tender apex of the root as it makes its way through the soil.

(ii) **Region of meristematic activity :** This layer is few millimetre above the root cap. The cells of this layer are thin-walled, small, with dense protoplasm. They divide repeatedly to produce new cells.

(iii) **Region of elongation:** The cells proximal to the meristematic region undergo rapid elongation and enlargement and are responsible for the growth of roots in length.

(iv) **Region of maturation :** The cells elongation zone gradually differentiate and mature. Hence, this zone proximal to region of elongatlon is called the region of maturation.
Some epidermal cells from the region of maturtion form very fine and delicate thread-like structures called root hair. The root hair increases the surface area for absorption of water and minerals from the soil.



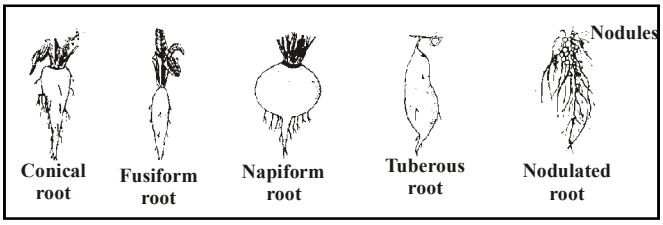
The regions of the root-tip

MODIFICATION OF ROOTS

1. Modified tap root for storage :

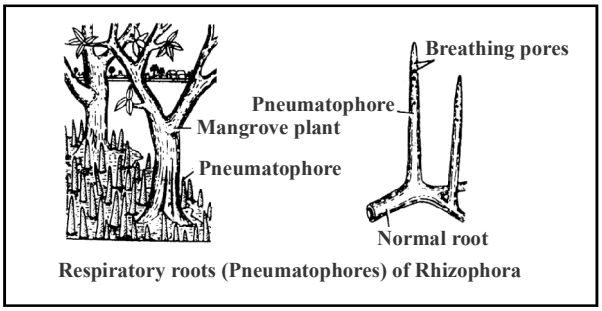
* **Fusiform roots / Spindle roots:** These root are thicker in the middle and tappered on both ends. In this type of roots both hypocotyl and root help in storage of food.
  eg. Radish (*Raphanus sativus*)

* **Conical roots :** These roots are thicker at their upper side and tapering at basal end.
eg. Carrot. (*Daucus*)
* **Napiform roots:** These roots become swollen and spherical at upper end and tappered like a thread at their lower end. **eg. Turnip (*Brassica rapa*), Sugarbeet = Beet root (*Beta vulgaris*)**
* **Tuberous root :** Such roots do not have regular shape and get swollen & fleshy at any portion of roots. eg. *Mirabilis*.
* **Nodulated root :** Nodules are formed on branches of roots by nitrogen fixing bacteria, (*Rhizobium*). eg. Plants of leguminosae family (Papilionatae) – **Pea, Gram, Bean.**



2. Tap root modified for respiration :

* In marshy/swampy areas, scarcity of oxygen is found.
* Some branches of tap root of the plants which grow in this region, grow vertically upward and comes on the surface. These roots are called **pneumatophores** which have minute pores called **pneumathodes** or **lenticels** by which air enters in the plant and plant gets oxygen for respiration.
* Pneumatophores are negatively geotropic.
Eg. Rhizophora, Heritiera, (Mangrove plants)



Respiratory roots (Pneumatophores) of Rhizophora

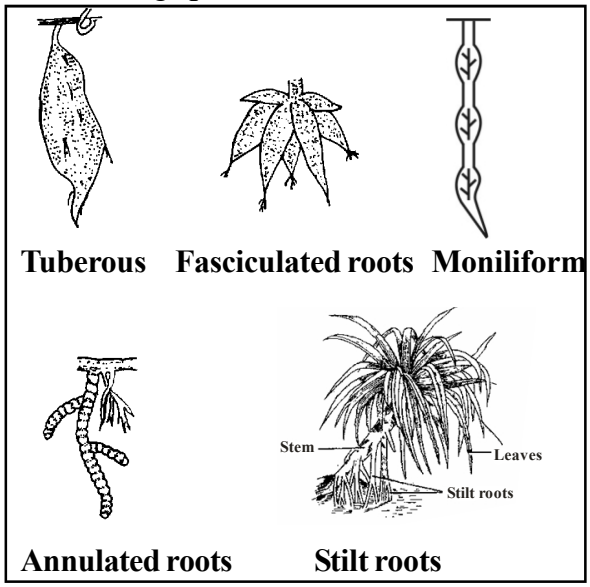
Modification of adventitious roots

(i) Tuberous adventitious roots : The food is stored in these roots, therefore, they become swollen and irregular.
eg. **Sweet potato (*Ipomea batatus*)**

(ii) . . . . . These are adventitious roots occuring in a clusters and all of them are swollen. eg. ***Dahlia, Asparagus***.

(iii) Beaded or moniliform : When root swells up like a bead at different places after a regular interval. eg. *Vitis* (Grapes), *Momordica* (Bitter gourd), Portulaca.

(iv) Annulated : Roots having series of ring like swellings eg. ***Ipecac***



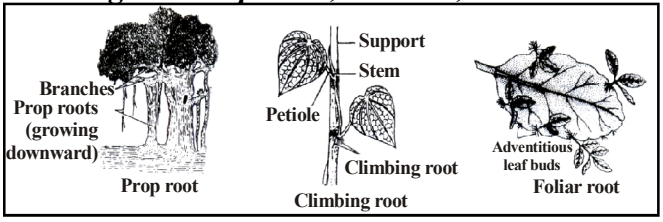
(v) Stilt roots or brace roots : These root arise from lower nodes and enter in the soil. These roots are supporting roots **eg. Maize, Sugarcane, *Pandanus* (screwpine)**

(vi) Prop root or pillar roots : These root arise from branches of plant and grows downward towards soil. It function as supporting stem for the plant. **eg. Banyan (*Ficus bengalensis).***

(vii) Climbing roots – These roots arise from nodes and helps in climbing. **eg. Money plant (*Pothos*), Betel, Black pepper, *Monstera*.**

(viii) Foliar roots or Epiphyllous roots – When roots arise from leaf they are called as foliar roots. **eg. *Bryophyllum, Begonia*.**

(ix) Sucking or haustorial roots or Parasitic roots : In parasitic plant roots enter in the host plant to absorbed nutrition from host.
eg. *Dendrophthoe, Cuscuta, Viscum*.



STEM

* The ascending part of the plant axis which bears branches, leaves, flowers and fruits is called stem.
* It generally grows above the ground and hence is considered as the aerial part of the plant.
* The plumule of the embryo present in the germinating seeds gives rise to the stem.
* The stem is generally green in colour at the initial young stage but later it becomes woody and dark brown.
* It is differentiated into nodes and internodes.
* The region bearing leaves, present at regular intervals on the stem and its branches are called **nodes** and the part of stem present between the two nodes is called **internode**.
* The stem bears buds which may be terminal or axillary.
* A bud is defined as the young, immature, under developed, compact shoot.
* The buds present on the stem are of two types namely :

(i) **Terminal bud :** The bud present at the tip of the stem is called terminal bud. The growth of the stem and its branches is accomplished through the terminal bud. The terminal bud is also called apical bud.

(ii) **Axillary bud :** The leaf makes an angle with the upper part of the stem. The angle made between the leaves and the upper part of the stem is called the axil. The bud which is present at the axil is called axillary bud.

Functions of Stem

* The main function of the stem is spreading out branches bearing leaves, flowers and fruits.
* It conducts water, minerals and photosynthates.
* Some stems perform the function of storage of food, support, protection and of vegetative propagation.

Forms of stem

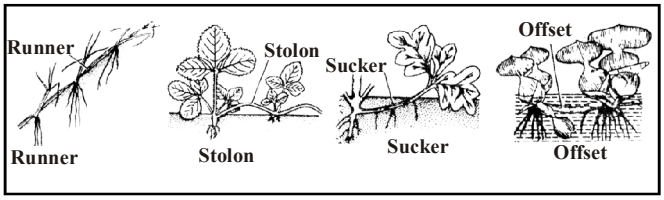
* **Caudex :** It is unbranched, erect, cylindrical stout stem and marked with scars of fallen leaves. Crown of leaves are present at the top of plant. eg.: Palm
* **Culm :** Stem is jointed with solid nodes & hollow internodes. eg. Bamboo (Graminae)
* **Excurrent :** The branches arise from the main stem in acropetal succession and the tree assumes a cone like appearance e.g. ***Pinus, Eucalyptus, Casuarina,*** etc.
* **Decurrent (Deliquescent) :** The lateral branches grow more vigorously and outcompetes the main trunk, giving a dome-shaped appearance, e.g., mango (***Mangifera indica***), shishem (***Dalbergia sissoo***) and banyan (***Ficus bengalensis***).

Modification of stem

(A) **Sub-aerial modification :**

These are creeping stems.

* **Runner –** When stem grows and spread on the surface of soil. Roots are developed at lower side and leaves from upper side from node eg. ***Cynodon dactylon*** **(Doob grass),** ***Oxalis*****.**
* **Stolon –** A slander lateral branch arises from the base of main axis and after growing aerially for some time arch downward to touch the ground. eg., **Jasmine, Peppermint.**
* **Sucker** – The lateral branch originate from the basal and underground portion of the main stem grow horizontally beneath the soil and come out obliquely upward giving rise to leafy shoot. eg. Pineapple, ***Chrysanthemum*****, Banana,** Mint.
* **Offset** – A lateral branch with short internode and each node bearing a rossette of leaves and tuft of roots at base. It is also known as aquatic runner. eg. ***Pistia, Eichhornea.***



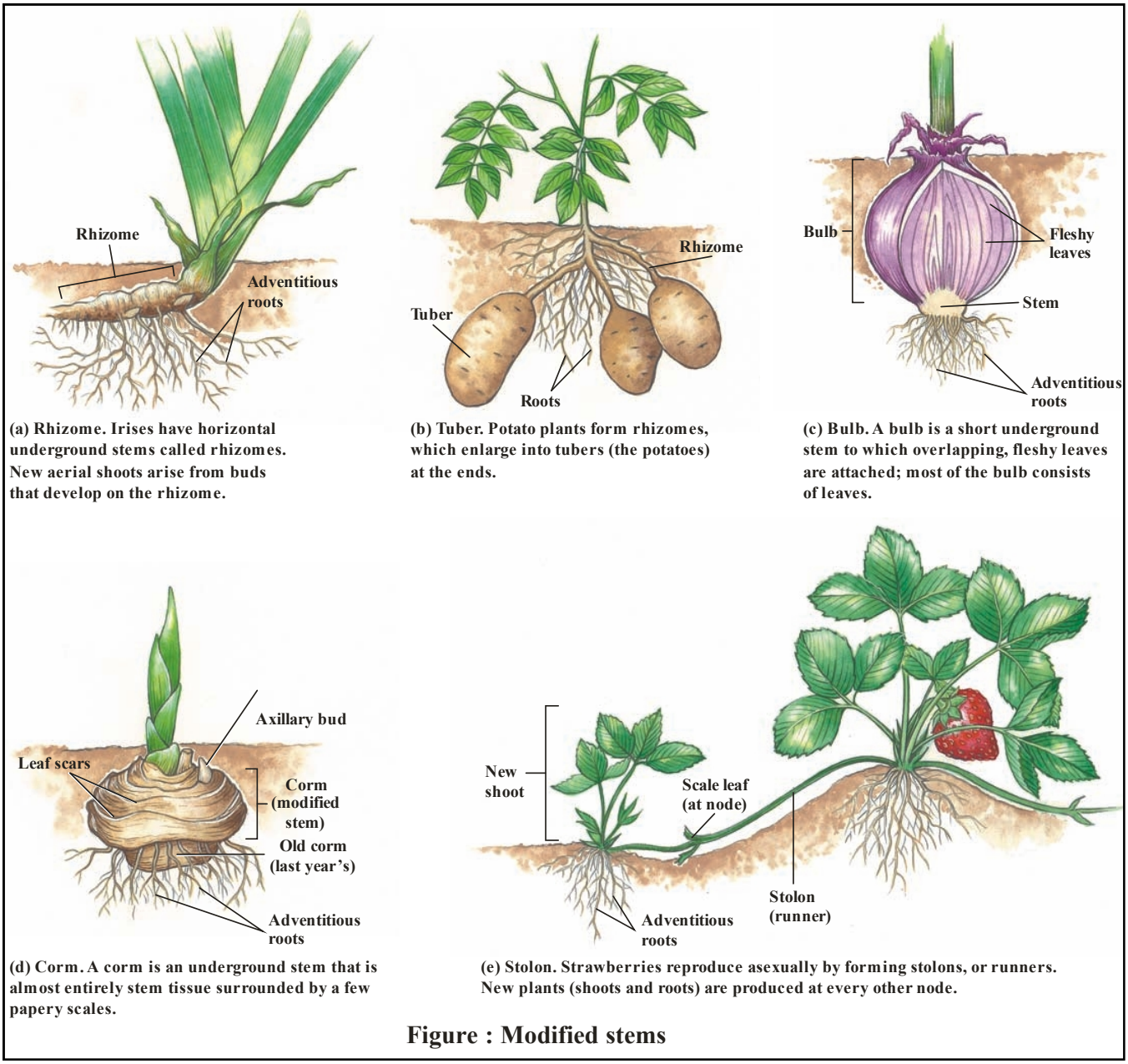
(B) **Underground modification :**

This type of modification occurs generally for food storage and vegetative propagation.

* **Tuber –** The tips of underground branches become swollen in the soil. Eyes are found on tuber which are axillary buds and axillary buds are covered with scaly leaves. eg. **Potato.**

* **Rhizome** – It is fleshy stem which grows horizontally in the soil. Nodes and small internodes are found which are covered by scaly leaves. eg. **Ginger, Turmeric, Canna, Banana, Water lily.**
* **Corm** – It is condensed structure which grow vertically under the soil surface.
eg. ***Colocasia, Alocasia*, Zaminkand, Saffron, *Gladiolus, Colchicum***
Organ of perennation : Underground stems of **Potato, Ginger, Turmeric,** *Colocasia*, *Zaminkand* are modified to store food in them. They also act as organ of perennation to tide over conditions unfavourable for growth.
* **Bulb** – This stem is reduced and has disc like structure and surrounds with numerous fleshly scaly leaves. Many roots arise from its base. Food is stored in flashy leaves. They show apical growth eg. **Onion, Garlic.**

Note : Type of stem in Banana is rhizome and modification is sucker. Banana propagates through rhizome. Aerial part of banana plant which looks like stem is pseudostem (leaf bases).



(a) Rhizome. Irises have horizontal underground stems called rhizomes. New aerial shoots arise from buds that develop on the rhizome.

(b) Tuber. Potato plants form rhizomes, which enlarge into tubers (the potatoes) at the ends.

(c) Bulb. A bulb is a short underground stem to which overlapping, fleshy leaves are attached; most of the bulb consists of leaves.

(d) Corm. A corm is an underground stem that is almost entirely stem tissue surrounded by a few papery scales.

(e) Stolon. Strawberries reproduce asexually by forming stolons, or runners. New plants (shoots and roots) are produced at every other node.

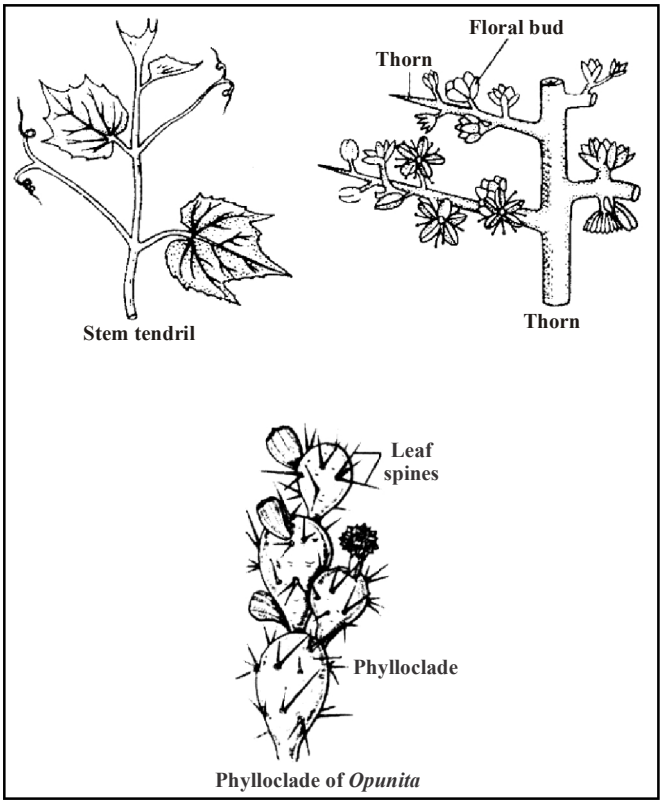
Figure : Modified stems

(C) Aerial modification :

1. . . . . . In this type of modification axillary bud forms tendril in place of branches and helps in climbing of those plants which have weak stem. Eg. Grapes/Grapevines, *Passiflora*, Gourds (*Cucumber*, Pumpkins, Watermelon)

2. **Stem thorn :** Thorn develops mainly from axillary bud of the stem. It may bear leaves, flowers. Eg. *Carissa* (Karonda), *Bougainvillea*, Pomegranate, *Citrus*.
Thorn protects plant from browsing animals. It is a **woody structure**.

3. **Phylloclade :** Stem is modified into a fleshy flat (***Opuntia***) or fleshy cylindrical (***Euphorbia***) and green leaf like structure and carries out photosynthesis like leaf. The leaves are modified into spines Eg. *Opuntia*, Euphorbia, Cactus.



LEAF

* The leaf is a lateral generally flattened structure borne on the stem.
* The leaves develop from the nodes.
* Their main function is photosynthesis and food making.
* Axillary buds are found in its axil.
* Axillary bud later develops into a branch.
* All the leaves of a plant is known as **phyllome.**
* Leaves originated from shoot apical meristem and are arranged in acropetal order.(older down and younger at the top)

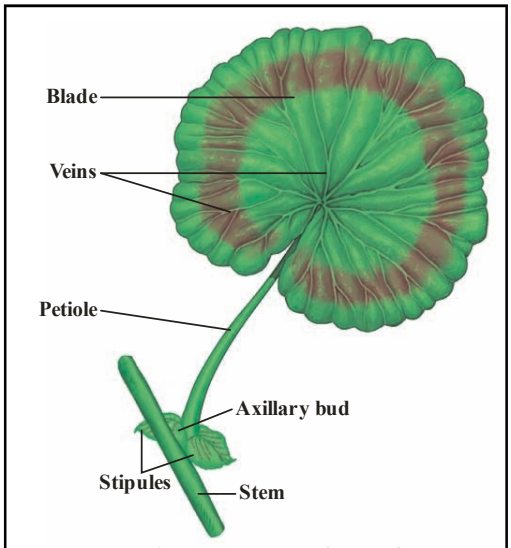


Figure : Parts of a leaf

Parts of leaf

Leaf is divided into 3 main parts :

1. Leaf base (Hypopodium) –

* The lowermost (basal) part of the leaf by which the leaf is attached to the node of the stem is called leaf base. Leaf base may bear two lateral small leaf like structures called stipules.
* Leaves are attached to stem by leaf base.
* In some leguminous plants, the leaf base swells and is called **pulvinus** e.g., Cassia, mimosa, bean.
* In some plants, leaf base expands into **sheath** (**Sheathing leaf base**), e.g., grasses and banana (monocots).

2. Petiole (Mesopodium) –

* The part of leaf connecting the lamina with the branch of stem.
* It holds the leaf blade above the level of the stem so as to provide sufficient light to the leaf.
* In ***Eichhornia*** petiole swell up and in citrus it is winged.
* Long thin flexible petiole allow leaf blade to flutter in air, thereby cooling the leaf and bringing fresh air to leaf.

3. Lamina (Epipodium) :

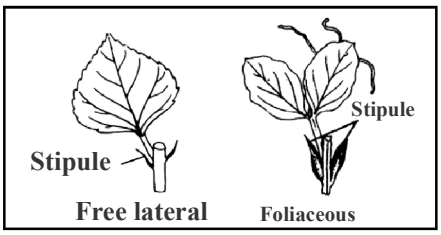
* It is a broad and flattened part of leaf.
* The leaf blade is supported by the veins and veinlets. The prominent vein present in the middle of the leaf blade is called **midrib**. The veins provide rigidity and strength to the leaf blade and also act as channel for transport of water, minerals and food material. The shape, margin, apex, surface and extent of incision of lamina varies in different leaves.
* Its main function are photosynthesis and transpiration.

Stipules :

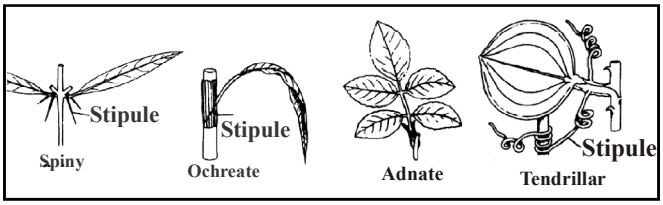
* Leaves of some plants have lateral appendages on either side of leaf base, known as stipules. If stipules are present in leaf it is called stipulated leaf (eg. Fabaceae) , if it is absent then leaf is called exstipulated (eg. Solanaceae, Liliaceae).

Stipules are of various types –

* **Free lateral –** They are independently present on both sides of leaf base. eg. ***Hibiscus rosasinensis*** (China rose)
* **Foliaceous** – These type of stipules are leaf like. eg. **Pea.**



* **Spiny –** Stipules modified into spine. eg. ***Zizyphus*** (Beri).
* **Ochreate –** When both stipules of leaf combine together and form a tube like structure, It is called ochreate. eg. **Polygonum**
* **Adnate** – Both stipules are attached with petiole. eg. **Rose**
* **Tendrillar –** Stipules are modified into tendrils like structure. eg. ***Smilax***



Duration of leaf :

* **Persistent / Evergreen –** Leaves of such plants are found in all season and do not (fall) shed combinedly. eg. ***Pinus*, *Saraca indica*, Datepalm.**
* **Deciduous –** All leaves of such plants shed at the same time eg. ***Azadirachta.***
* **Caducous –** Leaves fall soon just after appearance or after opening of bud. eg. **Cactus**.

Types of leaves :

* **Bracts -** These are leaf like structure which may present at base of pedicel of flower.
* **Bracteoles -** These are leaf like structures found on pedicel.

Venation of Lamina

* The arrangement of veins and veinlets in leaf lamina is known as venation. It is of 2 types

(A) Reticulate : It is found in dicots. When the vein and veinlets form a network, the venation is known as reticulate. Example : Peepal, Hibiscus, Luffa, etc.
Exception: ***Calophyllum*** (It has parallel venation)

* **Reticulate venation is of 2 types -**

(a) Unicostate or pinnate : This type of venation is having only one principal vein or midrib that gives off many lateral veins which proceed towards margin and apex of lamina of the leaf and form a network. Eg. : Mango, Guava, Peepal.

(b) Multicostate or palmate - In this type of venation **many principal veins** arising from the tip of petiole and proceed upward, this is again of two types -

(i) Multicostate convergent : Many principal veins arising from the tip of petiole, converge towards the apex of leaf. Eg. : Camphor, *Zizyphus*(plum), Tejpat, Chinarose.

(ii) Multicostate divergent - Many principal veins arising from the tip of peticle diverge from one another towards the margin of leaf blade
eg. Cotton, Castor, *Cucurbita*.

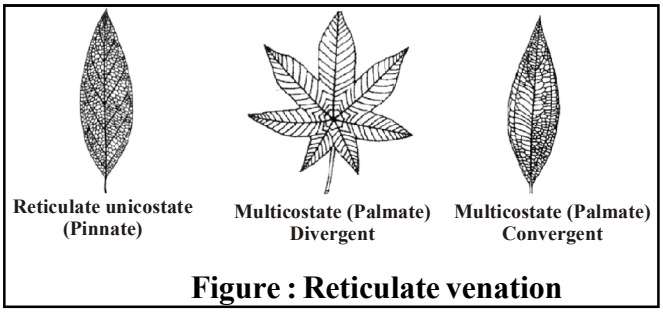


Figure : Reticulate venation

(B) Parallel : It is found in monocots. When the veins run parallel to each other and do not form network the venation is termed as parallel.
Example : Banana.
Exception – ***Smilax*** (It has reticulate venation).
They are of 2 types -

(a) Unicostate or pinnate : This type of pattern is having only one principal vein, that gives off many lateral veins, which proceed toward the margin of leaf blade in a parallel manner but they do not have veinlets. Eg. Banana, Ginger, Canna.

(b) Multicostate or palmate: This type of pattern is having many principal veins arising from the tip of the petiole and proceeding upwards.

(i) Multicostate convergent : Many principal veins arising from the tip of petiole converge towards the apex of leaf blade.
Eg. : Wheat, Grass, Sugarcane, Bamboo.

(ii) Multicostate divergent : Many principal veins arising from the tip of petiole diverge towards the margin of leaf. They do not divide into veinlets and do not form network. Eg. : Coconut, Fan palm.

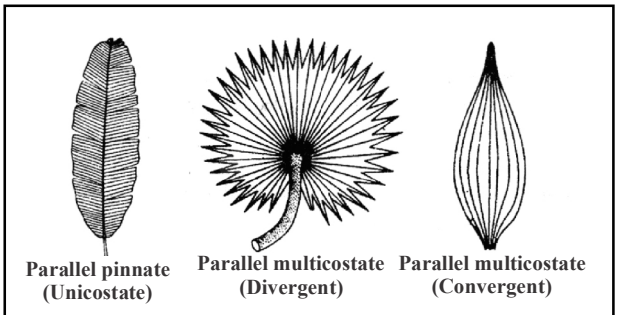


Figure : Parallel venation

Types of Leaves

* **Simple Leaf –** The leaf in which the leaf blade is not divided or when incised the incisions do not touch the midrib. It has bud at the axil of the petiole. eg. **Mango.**
* **Compound leaf –** The leaf in which the lamina or leaf blade is completely broken into distinct leaflets is called compound leaf. The leaf has the incisions which reach the midrib. Compound leave contains a bud at the axil of the petiole but is absent in the axil of leaflets.

It is of two types –

(A) Pinnately compound leaf – In this type of leaf midrib forms a common axis called rachis. Leaflets are arranged on both sides of rachis. eg. **Neem**.

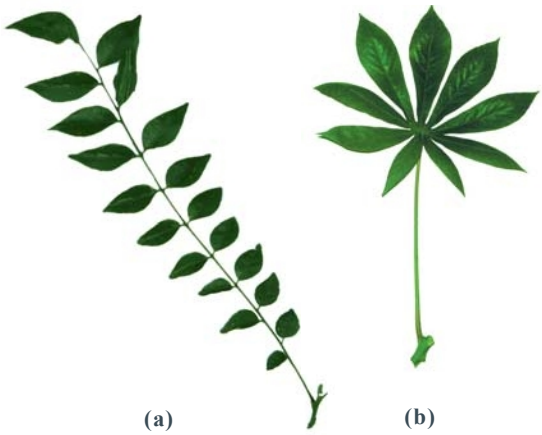


Figure : Compound leaves
(a) pinnately compound leaf
(b) palmately compound leaf

(B) Palmately compound leaf – In this type incision of leaf are directed from leaf margin to apex of petiole and all leaflets are attached at a common point (i.e. at the tip of the petiole).

* Rachis is absent in palmately compound leaf. Eg. Silkcotton (Bombax).
* A bud is present in the axil of petiole in both simple and compound leaves, but not in the axil of leaflets of the compound leaf.

Phyllotaxy

It is the pattern of arrangement of leaves on stem or stem branch. It is of following type –

(i) Alternate : Single leaf arising at each node in an alternate fashion. eg. **Chinarose**, **mustard** & **Sunflower**.

(ii) **Opposite :** A pair of leaves arise at each node on opposite side. Ex. *Calotropis*, Guava

(iii) **Whorled –** More than two leaves arise at each node eg. Nerium**,** ***Alstonia*** (Devil tree).

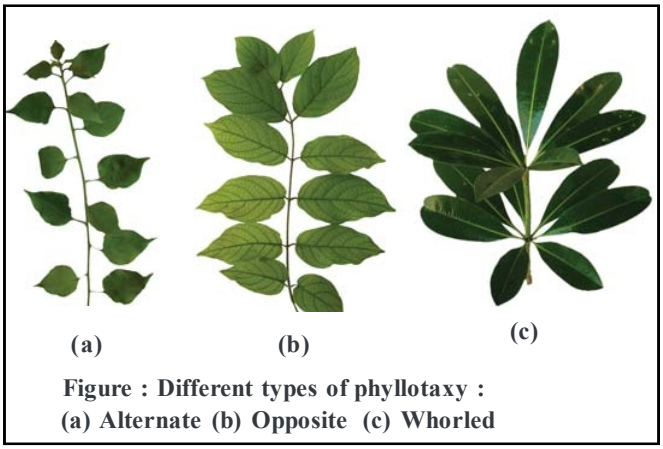


Figure : Different types of phyllotaxy : (a) Alternate (b) Opposite (c) Whorled

Modification of leaves

* Leaves are generally responsible for the process of photosynthesis, transpiration, gaseous exchange etc. But at some places where the conditions are unfavourable, leaves get modify and perform other functions such as storage, protection, support, defence etc. Different types of modifications that occur in leaves are :

(i) **Leaf tendrils:** In some plants, leaves modify into long, slender, thread-like sensitive structures called tendrils. They are sensitive to touch and therefore coil around a support to which they come in contact with and help the plant while climbing. Their main function is to provide support to the climbing plants. e.g. peas, sweet pea.

(ii) **Leaf spines :** In some plants such as *Aloe*, cactus etc. leaves modify into small, sharp pointed structures which reduce transpiration and protect the plants from browsing animals. The sharp-pointed structures are called leaf spines.

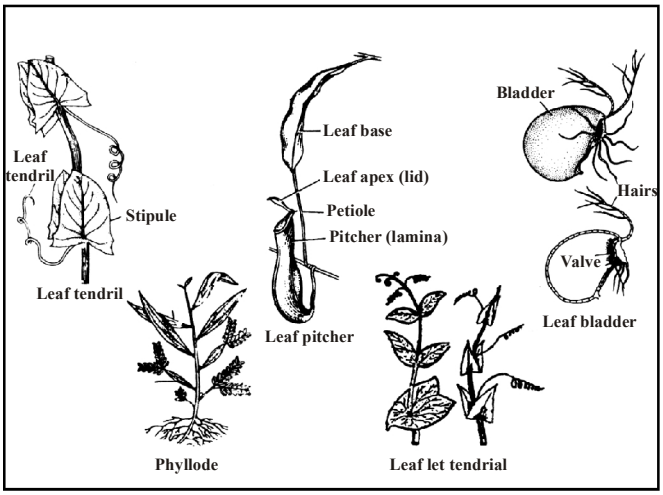
(iii) **Leaflet tendril –** When leaflet is modified into tendril like structure than it is called leaflet tendril. eg. ***Pisum sativum*** (Garden pea), ***Lathyrus odoratus*** (sweet pea)

(iv) **Leaf pitcher –** Leaves of some plants are modified to pitcher shape. eg. ***Nepenthes, Dischidia.***

(v) **Leaf bladder –** In some plant , leaves are modified into bladder like structure eg. ***Utricularia*** **(Bladder wort).**

(vi) **Leaflet hooks –** In some plants terminal leaflets are modified into curved hooks for helping the plant in climbing. eg. ***Argemone, Opuntia, Aloe,*** **Cat's nail (*Bignonia unguis cati*)**

(vii) **Phyllode –** In some plants petiole becomes flat structure and function as normal leaf. eg. ***Australian acacia*****, Parkinsonia.**



INFLORESCENCE

* The shoot modifies to form the flower i.e., the flower is considered as the modified shoot.
* When the apical shoot meristem changes to floral meristem then the shoot bears flowers.
* During the formation of floral meristem the axis condenses and internodes do not elongate.
* The axis bears flowers at successive nodes instead of leaves.
* The flowers are borne either singly or in clusters on the shoot.
* When the shoot tip transforms into a flower, it is always **solitary**.
* The arrangement of flowers on the floral axis of the plant is known as **inflorescence**.
* The flowers can be arranged in different ways, depending upon whether the shoot apex continuous to grow or convert into a flower.
* Two major type of inflorescence that can occur are :

(A) **Racemose :** In racemose inflorescence, the shoot axis continue to grow indefinitely and the flowers are borne in an acropetal succession i.e., younger flowers are present towards the apex and the older flowers are present at the base e.g. radish, lupin, mustard.

Figure : Racemose inflorescence

Racemose inflorescence is of following types :

(i) **Raceme :** Peduncle has bisexual and pedicellate flowers arranged acropetally, *e.g.,* Larkspur, radish.

(ii) **Panicle :** Peduncle branched and branches have pedicellate flowers, *e.g.* , Gulmohr, *Rhus.*

(iii) **Spike :** Peduncle has bisexual and sessile flowers, *e.g.* , *Achyranthes, Adhathoda.*

(iv) **Spikelet :** It is a small, special spike. Flowers are produced in the axil of fertile bracts called **lemma**, *e.g.*, wheat, grasses (Poaceae).

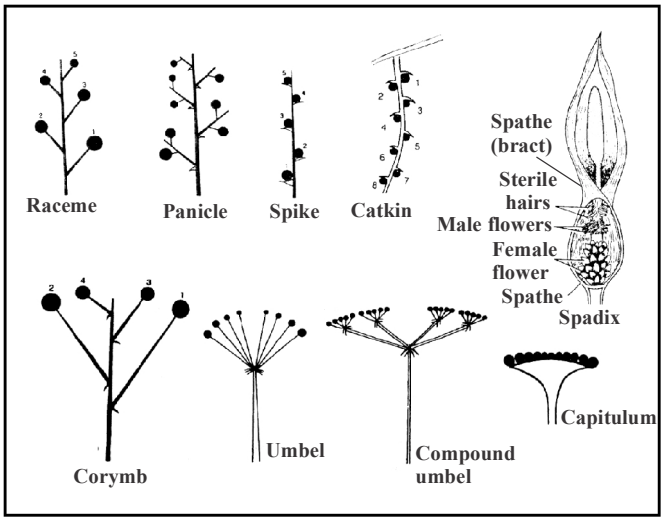
(v) **Catkin :** It is pendulous spike in leaf axis which bears unisexual flowers, e.g., *Morus*, Birch, Oak, *Acalypha*.

(vi) **Spadix :** It is spike with fleshy axis and having both male and female flowers. It is surrounded by large coloured bracts called **spathe,** *e.g., Musa,* Palm, *Colocasia, Alocasia* **(characteristically found in monocots).**

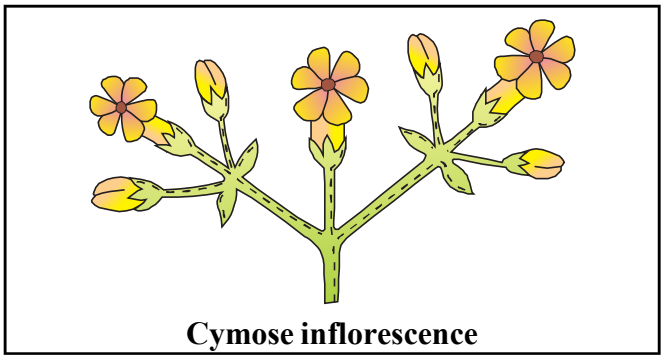
(vii) **Corymb :** The main axis is short. Lower flowers have long pedicels than upper ones so that all the flowers are brought more or less to the same level, *e.g., Iberis, Capsella.*
Compound corymb, *e.g.,* Cauliflower.
Corymbose raceme is found in mustard.

(viii) **Umbel :** The main axis is reduced very much and all flowers appear to be arising from the same point. At the base of flowers, cluster of bracts form an involucre, *e.g., Hydrocotyle.*
Scapigerous umbel is found in onion.
Compound umbel *e.g.,* Coriander.

(ix) **Capitulum or head :** Main axis becomes flat and called receptacle. It bears many sessile and small florets. Peripheral florets called ray florets are pistillate or neuter and zygomorphic, whereas disc florets are bisexual and actinomorphic *e.g.,* Sunflower, *Zinnia, Cosmos* (Asteraceae).



(B) **Cymose :** In cymose inflorescence, the main axis (peduncle) terminates into a flower and hence has a limited growth. In cymose inflorescence the flowers are borne in a **basipetal order.**
e.g., *Begonia, Teak, Bougainvillea, Dianthus, Solanum*.



Cymose inflorescence

Cymose inflorescence is of following types :

(i) **Monochasial or uniparous cyme.** A single lateral branch arises from a cymose axis which terminates in a flower. It is of two types:

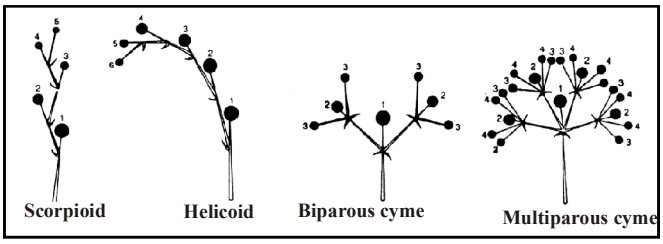
(a) **Helicoid cyme.** When the lateral axis develop successively on the same side, forming a helix *e.g., Atropa, Datura, Begonia, Heliotropium.*

(b) **Scorpioid cyme.** Lateral branches (successive flowers) arise alternately on left and right sides (in zig zag manner), *e.g., Ranunculus.*

(ii) **Dichasial or biparous cyme.** Two lateral branches arise at a time from a cymose axis, which end into flower.
e.g., Dianthus, Nyctanthes.

(iii) **Polychasial or multiparous cyme.** More than two lateral branches arise at a time from a cymose axis and all of them end into flowers.
e.g., Hamelia, Calotropis.

(iv) **Capitate.** Large number of sessile flowers grow on a suppressed axis to form a globose structure.
e.g., Acacia, Mimosa, Anthocephalus.



Special type of Inflorescence

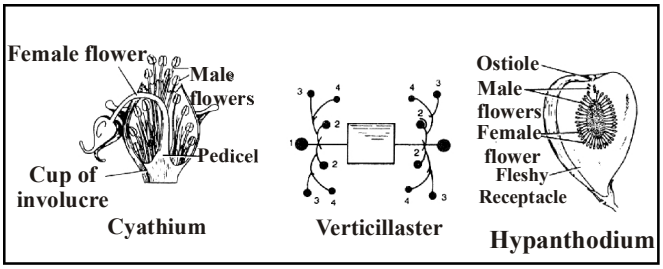
* **Special inflorescences :** These are of following types :

(i) **Verticillaster :** A cluster of sessile or subsessile flowers borne on a dichasial cyme ending in monochasial cyme (scorploid) in the form of condensed whorl on either side of the node.
e.g., Ocimum (Tulsi), *Salvia* (Lamiaceae).

(ii) **Cyathium :** It looks like a single flower. A cup shaped involucre formed by bracts encloses a single female flower and a number of male flowers. Each male flower is represented by single stamen, while a single pistil represents a female flower *e.g., Poinsettia (Euphorbia pulcherrima), Pedilanthus.*

(iii) **Hypanthodium :** Fleshy receptacle forming a hollow cavity with an apical opening called **ostiole.** The flowers are developed on inner wall of the hollow cavity. The male flowers are situated at the top near the opening, at the bottom are situated the female flowers with long styles and in between both are situated short styled **gall flowers** which are sterile. *e.g., Ficus* (Banyan, Fig, Gular).

(iv) **Coenanthium.** In *Dorstenia,* the receptacle becomes saucer shaped and its margins are slightly curved. The arrangement of florets is similar to hypanthodium.



* **Mixed inflorescence –** Some times flowers are arranged in both racemose and cymose manner on same peduncle called mixed inflorescence.
Mixed spadix – Banana
Cymose raceme or thyrsus – Grapes (*Vitis*)

FLOWER

* The flower is the reproductive unit in the angiosperms.
* It is a modified shoot, meant for sexual reproduction.
* It consists of four whorls which are successively arranged on the thalamus or receptacle.
* **Thalamus** is the swollen end of the pedicel or the stalk. The four whorls present in a flower are **calyx, corolla, androecium, gynoecium**.
* The calyx and corolla are non-essential, accessory organs and androecium and gynoecium are the reproductive organs of a flower.
* In some flowers like lily, the calyx and corolla are not distinct and are termed as **perianth.**

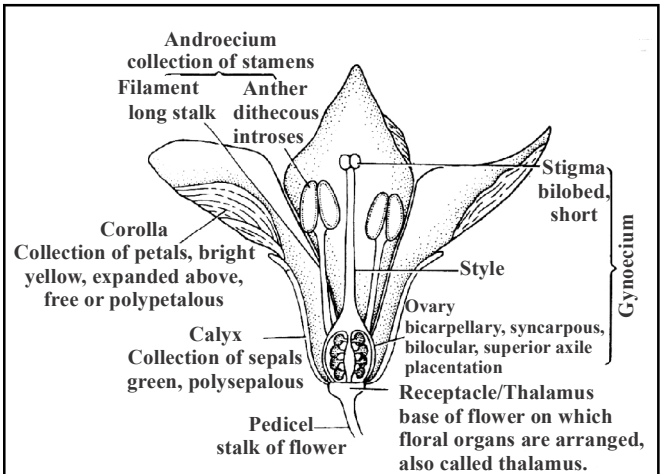


Figure : Parts of flower

Some words related to flower

* **Complete Flower–**When calyx, corolla, androecium and gynoecium are present.
* **Incomplete Flower –** Flower with one of the four whorl missing.
* **Bisexual flower :** When a flower has both androecium and gynoecium e.g., Pea, *Hibiscus*.
* **Unisexual flower:** A flower having either only stamens (androecium) or only carpels (gynoecium). e.g., Maize.
* **Trimerous flower :** When all the floral appendages (whorls) are in the multiples of three.
* **Tetramerous flower :** When all the floral appendages are in the multiples of four.
* **Pentamerous flower :** When all the oral appendages are in the multiples of five.
  In dicots flowers are usually pentamerous while in monocots flowers are trimerous.
* **Bracteate flower :** Flower with bracts (reduced leaf found at the base of the pedicel).
* **Ebracteate flower :** Flower without bracts.
* **Monoecious Plant –** When both male and female flowers are present on the same plant. eg. ***Cocos***, ***Ricinus, Colocasia, Zea, Acalypha***.
* **Dioecious Plant –** When male and female flowers are present on separate plant eg. Mulberry, Papaya.
* **Polygamous Plant –** When unisexual (male or female), bisexual and neuter flowers are present on the same plant eg. Mango, Polygonum.
* **Monocarpic Plant –** The plant which produces flowers and fruits only once in life eg. Pea, Mustard, Bamboo, Agave.
* **Polycarpic Plant –** The plants which produces flowers and fruits many times in life, eg. Pear, Mango,
* **Cauliflory :** Production of flowers on old stem from dormant buds eg. ***Artrocarpus, Ficus***.

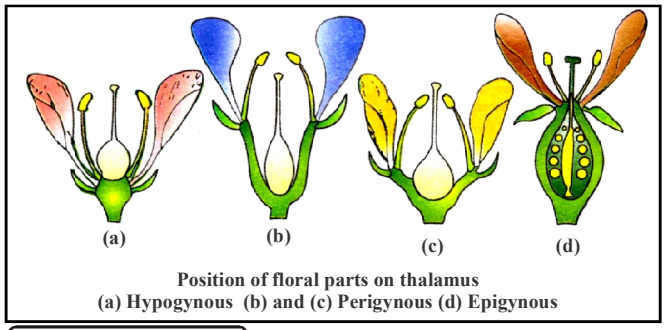
Symmetry of flower :

Floral symmetry is of three type-

* **Actinomorphic / Radial / Regular** – When a flower can be divided in two equal halves in any plane passing through the centre. eg. **Mustard, China rose, Datura, Chilli.**
* **Zygomorphic / Bilateral** – When a flower is divided into two equal halves only by one vertical plane, then it is called zygomorphic flower eg. **Pea, Bean, Gulmohur, Cassia.**
* **Asymmetrical / irregular –** When the flower cannot be divided into two equal halves from any plane, then it is called asymmetrical flower. eg. **Canna.**

Insertion of Floral leaves

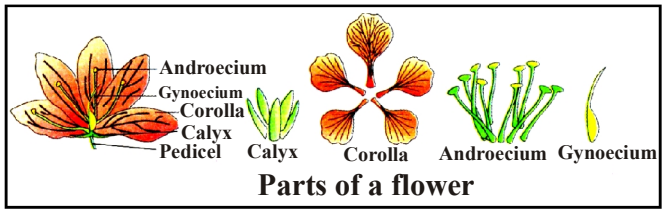
* **Hypogynous condition –** When petals, sepals and stamens are situated below the ovary, the flower is called hypogynous and in this condition ovary will be **superior**. eg. **mustard, Chinarose, Brinjal, Petunia.**
* **Perigynous condition –** In it thalamus grow upwardly and form a cup shaped structure. Gynoecium is situated in the centre and other parts of 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** eg. **plum, peach, rose.**
* **Epigynous condition –** The margin of thalamus grows upward enclosing the ovary completely and getting fused with it, the other parts of flower arises above the ovary, the ovary is said to be **inferior** and this condition is known as epigynous eg. **Guava, Cucumber, Bittergourd and ray florets of sun flower.**



Position of floral parts on thalamus
(a) Hypogynous (b) and (c) Perigynous (d) Epigynous

Parts of a flower

* A flower normally has four whorls namely calyx (sepals), corolla (petals), androecium (stamen) and gynoecium (carpel).



Parts of a flower

Calyx

* The outermost whorl of flower is called calyx. Each member of this whorl is called sepal.
* The sepals are generally green leaf-like structure that protect the flower in the bud stage.
* When all the sepals are free from each other, then it is called poly-sepalous condition eg. **Mustard, Radish**.
* When the sepals are fused in each other, then it is called gamosepalous condition eg. **Cotton, Datura, Brinjal.**
* In calyx of ***Mussaenda***, one of the sepal enlarge and form a leaf like structure. It attracts the insects and thus act as advertisement flag.
* In ***Trapa***, calyx is modified into spines and helps in protection of fruit.
* In the family of sunflower (compositae) sepals are modified into hairy structure. It is called **pappus**. The pappus is a modified calyx and helps in dispersal of fruit.

Duration of Sepals

* **Caducous** – Sepals fall just at the time of opening of flower bud. eg. Poppy (Opium plant).
* **Deciduous** – Sepals fall after pollination eg. Mustard.
* **Persistent** – If sepals do not fall and remain attached to fruit. eg. Tomato, Capsicum, Brinjal, Cotton, Datura.

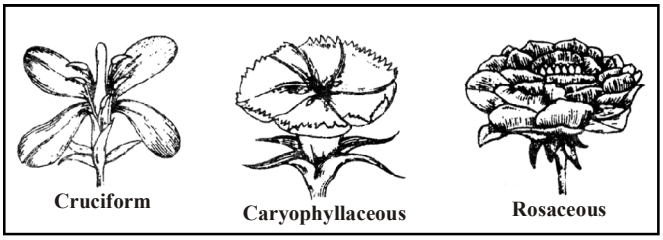
Corolla

* The second whorl of flower is called corolla and each member of it is called Petals. When all the petals are free, then it is called **polypetalous** while when petals are fused, then it is called **gamopetalous**.
* Petals are usually brightly coloured to attract insects for pollination.

Forms of Corolla

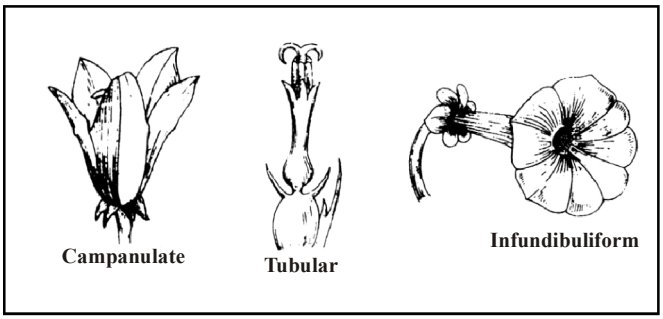
(A) Polypetalous :

* **Cruciform** – 4 petals are present in it. The lower narrow part of petal is called claw while the outer broad part is called limb. These petals are arranged cr**osswise. eg. Radish, Mustard (Cruciferae).**
* **Caryophyllaceous** – It consists of 5 petals the claw of petals are short and the limb of petals from right angle to the claw eg. ***Dianthus*, *Gypsophylla*.**
* **Rosaceous –** It consist of 5 or more petals. Claws are absent in it and limbs are spread regularly outwards. eg. Rose, Coconut.



(B) Gamopetalous

* **Campanulate / Bell shaped** – Five fused petals are arranged like bell. eg. **Tobacco, Raspberry, Campanula**.
* **Funnel shaped or infundibuliform** – Funnel like 5 fused petals arrangement eg. **Datura, Railway creeper**, **Petunia**.
* **Tubular –** 5 fused petals like tube eg. **Disc florets of sunflower**.

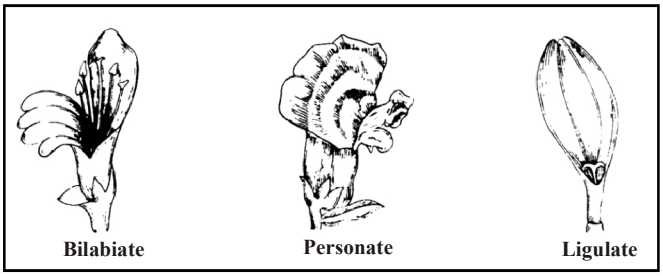


Zygomorphic polypetalous corolla

* **Papilionaceous (Butterfly shaped) –** Five petals are present. It's posterior petal is largest and is known as standard or vexillum. Vexillum covers two lateral petals which are called as wings and the innermost basal petals are united to form a keel or carina. Both lateral parts covers the keel. eg. **Pea, Bean, Gram, Arher.**

Zygomorphic gamopetalous corolla

* **Bilabiate –** The petal of gamopetalous corolla is divided into two lips. The place between two lips is called corolla mouth. eg. ***Ocimum* (Holy basil = Tulsi*), Salvia* (Labiatae family).**
* **Personate –** In this case the corolla is bilabiate but the two lips are near to each other eg. ***Antirrhinum* (Dog flower).**
* **Ligulate –** The upper part of corolla is long, flattened which is attached with short narrow tube. eg. **Ray florets of sunflower**.



Aestivation

* The mode of arrangement of sepals or petals in floral bud with respect to the other members of the same whorl is known as aestivation. It is of following types -

(i) **Valvate –** When petals or sepals in a whorl, just touches each other at margin without over lapping. eg. ***Calotropis*.**

(ii) **Twisted –** In this type one margin of a petal covers adjacent petal and the other margin is covered by another petal. One margin of the petal overlaps that of the next one, and the other margin is overlapped by the another one. Eg. Cotton, Ladyfinger, China rose (Malvaceae family).

(iii) **Imbricate –** When both margin of the one petal are covered by the others two petals and both margin of another one, covers other, Rest are arranged in twisted manner OR If the margins of sepals or petals overlap one another but not in any particular direction, then it is known as imbricate aestivation. Eg.: **Cassia, Gulmohur.**
Ascending imbricate – The posterior petal is innermost i.e., its both margins are overlapped. Caesalpinoidae sub-family of leguminosae.

(iv) **Vexillary or Papilionaceous or Descending imbricate** – The posterior petal is outermost & largest and is known as **standard** or **vexillum** which overlaps the two lateral petals **wings** or **alae**. These two laterals petals overlaps two smallest anterior petals i.e. **keel or carina**. Vexillary arrangement is found in pea family. Eg. Pea, Bean (Papilionatae sub-family of leguminosae family).

(v) **Quincuncial** – Out of the five petals, two are completely internal, two completely external and in the remaining petal, one margin is internal and the other margin is external. eg. ***Murraya, Ranunculus***.

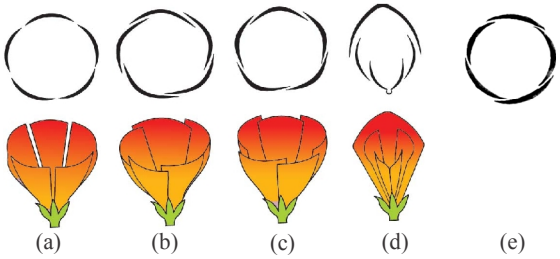


Figure : Types of aestivation in corolla
(a) Valvate (b) Twisted (c) Imbricate
(d) Vexillary (e) Quincuncial

Androecium

* It is made up of one or more stamens.
* Each stamen consist of filament, anther and connective.
* Each anther is usually bilobed and each lobe has two chambers the pollensac.
* The pollen grains are produced in pollensac.

Cohesion of stamens :

* When the floral parts of similar whorl are fused, then it is called cohesion.
* When the stamens of an androecium are free from one another, it is called polyandrous condition.
* **Adelphous** : when stamens are united by their filament only, it is called adelphous.
* It is of following types –

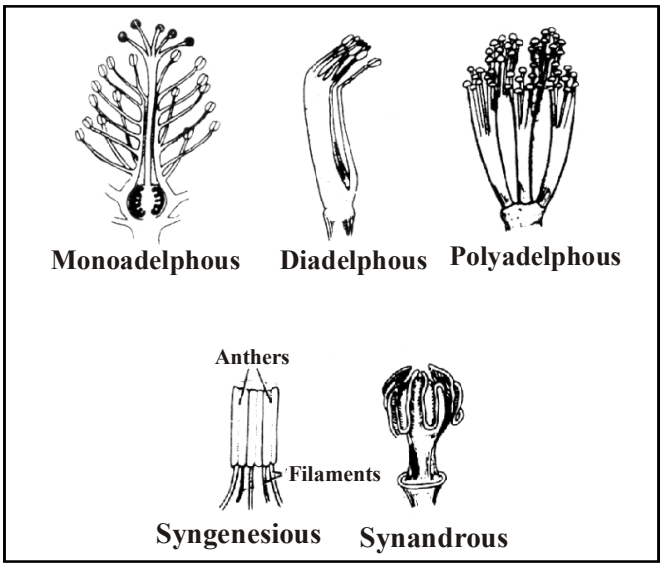
(a) **Monoadelphous** – When all the filaments are united into a single bundle but anthers are free from each other. In this type of cohesion a tube is formed around the gynoecium which is called staminal tube eg. **Chinarose (Malvaceae family)**.

(b) **Diadelphous –** When the filaments are united in two bundles but the anther remains free eg. **Pea.**

(c) **Polyadelphous –** When filaments are united into more then two bundles. eg. **Citrus.**

* **Synandrous –** When anthers as well as filaments of stamens are united through their whole length. eg. ***Colocasia, Alocasia,*** Cucurbitaceae family

* **Syngenesious** – In it only anthers are united in bundle but filaments remain free eg. Compositae family



Adhesion of stamens :

When the stamens are attached to other parts of flower, then it is called adhesion of stamens.

(a) **Epipetalous –** When stamens are attached to petals. eg. **Brinjal (Solanaceae).**

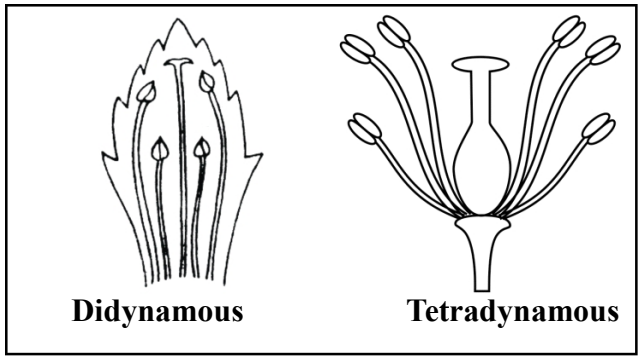
(b) **Epiphyllous –** When stamens are attached to tepals. eg. **Onion, Lily.**

(c) **Gynandrous** – When stamens are attached to gynonecium either throughout their whole length or by their anther eg. ***Calotropis***.

Length of stamens :

* **Didynamous –** When four stamens are present, out of them outer two are long and inner two are short, then it is called didynamous. eg. **Lamiaceae / Labiatae family, Salvia.**

* **Tetradynamous –** When there are six stamens and they are arranged in two whorls. In outer whorl, there are two short stamens while in inner whorl, there are four long stamens, this condition is called tetradynamous. eg. **Cruciferae family, Mustard**



Gynoecium

* It is female part of the flower comprising of the inner whorl of megasporophylls in the form of carpels bearing ovules.

* It consists of ovary, style and stigma.

* Ovary is the enlarged basal part, on which lies the elongated tube the style, the style connects the ovary to the stigma.

* The stigma is usually at the tip of the **style** and is receptive surface for pollen grains.

* Ovary is the lower part of the carpel which bears one of more ovules. These ovules, after fertilisation mature into seeds. The ovules are attached to a flattened, cushion-like structure called **placenta**. The ovary has one or more chambers or locull. The ovary containing one chamber is **unilocular**, two chambers is **bilocular**, three chamber is **triocular** and so on. The ovules are borne in these chambers. The wall of the ovary after fertilisation forms the pericarp (fruit wall).

* If only one carpel is present in gynoecium this condition is called monocarpellary.

* If more than one carpel is present in gynoecium this condition is called polycarpellary.

* If all the carpels in polycarpellary / multicarpellary condition are free, then condition is called apocarpous. eg., **Lotus, Rose, Michelia**

* If all the carpels are fused together, then condition is called syncarpous. eg., **Mustard, Tomato, Papaver, Hibiscus.**

Placentation

* The ovules are attached on ovary walls on one or more cushion like structure called placenta. The arrangement of ovule within ovary is known as placentation.

It is of following types –

(i) **Marginal :** Marginal placentation is found in monocarpellary gynoecium. The placenta forms a ridge along the ventral suture of the ovary and the ovules are borne on this ridge forming two rows. eg. **Pea (Leguminosae family), Tamarind, Cassia, Gulmohur, Acacia.**

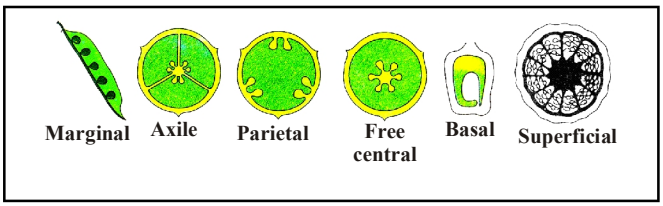
(ii) **Axile :** It is found in multicarpellary syncarpous gynoecium. The fusion margin of carpels grown inward and meet in the centre of the ovary. Thus an axis forms in the centre of ovary, thus ovary becomes multichambered. The ovules are born at the central axis. Number of these chambers are equal to the number of carpel fused.
eg. Potato, China rose, Lemon, Tomato.

(iii) **Parietal :** This type of placentation is found in unilocular syncarpus ovary. In it the ovule develops on the innerwall of the ovary or on peripheral part. Eg. Mustard, *Argemone*.
In some plants, ovary is one chambered but it becomes two chambered due to formation of a false septum. **Cruciferae family (eg. Mustard, Capsella) and Argemone.**

(iv) **Free central :** This type of placentation is found in syncarpous gynoecium. In it, the ovary is unilocular (Septa are absent) and the ovules are borne on the central axis eg. **Primrose, Dianthus.**

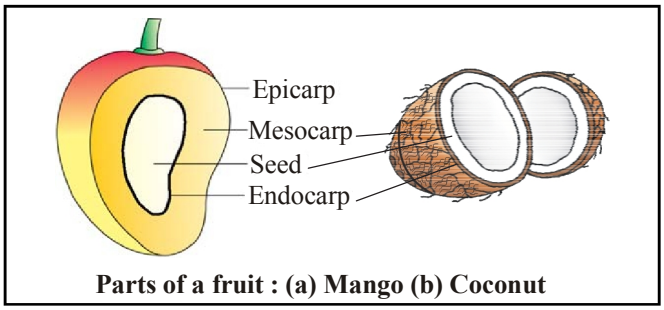
(v) **Basal :** The ovary is unilocular and a single ovule is borne at the base of ovary. eg. **Marigold**, **Sunflower (Asteraceae / Compositae family), Gramineae / Poaceae family.**

(vi) **Superficial –** This type of placentation is found in multicarpellary, syncarpous multilocular gynoecium. The ovules are attached on the walls of locule eg. **Nymphea** (Water lily)



FRUIT

* Fertilized and ripened ovary is fruit.
* A Fruit consist of (i) Pericarp (fruit wall), (ii) seed.



Parts of a fruit : (a) Mango (b) Coconut

* The seeds are protected inside fruit.
* But in some fruits seeds are not found like in grapes, banana and such type of fruits are seedless fruit.
* If a fruit is formed without fertilization of the ovary it is known as parthenocarpic fruit.

Pericarp :

* After ripening, the ovary wall change into pericarp.
* This pericarp may by thick and fleshy or thick and hard or thin and soft.
* Pericarp is differentiated in 3 layers

(i) **Epicarp :** It is the outermost layer, it may be thick or thin and hard or soft. It forms outermost layer of fruit which is also called rind.

(ii) **Mesocarp :** It is the middle layer which is thick and fleshy in **mango**, peach and date palm In **coconut**, this layer is made up of fibres which is also called coir.

(iii) **Endocarp :** It forms the innermost layer, it may be thin membranous (eg. Orange, Datepalm) or thick and hard (eg. Mango, Coconut)

True fruit or Eucarpic fruit

* When the fruit is developed only from the ovary, the fruit is called as true fruit. eg. Mango, Coconut, ***Zizyphus***.

False fruit or Pseudocarp

* In some fruits, in place of ovary, some other parts of flower like thalamus, inflorescence, calyx are modified to form a part of fruit.
* These types of fruit are called false fruits. eg. Apple, Strawberry, Pear, Mulberry, fig, Cashnew nut.

CLASSIFICATION OF FRUITS

* Fruits are divided in three groups :
Simple, Aggregate and Composite

Simple fruit

* These fruit develop from monocarpellary ovary or multicarpellary syncarpous ovary.
* Only one fruit is formed by the gynoecium.
* Simple fruits are of two types –
Fleshy fruit, Dry fruit
* **Fleshy Fruit:-** In fleshy fruits, fruit wall (pericarp) is differentiated into epicarp, mesocarp and endocarp. These fruit develop from superior or inferior syncarpous gynoecium. These may be unilocular or multilocular. These fruits are indehiscent. Dispersal of seeds occur after pericarp is destroyed.

Fleshy fruits are of following types :

* **Drupe fruit :-** These fruit develops from mono carpellary, superior ovary. In these fruits endocarp is hard and stony so these fruits are also called stony fruits. eg. Mango, coconut almond, peach, walnut, plum. Brachysclereids are present in endocarp.

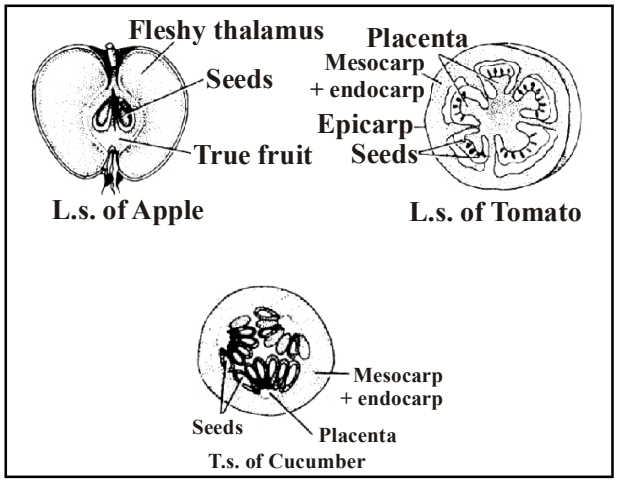
In **mango** the outermost cover or rind is called epicarp. Middle edible fleshy part is mesocarp and the inner stony hard endocarp. In plum (Ber), epicarp and mesocarp both are edible while endocarp is stony.

The hard covering of almond and walnut is endocarp and their edible part is seed. In **coconut** epicarp is hard and thin while mesocarp is thick and fibrous. The endocarp is hard and seed is proteced in it. The sweet water and edible part of coconut are liquid and solid endosperm respectively.

* **Berry :** These fruits develop from mono or multicarpellary syncarpous ovary. Ovary may be superior or inferior, Placentation is axile. In these epicarp is thin and seeds are embedded in fleshy part. Initially seeds are attached with placenta of fruit but after maturation these seeds are deteched from placenta and are spread randomly in fleshy part.

Plants with superior ovary (True berry) = Tomato, Grapes, Brinjal.
Plants with inferior ovary (False berry) = Guava, Banana

* **Date palm** is one seeded berry. In it pericarp is divided into epicarp, mesocarp and endocarp. Epicarp is thin and soft while mesocarp is thick and fleshy and endocarp is thin like a membrane. Which is attached with seed.
* **Arecanut** is one seeded fibrous fruit berry. When its thick fibrous layer is removed then seed comes out which is hard.
* **Pepo -** These fruit develops from tricarpellary, syncarpous and inferior ovary. This fruit is unilocular and have parietal placentation but looks like axile due to swelling of placenta. These fruits are fleshy and spongy. eg. fruits of cucurbitaceae family like cucumber (Khira),water melon (Tarbooz), *Cucurbita maxima* (*Pumpkin*), bitter gourd (Karela), muskmelon (Kharbuja).
* **Pome -** This fruit develops from bi or multicarpellary syncarpous inferior ovary. The rind and sponge are made up of thalamus. The main part of ovary is hard and dry and remain inside the fruit. Seeds are present in it. eg. Apple, Pear. These are false fruits. Fleshy swollen **thalamus** of these fruits is **edible** part.

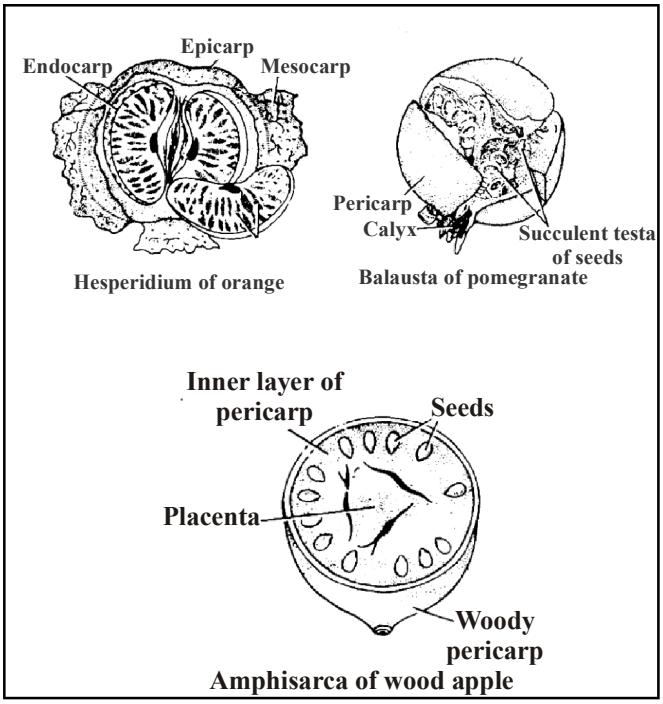


* **Hesperidium :** This fruit develops from multicarpellary, syncarpous, superior ovary and axile placentation. This fruit is specialy found in plants of Rutaceae family. eg. Orange, Lemon. Epicarp of these is made up of thick rind which is having many oil glands.

Mesocarp is white fibrous structure which is attached with epicarp. Membranous endocarp projects inward and form many chambers. Many glandular hairs are present on the inner side of endocarp. These glandular hairs are edible.

* **Balausta :** It is a multilocular multiseeded fruit, which develops from inferior ovary. Its pericarp is hard. Persistent calyx is arranged in the form of crown. Seeds are irregularly arranged on placenta. Epicarp is hard. Testa of seed is fleshy and juicy. This is the edible part of fruit. eg. Pomegranate **(*Punica granatum*).**

* **Amphisarca :** This fruit is multichambered which develops from multicarpellary superior ovary. Outer part of pericarp is woody and placenta is fleshy. The inner part of pericarp and placenta is edible part of fruit. eg. wood apple **(*Aegle marmelos*),** elephant apple.



* **Simple Dry Fruit -** Pericarp of simple dry fruit is hard and dry and not differentiated into epicarp, mesocarp and endocarp. Such fruits are called dry fruit.

Simple dry fruits can be divided into following three groups :

(i) Indehiscent ; (ii) Dehiscent ; (iii) Schizocarpic

(i) Indehiscent fruits : These simple dry fruits are generally of small size and single seeded pericarp does not rupture even after maturity.

(a) Cypsela : It is a small, single seeded dry fruit which develops from bicarpellary, syncarpous inferior ovary. Pericarp and seed coat are free from each other. In these fruits a bunch of hair is attached with the fruit which is known as Pappus. Pappus helps in fruit dispersal. Pappus is modification of calyx.

eg. Compositae family (Sunflower, marigold)

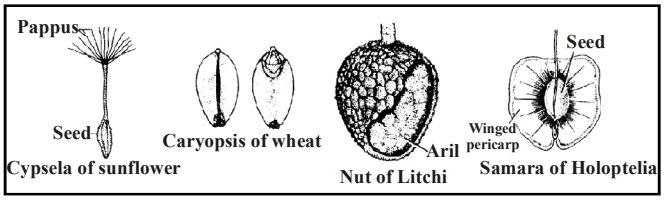
(b) Caryopsis : These are small, single seeded dry fruits. It develop from monocarpellary, superior ovary. Pericarp of these fruits is fused with the seed coat and form a joint surface. These fruits are present in family gramineae. eg. Wheat, rice, maize, etc.

(c) Achene : These are single seeded fruit which develops from monocarpellary superior ovary. In it, pericarp is free from the seed coat. Pappus are absent. eg. ***Clematis, Mirabilis, Boerhaavia***

(d) Nut : This is a single seeded fruit which develop from bi or multicarpellary syncarpous superior ovary. In it pericarp is hard eg. ***Quercus*** (oak), ***Anacardium occidentale*** (Cashewnut) ***Trapa***, (Water chest-nut), Litchi.

In Litchi epicarp and mesocarp is fused and give leathery apperence. Endocarp is membrane like thin. Outer seed coat grows forward and forms an additional coat around the seed which is called as aril. In mature fruit, this aril is fleshy and is only edible part.

(e) Samara : These are dry indehiscent one seeded feathery fruit. It develops from bi or tri carpellary, syncarpous and superior ovary. The main character of these fruits is wing like structure develops from its pericarp which helps in dispersal. eg. ***Holoptelia*** **(Chil-bil),** ***Dioscorea***.



In ***Shorea robusta*** wing develops from calyx instead of pericarp and these fruit are called samaroid.

(ii) Dehiscent Fruits : After ripening pericarp are ruptured and seeds are dispersed outside.

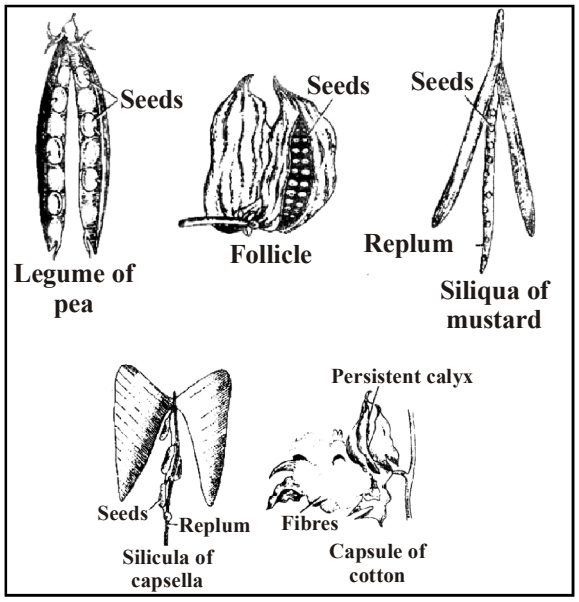
(a) **Legume or pods :** These fruits develop from monocarpellary, unilocular, superior ovary. It is generally long and multiseeded fruit. Dehiscense of fruit occurs at both sutures i.e. Dorsal and ventral side. Dehiscence start from apex and reaches to basal part. eg. Pea, Beans, Gram. When only one or two seeds are present in fruit, then it is also called as pod.

(b) **Follicle :** It is also multiseeded fruit which develops from superior unilocular, monocarpellary ovary but the dehiscence of it occur only at ventral suture. eg. ***Asclepias, Rauwolfia, Vinca, Delphinium***.

(c) **Siliqua :** This fruit develops from bicarpellary, syncarpous superior ovary with parietal placentation. Dehiscence occurs at both dorsal and ventral suture and starts from lower part and proceeds upward. Due to formation of false septum ovary become bilocular. On false septum, seeds are attached, This type of fruit is found in Cruciferae family. eg. Mustard.

(d) **Silicula :** A short broad siliqua is known as Silicula. It is also found in some members of Cruciferae family. eg. Candytuft (***Iberis amara***), Capsella.

(e) **Capsule :** This is dry multichambered and multiseeded fruit and develop from multicarpellary syncarpus, superior ovary. In it, Axile placentation is found and dehiscence occurs by various methods. Poricidal (Poppy), loculicidal (cotton), septifragal (Datura), septicidal (Lineseed).



(iii) **Schizocarpic fruit :** It is a multiseeded fruit. After ripening, it is divided into mericarp and seeds come out after destruction of pericarp. The fruits develop from mono or bi or multicarpellary superior or inferior ovary. The mericarp contains one or two seeds.

(a) **Lomentum :** It develops like legume. Fruits are constricted or divided in one seeded mericarp, after maturity these are separated from each other. Eg ***Tamarind, Cassia fistula, Mimosa pudica, Archis hypogea, Desmodium***.

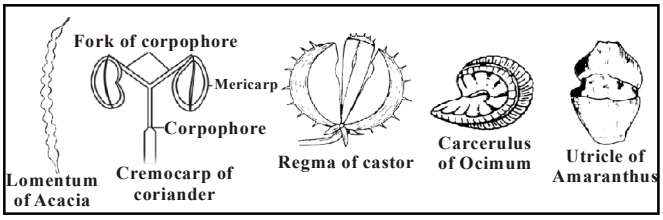
(b) **Cremocarp :** It is a double seeded fruit and develops from bicarpellary, syncarpous, inferior ovary. On maturation, it dehisces from apex to base in such a way that two mericarp forms and each contain one seed. These mericarp are attached with carpophore. Carpophore is the extended part of thalamus. eg. **Coriander, Cuminum, Foeniculum.**

(c) **Regma :** This fruit develops from tri to pentacarpellary, syncarpous superior ovary. In it 3 to 5 locules are present and its fruit breaks into 3 to 5 one seeded part. Each part is known as coccus. At the outer end of pericarp, spines are found. eg. Euphorbiaceae family, Castor has three cocci Geranium has 5 cocci.

(d) **Carcerulus :** It is a dry fruit which develops from multi carpellary or bicarpellary, syncarpous, superior ovary. Number of mericarp is more than locules because of formation of false septum. It divides into four one seeded locules. eg. ***Ocimum*** (Tulsi), ***Salvia.***
In hollyhock and abutilon (family malvaceae), the no. of locules is more than four

(e) **Utricle :** It is a single seeded fruit which has thin membrane. It dehiscence generally from cap. It develops from bicarpellary, unilocular, syncarpous, superior ovary. eg. ***Achyranthes, Amaranthus.***

(f) **Double Samara :** It develop from bicarpellary syncarpous superior ovary. Pericarp develops into two wings. On maturation it divides in two single seeded mericarp eg . samara , acer.



Aggregate fruit

* These fruits develop from multicarpellary apocarpous gynoecium. In apocarpous condition, each carpel is separated from one another, therefore it forms a fruitlet. These fruits are made up of bunch of fruitlets which is known as etaerio.

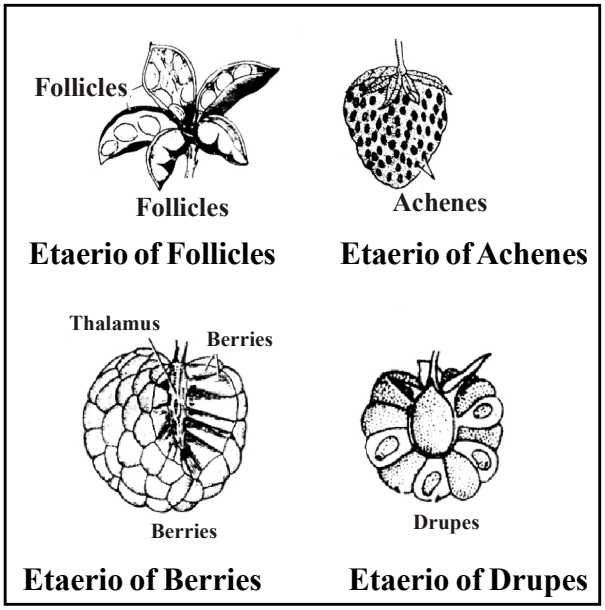
(i) **Etaerio of follicles :** Each fruitlet is a follicle. eg. ***Calotropis, Catharanthus, Magnolia.***

(ii) **Etaerio of achenes :** In this aggregate fruit, each fruitlet is an achene. eg. ***Rananculus***, Strawberry, Rose, Lotus.

* In **lotus**, thalamus becomes spongy and some achenes are embedded in it. In strawberry, thalamus is fleshy and small achenes are found on its surface. In rose, many achenes are present on a saucer (cup) like inner surface of fleshy thalamus.

(iii) **Etaerio of berries :** It is an aggregate of small berries. eg. ***polyalthia, Annona squamosa*** (Custard-apple). In etaerio of Anona all the berries are arranged densely on thalamus.

(iv) **Etaerio of drupes :** In this type of fruit, many small drupes develop from different carpels. eg. Raspberry, Blackberry.



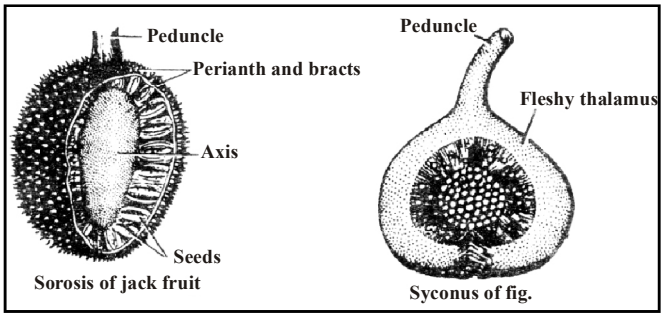
Composite fruit

* All composite fruits are false fruits.
* This type of fruit differ from aggregate fruit that in place of single ovary many ovaries and other floral parts combine together to form fruit.
* In composite fruits, generally whole inflorescence is modified into fruit. These are of two types.

(i) **Sorosis :** This fruit develops from spike, spadix or cartkin inflorescence. eg. Jack fruit, Mulberry, Pineapple

* In jack fruit (Kathal) pistillate flowers are developed around the peduncle. In fruit formation pericarp become spongy and fused.
* In Pine apple peduncle bracts and perianth become fleshy. Due to the fusion of perianths of flower a composite fruit is formed.
* In mulberry perianth become fleshy and axis of every flower becomes thick, sweet and fleshy and are edible.

(ii) **Syconus :** This fruit develops from hypanthodium inflorescence. eg. **Ficus** species like fig, Peepal



* **Geocarpic fruit :** When fruit development occurs inside soil e.g. **ground nut**.

Accessory fruits

* They differ from other fruits in that plant tissues in addition to ovary tissue make up the fruit.
* For example, the edible portion of a strawberry is the red, fleshy receptacle. Apples and pears are also accessory fruits; the outer part of each of these fruits is an enlarged floral tube, consisting of receptacle tissue along with portions of the calyx, that surrounds the ovary.

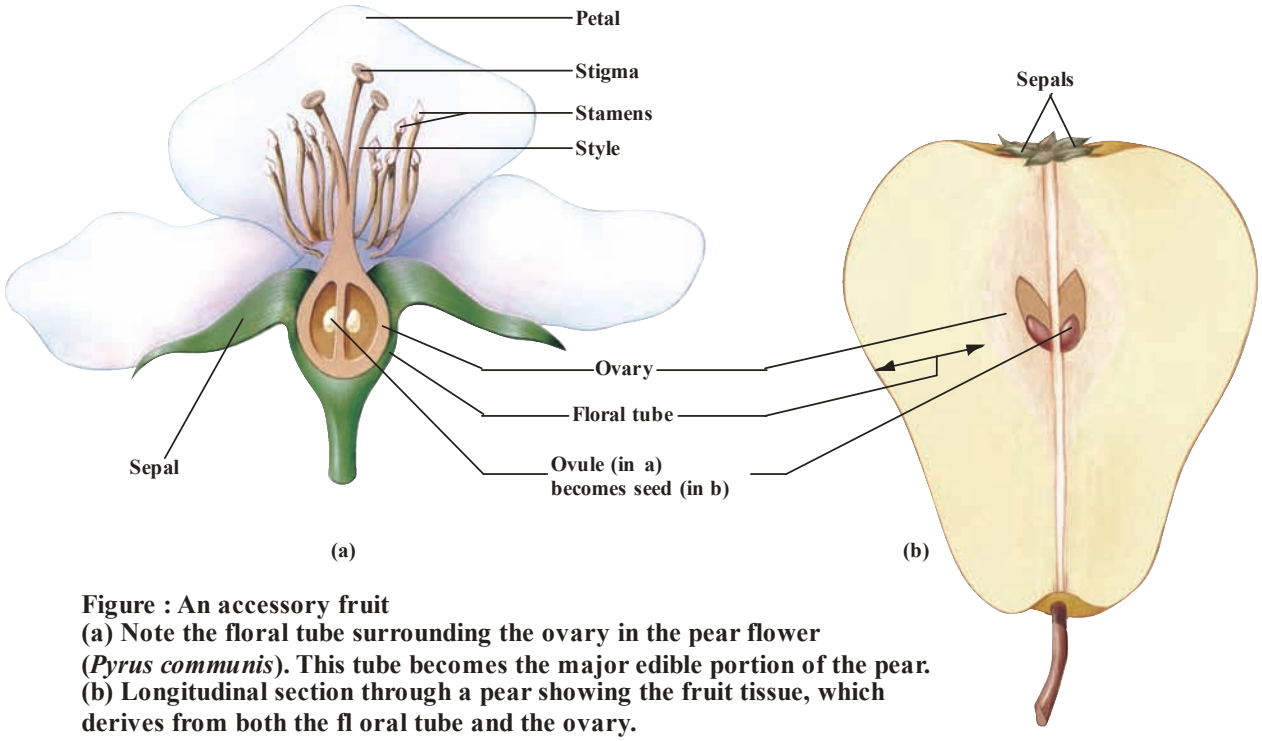
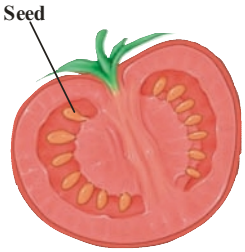


Figure : An accessory fruit
(a) Note the floral tube surrounding the ovary in the pear flower (*Pyrus communis*). This tube becomes the major edible portion of the pear.
(b) Longitudinal section through a pear showing the fruit tissue, which derives from both the fl oral tube and the ovary.

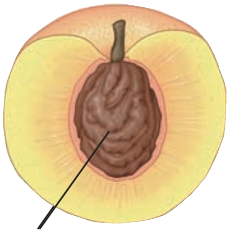
Defense Mechanisms in Plants

(i) **Thorns** : *e.g.,* Lemon, Pomegranate, *Duranta*
(ii) **Spines** : *e.g., Agave Yucca*
(iii) **Prickles** : *e.g.,* Silk cotton tree, Rose
(iv) **Stinging hair** : *e.g., Urtica dioica*
(v) **Glandular hair** : *e.g., Jatropha, Boerhaavia,* Tobacco
(vi) **Stiff hair** : *e.g., Gnaphalium*
(vii) **Latex** : *e.g., Ficus, Nerium , Euphorbia*
(viii) **Alkaloids** : *e.g. ,* Poppy, *Datura*
(ix) **Geophilous habit** : *e.g.,* Ginger, Turmeric, *Colocasia,* Onion
(x) **Mimicry** : *e.g., Arisaema, Sansevieria*

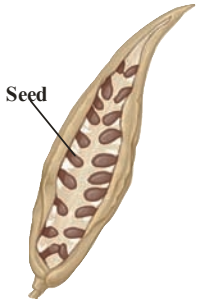
Fruit types : Fruits are botanically classified into four groups–simple, aggregate, multiple, and accessory–based on their structure and mechanism of seed dispersal.



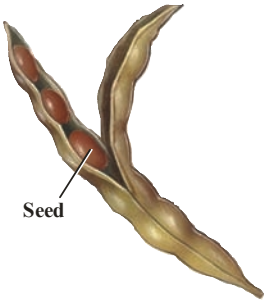
Berry (simple fruit)
A simple, fleshy fruit in which the fruit wall is soft throughout.
Tomato (Lycopersicon lycopersicum)



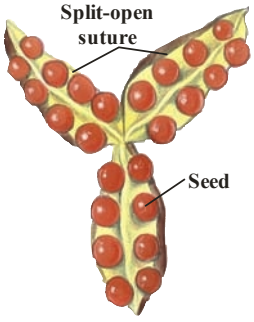
Drupe (simple fruit)
A simple, fleshy fruit in which the inner wall of the fruit is a hard stone.
Peach (Prunus persica)



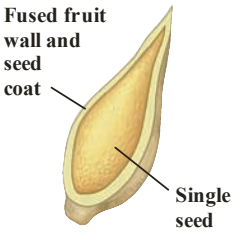
Follicle (simple fruit)
A simple, dry fruit that splits open along one suture to release its seeds; fruit is formed from ovary that consists of a single carpel.
Milkweed (Asclepias syriaca)



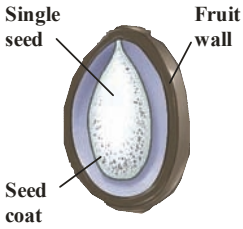
Legume (simple fruit)
A simple, dry fruit that splits open along two sutures to release its seeds; fruit is formed from ovary that consists of a single carpel.
Green bean (Phaseolus vulgaris)



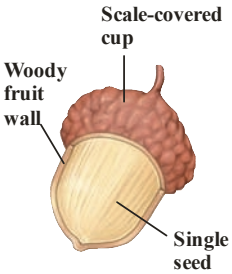
Capsule (simple fruit)
A simple, dry fruit that splits open along two or more sutures or pores to release its seeds; fruit is formed from ovary that consists of two or more carpels.
Iris (Iris)



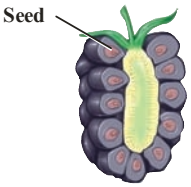
Caryopsis (simple fruit)
A simple, dry fruit in which the fruit wall is fused to the seed coat.
Wheat (Triticum)



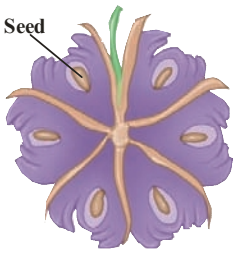
Achene (simple fruit)
A simple, dry fruit in which the fruit wall is separate from the seed coat.
Sunflower (Helianthus annuus)



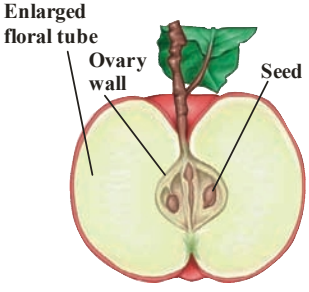
Nut (simple fruit)
A simple, dry fruit that has a stony wall, is usually large, and does not split open at maturity.
Oak (Quercus)



Aggregate fruit
A fruit that develops from a single flower with several to many pistils (i.e., carpels are not fused into a single pistil).
Blackberry (Rubus)



Multiple fruit
A fruit that develops from the ovaries of a group of flowers.
Mulberry (Morus)



Accessory fruit
A fruit composed primarily of nonovarian tissue (such as the receptacle or floral tube).
Apple (Malus sylvestris)

Edible parts of some fruits :

S.No.	Fruit	Type of fruit	Edible part
(i)	***Abelmoschus esculentus***/Lady's Finger	Capsule	Whole fruit (vegetable)
(ii)	***Achrus sapota***/Cheeku	Berry	Mesocarp and endocarp
(iii)	***Aegle marmelos***/Wood Apple	Amphisarca	Pulpy endocarp (inner pericarp) and placentae.
(iv)	***Anacardium occidentale***/Cashewnut	Nut	Cotyledons and Peduncle
(v)	***Ananas comosus*** = Pineapple	Sorosis	Outer fleshy axis, bracts fused perianth & Pericarp
(vi)	***Annona squamosa***/Custard Apple	Etaerio of Berries	Mesocarp (Pericarp)
(vii)	***Arachis hypogea***/Ground nut/Peanut	Lomentum	Seeds/Cotyledons
(viii)	***Areca catechu***/Betel or Areca Nut	Berry	Seed/Endosperm
(ix)	***Artocarpus integrifolia***/Jack Fruit	Sorosis	Bracts, perianth and seeds
(x)	***Carica papaya***/Papaya	Berry	Mesocarp and Endocarp
(xi)	Cereals, ***Avena sterilis*** (Oat), ***Oryza sativa*** (Rice), ***Hordeum vulgare*** (Barley), ***Triticum duram*** (Durum Wheat), ***Triticum aestivum*** (Bread Wheat), ***Zea mays*** (Maize)	Caryopsis	Whole fruit (Endosperm and embryo)
(xii)	***Citrus reticulate***/Orange, ***Citrus sinensis***/Sweet Orange, ***Citrus aurantifolia***/Lime	Hesperidium	Glandular hair
(xiii)	***Cocos nucifera***/Coconut	Drupe	Endosperm
(xiv)	***Cucumis melo***/Musk Melon	Pepo	Mesocarp, Endocarp & seeds

(xv)	***Cucumis vulgaris***/Water melon	Pepo	Mesocarp, Endocarp & seeds
(xvi)	***Cucumis sativus***/Cucumber	Pepo	Mesocarp, Endocarp and Young seed
(xvii)	***Ficus carica***/Fig/Anjeer	Syconus	Fleshy receptacle
(xviii)	***Fragaria vesca***/Strawberry	Etaerio of achenes	Fleshy thalamus
(xix)	***Grewia asiatica***/Dhamin/Phalsa	Drupe	Mesocarp
(xx)	***Juglans regia***/Walnut	Drupe	Lobed cotyledons
(xxi)	***Litchi chinensis***/Litchi	Nut	Aril
(xxii)	***Lycopersicon esculentum***/Tomato	Berry	Whole fruit (Pericarp and placenta)
(xxiii)	***Pyrus malus*** (M. sylvestris)/Apple	Pome	Fleshy thalamus
(xxiv)	***Mangifera indica***/Mango	Drupe	Mesocarp
(xxv)	***Morus alba, M. nigra***/Mulberry	Sorosis	Fleshy perianth, Fleshy axis
(xxvi)	***Phoenix dactylifera***/Date	Berry	Pericarp
(xxvii)	***Prunus amygdalus***/Almond	Drupe	Seed (Cotyledons and embryo)
(xxviii)	***Musa paradisiaca***/Banana	Berry	Less developed Mesocarp & well developed endocarp
(xxix)	***Psidium guajava***/Guava	Berry	Thalamus, pericarp and placenta
(xxx)	Pulses	Pod/Legume	Seed
(xxxi)	***Punica granatum***, Pomegranate/Anar	Balausta	Testa
(xxxii)	***Pyrus comunis***/Pear	Pome	Fleshy thalamus

(xxxiii)	***Solanum melongena***/Brinjal	Berry	Whole fruit (Pericarp & Placenta)
(xxxiv)	***Tamarindus indica***/Tamarind	Lomentum	Pericarp (Mesocarp)
(xxxv)	***Trapa bispinosa***/Water Chestnut/Singhara	Nut	Seed
(xxxvi)	***Vitis vinifera***/Grape	Berry	Whole fruit (Pericarp and placenta)
(xxxvii)	***Zizyphus mauritiana***/Jujube/ Chinese Dates/Ber	Drupe	Epicarp and mesocarp

THE SEED

* The ovules after fertilization develop into the seeds.
* A seed is made up of seed coat and an embryo.
* An embryo is made up of an embryonic axis having plumule and radicle with one or two cotyledons (One cotyledon Example - Maize, Two cotyledon Example - Pea).

Structure of a Dicotyledonous seed

Dicots have two cotyledons inside the seed coat. They are usually rounded and fat, because they contain the food store to feed the growing embryo.

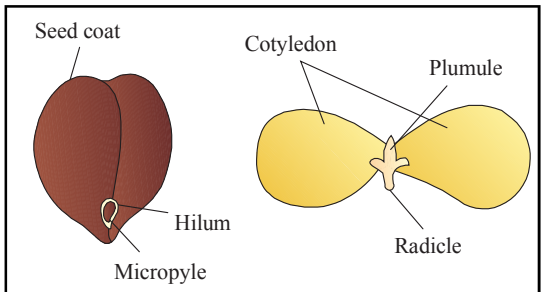


Figure : Structure of dicotyledonous seed

Structure of a Monocotyledonous seed

Monocots have only one cotyledon inside the seed coat. It is often only small because the endosperm to feed the new plant is not inside the cotyledon.

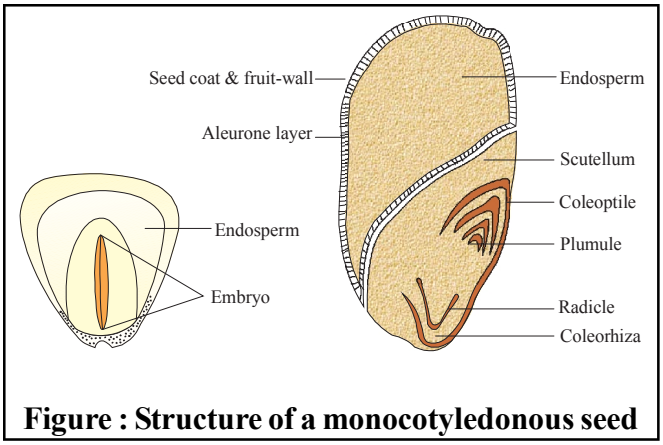


Figure : Structure of a monocotyledonous seed

Dispersal of fruits and seed

* The seeds falling directly under the mother plant have to germinate and develop under limited food supply and space. To overcome this problem, the fruits and seeds have developed several special devices for wide dispersal.
* The natural agents like wind, water, animals and even mechanism of dehiscence in some fruits, help the seeds and fruits to disperse from one place to another, and to long distances from the parent plant.

Wind (Anemochory) :

* In the species where the seeds are light in weight or have some accessory part to help dissemination, are dispersed by the air current.
* The seeds of Drum-stick and Cinchona, and fruits of yam, maple and sal tree, are having appendages in the form of thin, flat and membranous wings, which help them to float in the air and be carried away to long distances.

* In the members of Asteraceae, the calyx is modified into hair like structures called pappus. They persist in fruit and open out like umbrella, helping the seeds to float in the air.
* In poppy and prickly poppy (**Argemone**), the fruit dehisces and seeds are thrown out to a distance away from the parent plant. (Censor mechanism)
* The seeds of Calotropis, Alstonia and cotton are provided with hair and cover sufficient distances alongwith the wind.
* The seeds of orchids and some grasses are very small and light in weight and may be easily carried away by wind to far off places.

Water (Hydrochory) :

* The fruit and seeds with specialised devices which may be in the form of spongy and fibrous outer walls as in coconut and spongy thalamus as in lotus, and small seeds with airy aril as in water lily, float very easily in water and are carried away to long distances with the water current.

Animal (Zoochory) :

* The fruit and seeds with hooks, spines, bristles, stiff hair, etc., get attached to the body of animals and are carried away by them to distant places.
* Fruits of ***Xanthium*** and ***Urena*** bear curved hooks.
* Spear grass has a bunch of stiff hair.
* ***Tribulus*** has sharp and rigid spines.
* ***Boerhaavia*** has sticky hair, which help their dispersal by animals. In *Martynia* two curved hooks are present.
* The edible fruits like guava, grape, fig and plum are dispersed by birds and even human beings by feeding on them and passing out undigested seeds with faeces or by carrying them to other places for later feeding.

FAMILIES OF ANGIOSPERM

Semi-technical description of a typical flower plant

* The plant is described beginning with its habit, vegetative characters roots, stem and leaves and then floral characters inflorescence and flower parts. After describing various parts of plant, a floral diagram and a floral formula are presented. The floral formula is represented by some symbols. In the floral formula, **Br** stands for bracteate, **K** stands for calyx , **C** for corolla, **P** for perianth, **A** for androecium and **G** for , Gynoecium G for superior ovary and $\bar{G}$ for inferior ovary, ♂ for male, ♀ for female, ⚥ for bisexual plants, ⊕ for actinomorphic and % for zygomorphic nature of flower. Fusion is indicated by enclosing the figure within bracket and adhesion by a line drawn above the symbols of the floral parts.
* A floral diagram provides information about the number of parts of a flower, their arrangement and the relation they have with one another
* The position of the mother axis with respect to the flower is represented by a dot on the top of the floral diagram.
* Calyx, corolla, androecium and gynoecium are drawn in successive whorls, calyx being the outermost and the gynoecium being in the centre. Floral formula also shows cohesion and adhesion within parts of whorls and in between whorls.

* **The symbols used in Floral Formula**

(1)	Br	:	Bracteate flower
(2)	Ebr	:	Ebracteate flower (bract absent)
(3)	⊕	:	Actinomorphic flower
(4)	%	:	Zygomorphic flower
(5)	⚥	:	Bisexual flower
(6)	♂	:	Unisexual; male flower
(7)	♀	:	Unisexual; female flower
(8)	K	:	Calyx
	K_n	:	Polysepalous
	$K_{(n)}$	:	Gamosepalous
	where n = Number of sepals		
(9)	Epi	:	Epicalyx (below sepals)
(10)	C	:	Corolla
	C_n	:	Polypetalous
	$C_{(n)}$	:	Gamopetalous
	where n = Number of petals		
(11)	P	:	Perianth

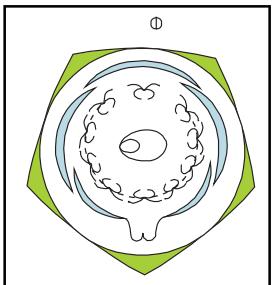
(12) A : Androecium
A_{∞} : Infinite stamens
$\overset{\frown}{C\ A}$: Epipetalous stamens
$\overset{\frown}{P\ A}$: Epitepalous or epiphyllous stamens

(13) G : Gynoecium
$\underline{G}_{(n)}$: Syncarpous ovary
G_n : Apocarpous ovary
$\underline{G}_n$: Superior ovary
$\overline{G}_n$: Inferior ovary
where n Number of carpels

(14) In the flora diagram the dot (•) represents the position of mother axis. It denotes the posterior side of the flower.

Description of some important families

1. Fabaceae : This family was earlier called Papilonoideae, a subfamily of family Leguminosae. It is distributed all over the world.



Floral diagram

Vegetative Characters : Trees, shrubs, herbs; root with root nodules.
Stem: erect or climber.
Leaves: alternate, pinnately compound or simple; leaf base, pulvinate; stipulate; venation reticulate.
Floral characters :
Inflorescence: racemose.
Flower: bisexual, zygomorphic.
Calyx: sepals five, gamosepalous; 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: ten, diadelphous, anther dithecous
Gynoecium: ovary superior, mono carpellary, unilocular with many ovules, style single.
Fruit: legume; seed: one to many, non-endospermic.

Floral Formula: . % $\overset{\male}{\underset{\female}{\oplus}}$ $K_{(5)}\ C_{1+2+(2)}\ A_{(9)+1}\ \underline{G}_1$

Economic importance : Many plants belonging to the family are sources of pulses (gram, arhar, sem, moong, soyabean; edible oil (soyabean, groundnut); dye (indigofera); fibres (sunhemp); fodder (Sesbania, Trifolium), ornamentals (lupin, sweet pea); medicine (muliathi).

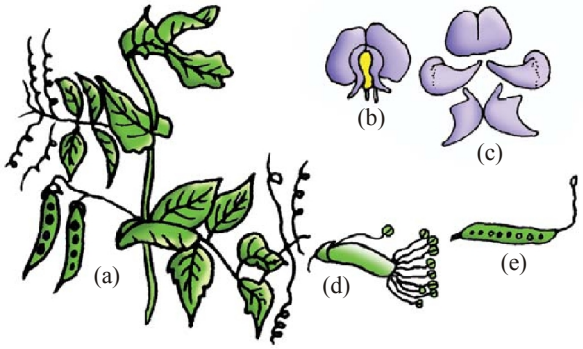
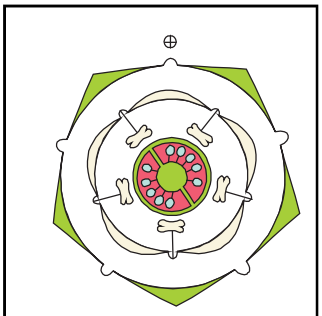


Figure : *Pisum sativum* (pea) plant : (a) Flowering twig (b) Flower (c) Petals (d) Reproductive parts (e) L.S.carpel

2. Solanaceae : It is a large family, commonly called as the potato family. It is widely distributed in tropics, subtropics and even temperate zones.



Floral diagram

Vegetative Characters : Plants mostly, herbs, shrubs and small trees .
Stem: herbaceous rarely woody, aerial; erect, cylindrical, branched, solid or hollow, hairy or glabrous, underground stem in potato (Solanum tuberosum).
Leaves: alternate, simple, rarely pinnately compound, exstipulate; venation reticulate.
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 swollen with many ovules, **axile**.
Fruits: berry or capsule.
Seeds: many, endospermous.

Floral Formula: $\oplus \, ♀ \, \overset{\frown}{K_{(5)} C_{(5)}} A_{(5)} \underline{G}_{(2)}$
Economic Importance : Many plants belonging to this family are source of food (tomato, brinjal, potato), spice (chilli); medicine (belladonna, ashwagandha); fumigatory (tobacco); ornamentals (petunia).

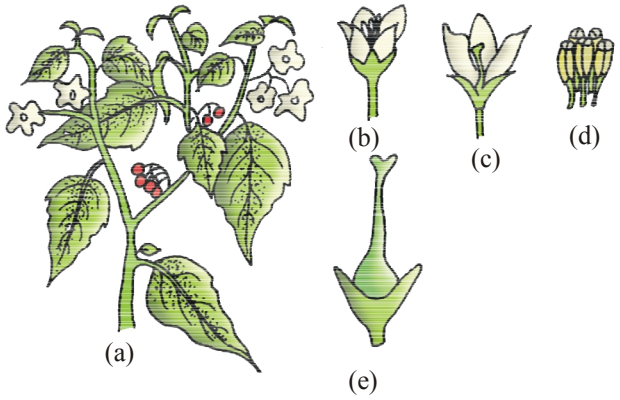
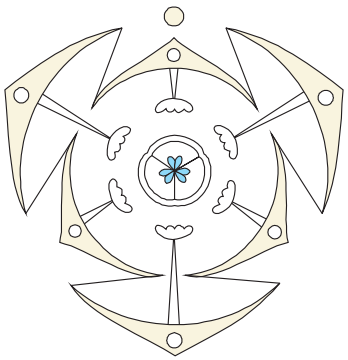


Figure : Solanum nigrum (makoi) plant :
(a) Flowering twig (b) Flower
(c) L.S. of flower (d) Stamens (e) Carpel

3. Lilaceae : Commonly called the Lily family is a characteristic representative of monocotyledonous plants. It is distributed world wide.



Floral diagram

Vegetative characters: Perennial herbs with underground bulbs/corms/rhizomes.
Leaves mostly basal, alternate, linear, exstipulate with parallel venation.
Floral characters :
Inflorescence: solitary/cymose; often umbellate clusters .
Flower: bisexual; actinomorphic.
Perianth tepal six (3+3), often united into tube; valvate aestivation Androcium: stamen six, (3+3)
Gynoecium: tricarpellary, syncarpous, ovary superior, trilocular with many ovules; axile placentation.
Fruit: capsule, rarely berry.
Seed: endospermous
Floral Formula: . $\oplus \, ♀ \, P_{3+3} A_{3+3} \underline{G}_{(3)}$
Economic Importance : Many plants belonging to this family are good ornamentals (tulip, Gloriosa), source of medicine (Aloe), vegetables (Asparagus), and colchicine (Colchicum autumnale).

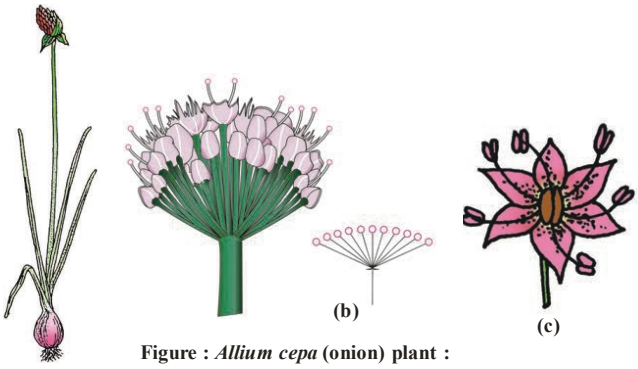


Figure : *Allium cepa* (onion) plant :
(a) Plant (b) Inflorescence (c) Flower

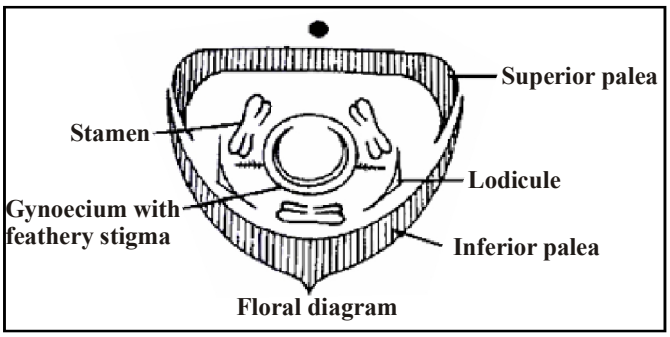
4. Poaceae or Gramineae:
Most advanced family among monocots

(1) Inflorescence spike of spikelets *(Triticum)*, panicle of spikelets *(Avena)*.
(2) Flowers small, sessile, surrounded by two scales, **lemma** (fertile bract, inferior or outer palea) and **palea** (superior or inner palea) . The lemma bears a long, stiff process called awn.
(3) Flowers zygomorphic, incomplete, hypogynous.
(4) Perianth represented by two or sometimes three lodicules.
(5) Androecium 3 or 6, polyandrous, versatile fixation of anthers.
(6) Monocarpellary, superior, unilocular ovary with basal placentation. Stigma is feathery.
(7) Fruit is caryopsis or nut *(Dendrocalamus)* or berry *(Bambusa)*

* **Floral formula -**

$\% \, ♂ \, P_{2 \text{ or } 3 \text{ (lodicules)}} \, A_{3 \text{ or } 6} \, \underline{G}_{1}$

* **Diagram -**



Floral diagram

Important plants

(1) *Avena sativa* (Oat)
(2) *Triticum aestivum* (Wheat)
(3) *Sorghum vulgare* (Jowar)
(4) *Pennisetum typhoides* (Bajra)
(5) *Hordeum vulgare* (Jau)
(6) *Saccharum officinalis* (Sugarcane)
(7) *Zea mays* (Maize)
(8) *Oryza sativa* (Rice)
(9) *Bambusa tulda* (Bamboo)
(10) *Cynodon dactylon* (Doob grass)
(11) *Secale cereale* (Rye)
(12) *Vetiveria zizanioides* (Khus-khus)
(13) *Cymbopogon citratus* (Lemon grass)

CONCEPT REVIEW

* Flowering plants exhibit enormous variation in shape, size, structure, mode of nutrition, life span, habit and habitat.
* They have well developed root and shoot systems.
* Root system is either tap root or fibrous. Generally, dicotyledonous plants have tap roots while monocotyledonous plants have fibrous roots.
* The roots in some plants get modified for storage of food, mechanical support and respiration.
* The shoot system is differentiated into stem, leaves, flowers and fruits.
* The morphblogical features of stems like the presence of nodes and internodes, multicellular hair and positively phototrophic nature help to differentiate the stems from roots.
* Stems also get modified to perform diverse functions such as storage of food, vegetative propagation and protection under different conditions.
* Leaf is a lateral outgrowth of stem developed exogenously at the node.
* These are green in colour to perform the function of photosynthesis.
* Leaves exhibit marked variations in their shape, size, margin, apex and extent of incisions of leaf blade (lamina).
* Like other parts of plants, the leaves also get modified into other structures such as tendrils, spines for climbing and protection respectively.
* The flower is a modified shoot, meant for sexual reproduction, The flowers are arranged in different types of inflorescences.
* They exhibit enormous variation in structure, symmetry, position of ovary in relation to other parts, arrangement of petals, sepals, ovules etc.
* After fertilisation, the ovary is converted into fruits and ovules into seeds.
* Seeds either may be monocotyledonous or distotyledonous.
* They vary in shape, size and period of viability.
* The floral characteristics form the basis of classification and identification of flowering plants.

* This can be illustrated through semi-technical description of families.
* Hence, a flowering plant is described in a definite sequence by using scientific terms.
* The floral features are represented in the summarised form as floral diagrams and floral formula.

IMPORTANT POINTS

* *Cascuta* is total stem parasite.
* Plant having column of vascular tissues bearing fruits and having a tap root system is dicot.
* Prolongation of radicle gives rise to primary root.
* Carrot is root.
* Root cap is absent in hydrophytes.
* Tap root = Carrot
  Prop root = Banyan tree
  Adventitious root = Sweet potato
* Bulb is modified shoot.
* Stem tendrils occur in *Vitis*.
* Bamboo is culm.
* Underground stem = Potato
  Stem tendril = Cucumber
  Stem thorn = *Citrus*
  Flattened stem = *Opuntia*
  Fleshy cylindrical stem = *Euphorbia*.
* In Tamarind (Imli) the pinnate leaf is paripinnate.
* Petiole is modified into tendril is *Clematis*.
* A leaf is identified from presence of axillary bud.
* Parallel venation occurs in monocots.
* Acicular = Pine
  Linear = Grass
  Lanceolate = *Nerium*
  Oblong = Banana
* Venation is generally reticulate in dicot plants.
* The central stalk-like structure of the spikelet is Rachilla.
* The inflorescence present in *Euphorbia* is cyathium.
* The inflorescence in family compositae is caapitulum.
* Edible part of cauliflower is inflorescence.
* Verticillaster type of inflorescence occurs in *ocimum*.
* Cymose inflorescence is found in *Solanum*.
* Liqulate corolla is also strap-shaped.
* Axis developing between androecium and gynaecium is gynophore.
* Part of pistil which receives pollen is stigma.
* Pappus is modification of calyx.
* Diadelphous (9+1) stamens occur in papilionatae.
* Anthers represents male sporophylls.
* Anthesis is opening of floral bud.
* Clove used as spice represents flower buds.
* Epicalyx occurs in china rose.
* Aestivation found in pea flowers is vexillary.
* Basal = Marigold
  Free central = *Dianthus*
  Parietal = Argemone
  Axile = Lemon
  Marginal = Pea
* In pineapple (*Ananas sativus*) the fruit is sorosis.
* Fruit of tomato is berry as the pericarp is fleshy with pulpy endocarp.
* Edible part of mango is mesocarp.
* Fruit of groundnut is legume.
* In groundnut the food / oil reserve is present in cotyledons.
* Edible part of guava is thalamus and pericarp.
* An example of pseudocarp is pear.
* Berry = Tomato
  Siliqua = Mustard
  Sorosis = Jack fruit
  Syconus = Ficus
* In coconut fruit, the hard shell is endocarp.
* Pericarp develops from ovary wall.
* Seed develops from ovule.
* Aleurone layer helps in utilization of stored food.
* Embryo of sunflower has two cotyledons.
* Maize, wheat and rice are monocot albuminous seed.
* A dicotplant lacking cotyledons is *cuscuta*.
* The portion of embryo axis above cotyledons is epicotyl.
* **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.
* **Zygomorphic :** Zygomorphic flowers are those flowers which can be divided into two similar halves by a single vertical plane. Examples of these flowers include pea and beans.

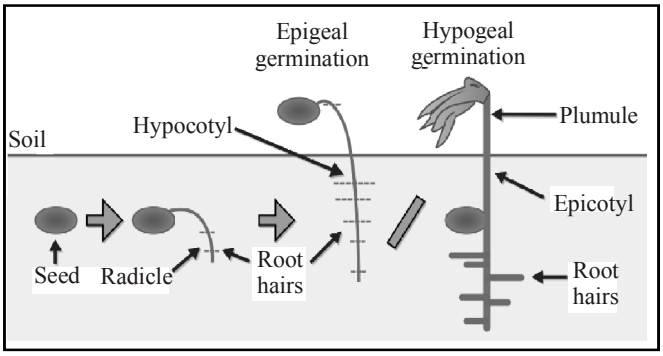
* **Racemose V/s cymose inflorescence**

S.N.	Racemose	Cymose
1	Main axis continues to grow.	Main axis terminates.
2	Flowers are arranged in acropetal order.	Flowers are arranged in basipetal order.

* **Fibrous root V/s adventitious root**

S.N.	Fibrous root	Adventitious root
1	Arise from embryonal axis.	Do not come from embryonal axis.
2	Main function is absorption of mineral and water.	It can provide additional support and can carry out vegetative propagation.

* In hypogeal germination the epicotyl extends and the cotyledons stay in the ground, whereas in epigeal germination the hypocotyl extends and the cotyledons come out of the ground. (It is where the cotyledons end up that defines the terms - hypo for under and epi for above).
In hypogeal germination the cotyledons provide a food source for the growing seedling, eventually shrivelling up. The first leaves are formed from the plumule and are sometimes referred to as 'true leaves'.
* In epigeal germination, the cotyledons become photosynthetic, and are often known as the 'seed leaves', the second leaves to form derive from the plumule. Phaseolus vulgaris (common bean)is an example of a plant that has epigeal germination. *Vicia faba* is an example of a plant that has hypogeal germination.



* (a) Carrot — Tap roots
(b) Cotocesie — Stem
(c) Sweet potato — Roots
(d) Asparagus — Roots
(e) Radish — Roots
(f) Potato — Stem
(g) Dahlia — Adventitious roots
(h) Turmeric — Adventitious roots
(i) Gladiolus — Stem
(j) Ginger — Stem
(k) Portulaca — Adventitious roots
* Fabaceae is the alternative name of the **Papilionaceae.**
* Compositae = **Asteraceae** is the largest family of angiosperms.
* ***Desmodium latifolium*** the member of papilionateae family which is halophyte.
* J.C. Bose conducted experiment of plant movement on ***Desmodium gyrans***.
* Pollen grains in Mimosoidae are usually present in the form of packets.
* Soyabean contains more protein than meat.
* Aloin alkaloides are obtained from ***Aloe*** plant of Liliaceae.
* ***Smilax*** is a monocot, having, reticulate venation.
* The flowers enter into the soil after fertilization in ground nut (Geocarpic fruit).
* Pulses are rich source of proteins.
* Arrangement of flowers on peduncle and study of flowers is called **Anthology.**
* **National flower** of India is **Lotus** (***Nelumbo nucifera***)
* **Longest styles** are found in **maize.**
* **Longest inflorescence** is in **Agave** (12m),
* In **Mussanda**, One (odd) sepal is enlarged to form a leafy structure called **Advertisement Flag.**
* **National fruit** of India is **Mango** (***Mangifera Indica***)
* **Largest fruit** and **largest seed** is of ***Lodoicea maldivica*** (double coconut, weight is 18 Kgs.)
* **False nuts** are **Coconut** (drupe), **Areca nut** (Berry), **Pea nut or Ground nut** (Lomentum), **Walnut** (drupe) and **Chilgoza** (seed)
* Dispersal of fruits and seeds by ants is called **myrmechory** eg. ***Ulex*** and ***Trillium*** (seeds).
* ***Monophyllea*** is a plant with **single leaf**.

* ***Welwitschia*** (a gymnosperm) is a plant with **two leaves** throughout the life.
* ***Victoria regia*** has **broadest** leaves each with a diameter of 1.5–1.8m.
* Leaves are **longest** in ***Raphia vinifera*** (10–15m)
* **Largest bud** is cabbage.
* Shruby climbers which climb with the help of hooks are called **Stragglers** eg. ***Bougainvillea, Artobotrys.***
* **Marine** angiosperm is ***Zostera***.
* **Smallest** angiosperm is ***Wolffia*** (less than 0.1 mm) and **largest** or **tallest** angiosperm is ***Eucalyptus regnans*** (height more that 114 m or 375 ft)
* Plants with **roots only** are ***podostemon***, ***Arceuthobium***, ***Rafflesia*** and ***Sapria***.
* Maize (***Zea mays***) has largest stigma and style.
* The sterile pistil is called pistalloide.
* National tree of India → Ficus bengalansis.

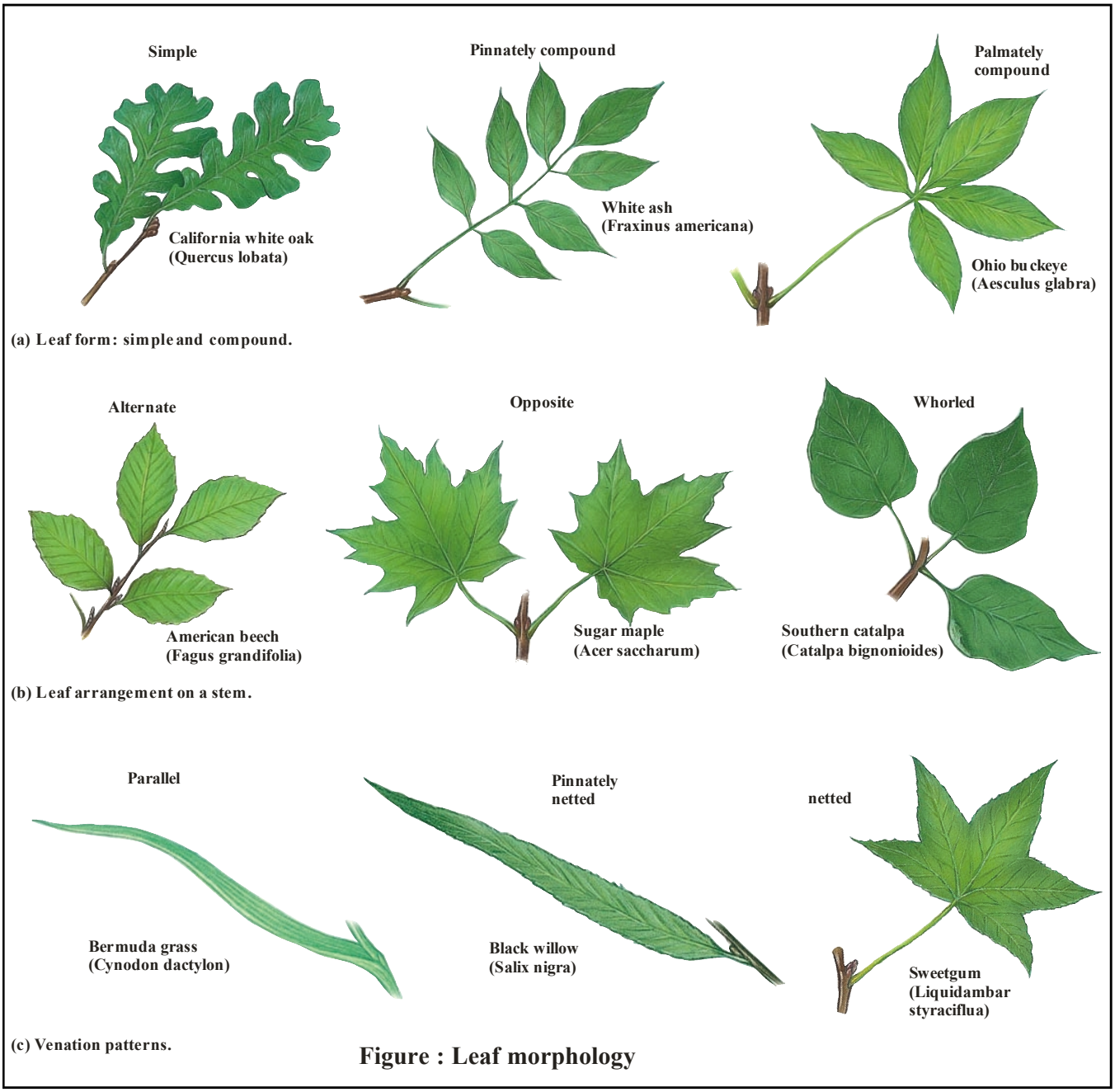
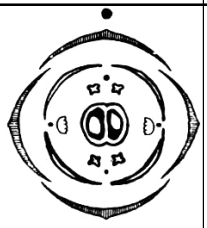
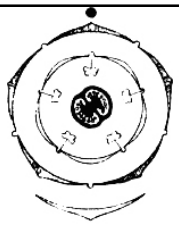
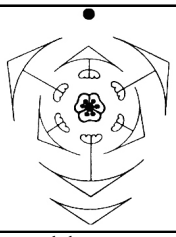
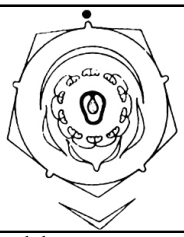


Figure : Leaf morphology

Families of Angiosperms

	Cruciferae (Mustard family)	Solanaceae (Potato family)	Liliaceae (Lily family)	Malvaceae (Cotton family)	Fabaceae (Pea family)
Floral formula	**Ebr** ⊕ ♂♀ $K_{2+2}\ C_{4x}\ A_{2+4}\ \underline{G}_{(2)}$	Br or Ebr ⊕ ♂♀ $K_{(5)}\ \overset{\frown}{C_{(5)}}\ A_5\ \underline{G}_{(2)}$	Br ⊕ ♂♀ $P_{3+3}\ A_{3+3}\ \underline{G}_{(3)}$	Br ⊕ ♂♀ $Epi_{3-7}K_{(5)}\ \overset{\frown}{C_5}\ A_{(\infty)}\underline{G}_{(5-\infty)}$	Br % ♂♀ $K_{(5)}\ C_{1+2+(2)}\ A_{(9)+1}\ \underline{G}_{(}$
Floral diagram					
Class	Dicotyledonae	Dicotyledonae	Monocotyledonae	Dicotyledonae	Dicotyledonae
Subclass	Polypetalae	Gamopetalae	---	Polypetalae	Polypetalae
Series	Thalamiflorae	Bicarpellatae	Coronarieae	Thalamiflorae	Calyciflorae
Order	Parietales	Polymoniales	---	Malvales	Rosales
Special character	Pungent odour, Replum developed from thalamus (False septum)	Odd sepal-posterior Ovaries-turn by 45º Posterior carpel - right Anterior carpel - left	Trimerous	Epicalyx are 3-7, The mucilage is present in various plant organs like flower	Odd sepal – anterior Papilionaceous petals and diadelphous (9) + 1.
Inflorescence	Generally raceme ***Iberis amara*** – corymb **Cauliflower** – compd. corymb. **Mustard** – Corybose raceme	Cymose or Solitary axillary	Scapigerous umbel in onion and garlic, Panicle-**yucca, dracaena** Scorpoid-**Haemorocalis** Spadix-**Aloe vera**	Cymose or Solitary axillary or Solitary terminal	Raceme sometimes Solitary Axillary (***Lathyrus aphaca***)
Calyx	Quincuncial aestivation Imbricate / Valvate	Valvate Persistant – (Accrescent) (Brinjal)	---	Valvate aestivation Persistant calyx are present it means present on fruit eg. Gossypium	Valvate / Imbricate
Corolla	Valvate Corolla $\xrightarrow[\text{Into}]{\text{trans}}$ stamen Incapsella	Valvate Imbricate	---	Twisted aestivation	Vexillary / Descending imbricate Odd petal (Vexillum) Posterior
Androecium	Outer stamen – antisepalous Inner stamen – antipetalous Basifixed. Dithecous Tetradynomous	Introse, basifixed Anther-Dithecous Dehiscence Longitudinal-Generally Apical pores-Solanum	3+3 Basifixed Introse	Stamens indefinite Monoadelphous From staminal tube Monothecous	Diadelphous (9) + 1 Free stamen – posterior
Gynoecium	Parietal placentation Ovule is campylotropous Unilocular $\xrightarrow{\text{replum}}$ Bilocular	Axile placentation Bilocular	Axile placentation Trilocular Stigma-trifid	Stigma are free so that gynoecium is incompletely syncarpous. Axile placentation	Marginal placentation Unilocular
Fruit	Siliqua generally silicula – capsella	Berry sometimes capsule Datura-Septifragal capsule	Berry – Lily Capsule – Onion	Loculicidal capsule Carcerulus fruit is found in holly hock	Legume / Pod Lomentum – Arachis
Leaf		Simple, Exsipulate	Cauline, Radical (Asphodelus), Parallel venation, Tunicated leaves.	simple	Stipulate, imperipinnate Leaflet tendril – ***Pisum sativum*** & ***Lathyrus***, stipules – foliaceous.
Root	Taproot, fusiform root is present in Raphanus	Tap root system	Adventitious fibrous root, Fasciculated root in Asparagus.	taproot	Nodulated – Rhizobium is present
Stem		Bicollateral V.B. are present	Mostly underground, Bulb-tunicated leaves Garlic, Corm (Colchicum)	Mostly aerial	Twinner or climber and erect aerial
Habit	Generally Herb	Herbs and shrubs	Herbs, climbers, Abnormal secondary growth-draceena, Yucca.	Herbs & shrub	Herbs
Perianth	....	....	Tepal 6, polytepalous Imbricate tepal	---	---

QUESTION BANK

EXERCISE - 1 (LEVEL-1) [NCERT EXTRACT]

SECTION - 1 (VOCABULARY BUILDER)

Choose one correct response for each question.

For Q.1-Q.6

Match the column I (Basic terms) with columnII (definition).

Q.1

Column I	Column II
(a) Morphology	(i) The study of various external features of the organism.
(b) Adventitious	(ii) A root that develops from any part other than radicle.
(c) Aerial	(iii) Roots growing in the air.
(d) Fibrous	(iv) A primary root that more or less enlarges and grows downward into the soil.
(e) Taproot	(v) Roots are thread-like and normally tough.

(A) (a) - i, (b)-ii, (c)-iii, (d)-v, (e)-iv
(B) (a) - i, (b)-ii, (c)-iii, (d)-iv, (e)-v
(C) (a) - ii, (b)-i, (c)-iii, (d)-iv, (e)-v
(D) (a) - i, (b)-iii, (c)-ii, (d)-iv, (e)-v

Q.2

Column I	Column II
(a) Nodes	(i) The region of the stem where leaves are born.
(b) Stipules	(ii) The leaf may bear two lateral small leaf like structures.
(c) Pulvinus	(iii) A swollen leaf base.
(d) Lamina	(iv) green expanded part of the leaf with veins and veinlets.
(e) Venation	(v) The arrangement of veins and the veinlets in the lamina of leaf.

(A) (a) - i, (b)-ii, (c)-iii, (d)-v, (e)-iv
(B) (a) - i, (b)-ii, (c)-iii, (d)-iv, (e)-v
(C) (a) - ii, (b)-i, (c)-iii, (d)-iv, (e)-v
(D) (a) - i, (b)-iii, (c)-ii, (d)-iv, (e)-v

Q.3

Column I	Column II
(a) Phyllotaxy	(i) The pattern of arrangement of leaves on the stem or branch.
(b) Inflorescence	(ii) The arrangement of flowers on the floral axis.
(c) Bracteate	(iii) Flower divided into two similar halves only in one particular vertical plane.
(d) Actinomorphic	(iv) Flower divided into two equal radial halves in any radial plane passing through the centre.
(e) Zygomorphic	(v) Flowers with bracts-reduced leaf found at the base of the pedicel.

(A) (a)-i, (b)-ii, (c)-iii, (d)-v, (e)-iv
(B) (a)-i, (b)-ii, (c)-iii, (d)-iv, (e)-v
(C) (a)-i, (b)-ii, (c)-v, (d)-iv, (e)-iii
(D) (a)-i, (b)-iii, (c)-ii, (d)-iv, (e)-v

Q.4

Column I	Column II
(a) Bisexual	(i) Flower with both androecium and gynoecium.
(b) Unisexual	(ii) Flower having either only stamens or only carpels.
(c) Epigynous.	(iii) The flower with superior ovary.
(d) Hypogynous.	(iv) The flower with inferior ovary.
(e) Perigynous.	(v) The flower with half inferior ovary.

(A) (a) - i, (b)-ii, (c)-iv, (d)-iii, (e)-v
(B) (a) - i, (b)-ii, (c)-iii, (d)-iv, (e)-v
(C) (a) - ii, (b)-i, (c)-iii, (d)-iv, (e)-v
(D) (a) - i, (b)-iii, (c)-ii, (d)-iv, (e)-v

Q.5

Column I	Column II
(a) Calyx	(i) Outermost whorl of the flower.
(b) Androecium	(ii) The stamens collectively.
(c) Corolla	(iii) The whorl of petals of a flower.
(d) Gynoecium	(iv) The whorl of carpels.

(A) (a) - i, (b)-ii, (c)-iv, (d)-iii
(B) (a) - i, (b)-ii, (c)-iii, (d)-iv
(C) (a) - ii, (b)-i, (c)-iii, (d)-iv
(D) (a) - i, (b)-iii, (c)-ii, (d)-iv

Q.6

Column I	Column II
(a) Pericarp	(i) Wall of fruit having epicarp, mesocarp and endocarp.
(b) Placenta	(ii) The seed coat; encloses and protects the seed from insects and fungi.
(c) Scutellum	(iii) Single cotyledon of maize grain.
(d) Testa	(iv) Point of attachment of ovule to ovary.
(e) Plumule	(v) The embryo shoot; two leaves and a growing point.

(A) (a)-i, (b)-ii, (c)-iii, (d)-v, (e)-iv
(B) (a)-i, (b)-ii, (c)-iii, (d)-iv, (e)-v
(C) (a)-i, (b)-ii, (c)-v, (d)-iv, (e)-iii
(D) (a)-i, (b)-iv, (c)-iii, (d)-ii, (e)-v

SECTION - 2 (BASIC CONCEPTS BUILDER)

For Q.7 to Q.20 :
Choose one word for the given statement from the list.

Reticulate, Anther, Racemose Inflorescences, Stipule, Simple leaf, Drupe, Compound leaf, Axil, , Filament, Monocotyledons, Parallel, Stigma, Cymose Inflorescences, Pinnately compound

Q.7 The venation, where the veins are arranged in the form of a complex network is called _____.

Q.8 The venation, where the veins are arranged parallely is called _____.

Q.9 Small leaf-like structure present commonly in pair at the base of a petiole is called _____.

Q.10 A leaf, where a single lamina is present on a petiole. is called _____.

Q.11 A leaf, where lamina divides into a number of small leaflets is called _____.

Q.12 The space between a petiole (or blade) and the stem is called _____.

Q.13 The leaf in which leaflets are arranged in pairs along a common axis is called _____.

Q.14 The ____ have one cotyledon (seed leaf) in the seed.

Q.15 Inflorescence in which axis is indeterminate (continues to grow) is called _____.

Q.16 Inflorescence in which upward growth of the floral axis is stopped early by the development of a terminal flower is called _____.

Q.17 Thin stalk that attaches the anther to the rest of the flower is called _____.

Q.18 Lobed, oblong, bag-like appendage at the top of the filament that produces the pollen grains that develop the male germ cells is called _____.

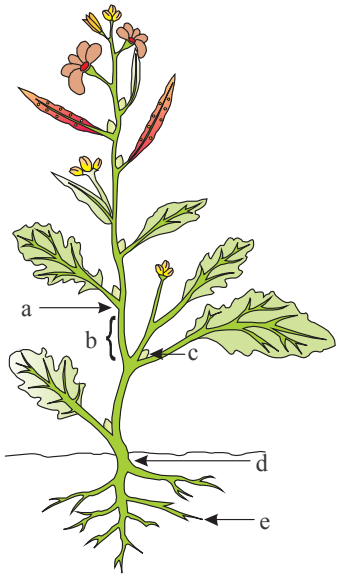
Q.19 The tip of the pistil especially adapted to receive the pollen grains is known as _____.

Q.20 Stone fruit produced from a single carpel is known as _____.

SECTION - 3 (ENHANCE DIAGRAM SKILLS)

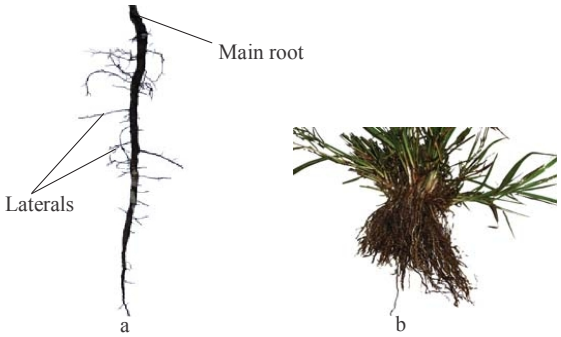
Choose one correct response for each question.

Q.21 Identify a to e in the given diagram.



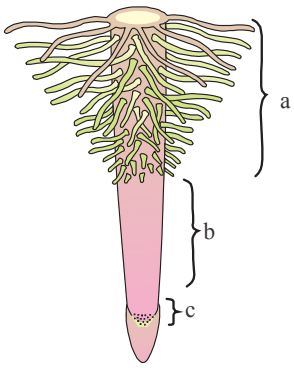
(A) a-Node, b-Internode, c-Accessory bud, d-Primary root, e-Secondary root
(B) a-Node, b-Internode, c-Bud, d-Primary root, e-Secondary root
(C) a-Internode, b-Node, c-Callus, d-Primary root, e-Secondary root
(D) a-Internode, b-Node, c-Bud, d-Primary root, e-Secondary root

Q.22 Identify the types of roots in the diagram a & b.



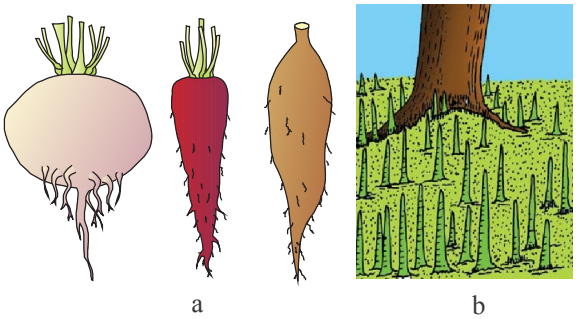
(A) a-Fibrous; b-Tap
(B) a-Adventitious; b-Fibrous
(C) a-Fibrous; b-Adventitious
(D) a-Tap; b-Fibrous

Q.23 Identify a, b and c in the given diagram.



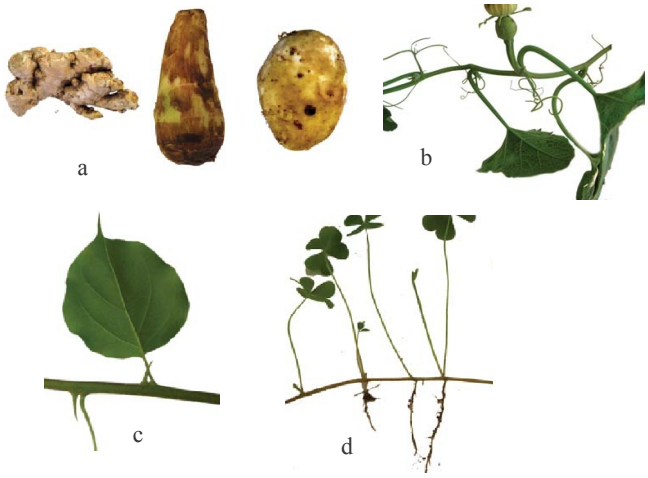
(A) a-Region of maturation, b-Region of elongation, c-Region of meristemastic activity
(B) a-Region of elongation, b-Region of maturation, c-Region of meristematic activity
(C) a-Region of meristematic,b-Region of maturation, c-Region of elongation activity
(D) a-Region of meristematic,b-Region of elongation, c-Region of maturation

Q.24 Which of the following is incorrect about the diagrams a and b ?



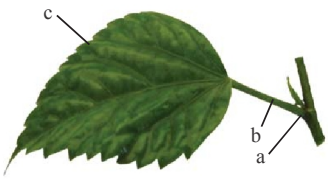
(A) Tap roots of carrot, turnip and adventitious root of sweet potato get swollen and store food.
(B) Pneumatophores help to get oxygen for respiration.
(C) Pneumatophores are found in the plants that grows in sandy soil.
(D) a is underground roots, but b grows vertically upwards.

Q.25 Identify the stem modification for (a to d).



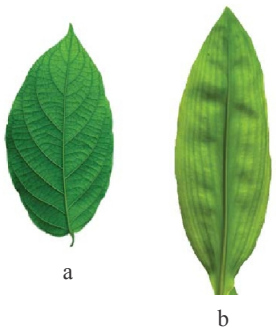
(A) a-Support, b-Storage, c-Vegetative propagation, d-Protection
(B) a-Storage, b-Support, c-Vegetative propagation, d-Protection
(C) a-Storage, b-Support, c-Protection, d-Vegetative reproduction
(D) a-Support, b-Storage, c-Protection, d-Vegetative reproduction

Q.26 Identify a, b and c in the given diagram.



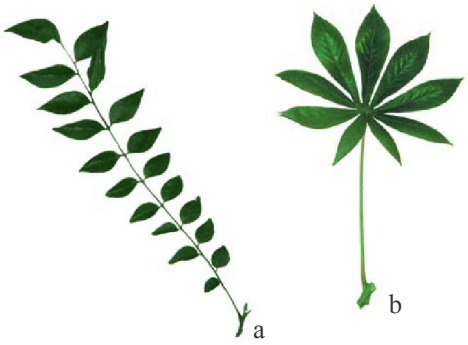
(A) a-Leaf base, b-Lamina, c-Petiole
(B) a-Leaf base, b-Petiole, c-Lamina
(C) a-Lamina, b-Petiole, c-Leaf base
(D) a-Lamina, b-Leaf base, c-Petiole

Q.27 Identify the type of venation in the given diagram (a and b).



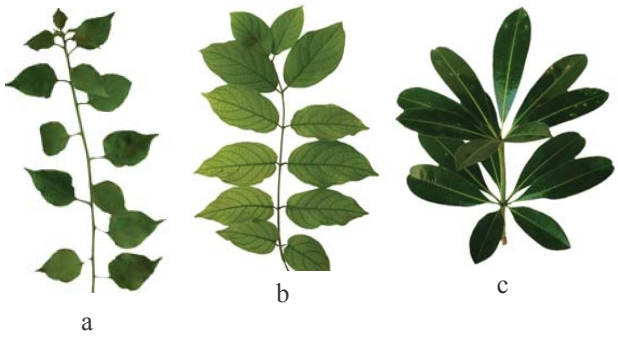
(A) a-Reticulate (dicotyledons) ; b-Parallel (monocots)
(B) a-Reticulate (monocots); b-Parallel (dicots)
(C) a-Parallel (dicots); b-Reticulate (monocots)
(D) a-Parallel (monocots); b-Reticulate (dicots)

Q.28 Identify the types of leaves given in the diagram a and b.



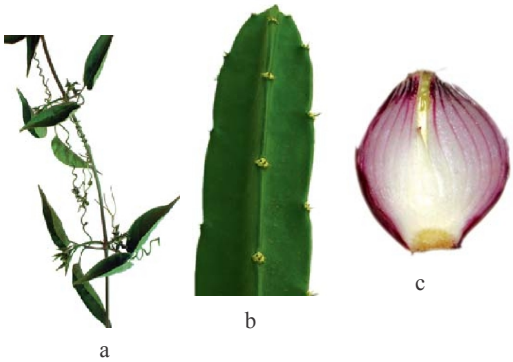
(A) a-Pinnately compound leaf (neem); b-Palmately compound leaf (silk cotton)
(B) a-Pinnately compound leaf (silk cotton); b-Palmately compound leaf (neem)
(C) a-Palmately compound leaf (silk cotton); b-Pinnately compound leaf (neem)
(D) a-Palmately compound leaf (neem); b-Pinnately compound leaf (silk cotton)

Q.29 Identify the type of phyllotaxy in the given diagrams (a, b and c).



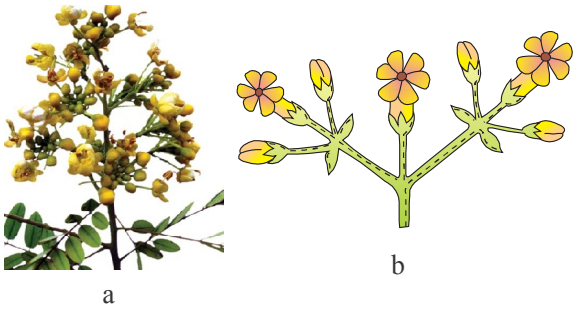
(A) a-Whorled, b-Opposite, c-Alternate
(B) a-Whorled, b-Alternate, c-Opposite
(C) a-Alternate, b-Opposite, c-Whorled
(D) a-Alternate, b-Whorled, c-Opposite

Q.30 Identify the type of leaf modification in the given diagram (a to c)



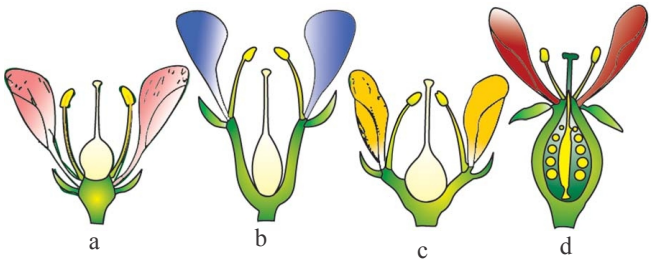
(A) a-Support (spines), b-Protection (tendril), c-Storage (treshy leaves)
(B) a-Protection (Tendril), b-Support (spine), c-Storage (treshy leaves)
(C) a-Support (Tendril), b-Protection (spine), c-Storage (treshy leaves)
(D) a-Protection (spine), b-Support (fendril), c-Storage (treshy leaves)

Q.31 Identify the type of inflorescence in the given diagrams (a and b).



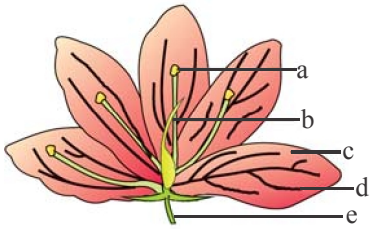
(A) a-Racemose; b-Cymose
(B) a-Cymose; b-Racemose
(C) a-Cymose; b-Cymose
(D) a-Racemose; b-Racemose

Q.32 Identify the position of gynoecium in the given diagrams a to d.



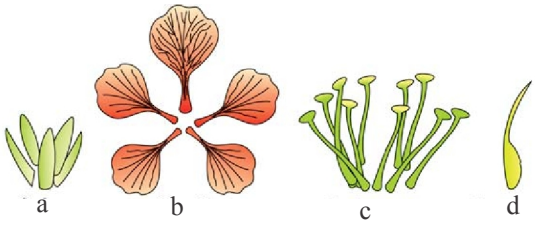
(A) a-Perigynous,b-Perigynous,c-Hypogynous, d-Epigynous
(B) a-Epigynous,b-Perigynous, c-Hypogynous, d-Perigynous
(C) a-Hypogynous,b-Perigynous,c-Perigynous, d-Epigynous
(D) a-Hypogynous,b-Epigynous, c-Perigynous, d-Perigynous

Q.33 Identify the flower parts a to e in the given diagram.



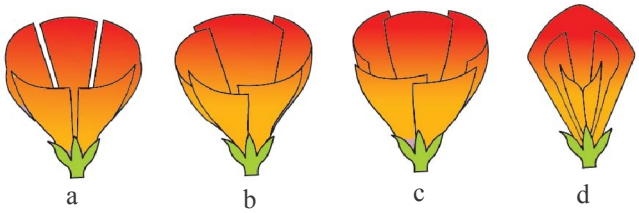
(A) a-Androecium, b-Gynoecium, c-Corolla, d-Pedicel, e-Calyx
(B) a-Androecium, b-Gynoecium, c-Corolla, d-Calyx, e-Pedicel
(C) a-Androecium, b-Gynoecium, c-Pedicel, d-Corolla, e-Calyx
(D) a-Androecium, b-Gynoecium, c-Calyx, d-Corolla, e-Pedicel

Q.34 Identify flower parts a to d in the given diagrams correctly.



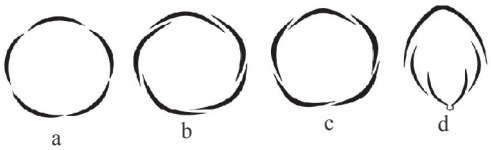
(A) a-Corolla, b-Calyx, c-Androecium, d-Gynoecium
(B) a-Calyx, b-Corolla, c-Androecium, d-Gynoecium
(C) a-Calyx, b-Corolla, c-Gynoecium, d-Androecium
(D) a-Corolla, b-Calyx, c-Gynoecium, d-Androecium

Q.35 Identify types of aestivation in the given diagrams a to d.



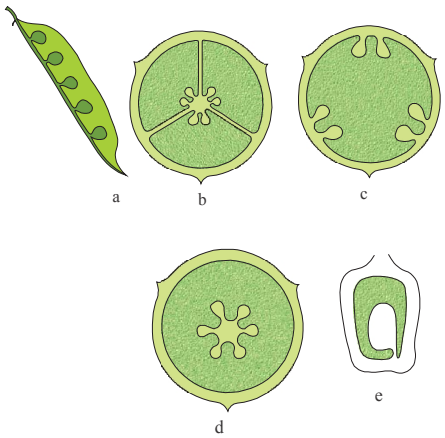
(A) a-Valvate, b-Imbricate, c-Twisted, d-Vexillary
(B) a-Valvate, b-Twisted, c-Imbricate, d-Vexillary
(C) a-Vexillary, b-Twisted, c-Imbricate, d-Valvate
(D) a-Vexillary, b-Imbricate, c-Twisted, d-Valvate

Q.36 Identify the type of aestivation in the given diagrams (a to d).



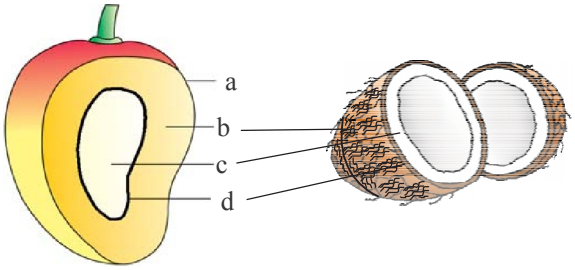
(A) a-Twisted, b-Valvate, c-Vexillary, d-Imbricate
(B) a-Valvate, b-Twisted, c-Imbricate, d-Vexillary
(C) a-Valvate,b-Twisted, c-Vexillary, d-Imbricate
(D) a-Valvate,b-Vexillary,c-Twisted, d-Imbricate

Q.37 Identify the types of placentation in the given diagrams (a to e).



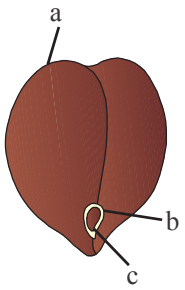
(A) a-Marginal, b-Axile, c-Parietal, d-Free central, e-Basal
(B) a-Marginal, b-Basal, c-Parietal, d-Free central, e-Axile
(C) a-Parietal, b-Basal, c-Marginal, d-Free central, e-Axile
(D) a-Parietal, b-Axile, c-Marginal, d-Free central, e-Basal

Q.38 Identify a to d in the parts of a fruit mango and coconut.



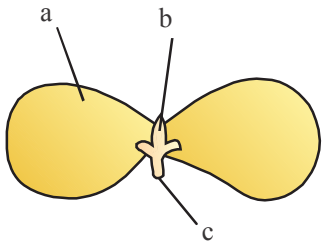
(A) a-Epicarp, b-Mesocarp, c-Seed, d-Endocrap
(B) a-Mesocarp, b-Epicarp, c-Seed, d-Endocarp
(C) a-Mesocarp, b-Epicarp, c-Endocarp, d-Seed
(D) a-Epicarp, b-Mesocarp, c-Endocarp, d-Seed

Q.39 Identify a, b and c in the given diagram.



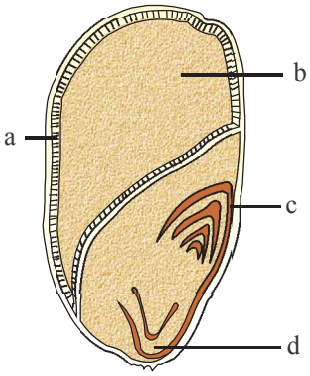
(A) a-Seed coat, b-Micropyle, c-Hilum
(B) a-Seed coat, b-Hilum, c-Micropyle
(C) a-Micropyle, b-Seed coat c-Hilum
(D) a-Hilum, b-Seed coat, c-Micropyle

Q.40 Identify a, b and c in the given diagram.



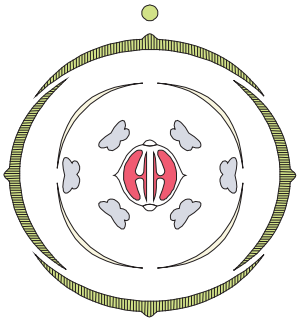
(A) a-Plumule, b-Cotyledon, c-Radicle
(B) a-Radicle, b-Cotyledon, c-Plumule
(C) a-Cotyledon, b-Plumule, c-Radicle
(D) a-Cotyledon, b-Radicle, c-Plumule

Q.41 Identify a, b, c and d in the given diagram.



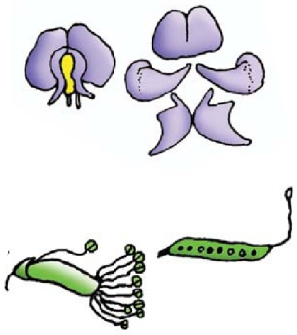
(A) a-Aleurone layer, b-Endosperm, c-Coleoptile, d-Coleorhiza
(B) a-Aleurone layer, b-Coleoptile, c-Endosperm, d-Coleorhiza
(C) a-Coleoptile, b-Aleurone layer, c-Endosperm, d-Coleorhiza
(D) a-Coleoptile, b-Aleurone layer, c-Coleorhiza, d-Endosperm

Q.42 Identify the family represented in given floral diagram.



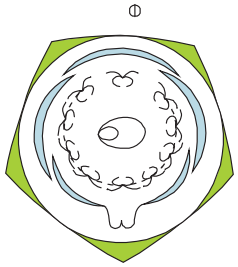
(A) Brassicaceae (B) Poaceae
(C) Asteraceae (D) Fabaceae

Q.43 For the pea plant Flower, Petals, Reproductive parts and L.S.carpel is shown. Identify the family



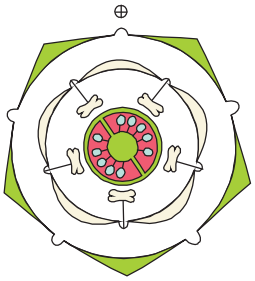
(A) Fabaceae (B) Solanaceae
(C) Liliaceae (D) None of these

Q.44 Floral diagram belongs to



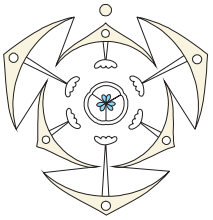
(A) Solanaceae (B) Fabaceae
(C) Liliaceae (D) None of these

Q.45 Given floral diagram represents

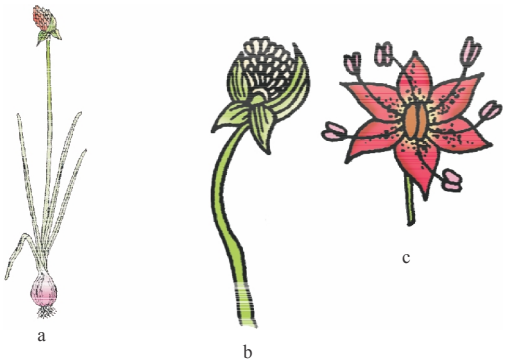


(A) Solanaceae (B) Fabaceae
(C) Liliaceae (D) Musaceae

Q.46 Diagram belongs to
(A) coffee plant (Solanaceae)
(B) vinea plant (Rutaceae)
(C) potato plant (Solanaceae)
(D) onion plant (Liliaceae)



Q.47 The given diagram belongs to.



The diagram shown is the
(A) onion plant (B) garlic plant
(C) lily plant (D) potato plant

SECTION - 4 (ENHANCE PROBLEM SOLVING SKILLS)

Choose one correct response for each question.

PART - A : THE ROOT

Q.48 The fibrous roots are commonly found in
(A) Dicotyledons (B) Monocotyledons
(C) Gymnosperms (D) None of above

Q.49 Root apex covered by thimble-like structure called
(A) region of elongation (B) region of maturation
(C) region of dividing (D) root cap

Q.50 The tap root system is commonly found in –
(A) Dicotyledons (B) Bryophytes
(C) Monocotyledons (D) All of them

Q.51 The direct elongation of radicle leads to the formation of
(A) stem (B) primary root
(C) secondary root (D) tertiary root

Q.52 Stilt roots originate from the nodal part of
(A) stem (B) secondary root
(5) leaf (D) primary root

Q.53 Which of the following is an INCORRECT statement –
(A) Roots are positively geotropic.
(B) Roots are always positively phototropic.
(C) Roots are negatively phototropic.
(D) Both (A) and (B).

Q.54 Root hairs are present on the –
(A) root cap
(B) region of elongation
(C) region of maturation
(D) region of dividing cell

Q.55 The edible roots are found in
(A) Wheat (B) Rice
(C) Sweet potato (D) Potato

Q.56 Primary roots and its branches constitute the
(A) tap root system
(B) adventitious root system
(C) tertiary root system
(D) fibrous root system

Q.57 Prop roots are found in
(A) Mango tree (B) Guava tree
(C) Banyan tree (D) Gulmohar tree

Q.58 Pneumatophores are the roots for
(A) respiration
(B) asexual reproduction
(C) storing water
(D) sexual reproduction

Q.59 Fibrous root system originates from the base of
(A) root (B) lamina
(C) leaves (D) stem

Q.60 The stilt roots are found in
(A) Egg plant (B) Gram
(C) Maize (D) Potato

Q.61 The following question is based on parts of a growing primary root.
I. root cap
II. zone of elongation
III. zone of cell division
IV. zone of cell maturation
V. apical meristem
Which of the following is the correct sequence from the growing tips of the root upward?
(A) I, II, V, III, IV (B) III, V, I, II, IV
(C) II, IV, I, V, III (D) I, V, III, II, IV

Q.62 Roots arising from the part of plant other than the radicle are called –
(A) adventitious root (B) internodal root
(C) nodal root (D) stilt root

Q.63 Tap roots of carrot, turnip and adventitious roots of sweet potato are the modification for the storage of
(A) food (B) water
(C) secondary compound (D) primary compound

Q.64 Root hairs are most important to a plant because they –
(A) anchor a plant in the soil.
(B) store starches.
(C) increase the surface area for absorption.
(D) provide a habitat for nitrogen-fixing bacteria.

Q.65 Prop roots are the modification for
(A) support (B) respiration
(C) storage food (D) increasing mass

PART - B : THE STEM

Q.66 Stem tendrils are developed from the ____ which are slender and spirally coiled.
(A) terminal buds (B) auxiliary buds
(C) Both (A) and (B) (D) shoot tip

Q.67 The nodes and internodes are found on –
(A) Tap root (B) Adventitious
(C) Stem (D) None of above

Q.68 Underground stems of potato, ginger, turmeric, Zaminkand, *Colocasia* are the examples of modified stem for
(A) conduction of minerals
(B) conduction of water
(C) Both (A) and (B)
(D) storage of food

Q.69 The lateral branches originate from the basal and underground portion of main stem and then come obliquely upward giving rise to leafy shoots is found in –
(A) Banana (B) pineapple
(C) *Chrysanthemum* (D) all of these

Q.70 Select the edible stem from the following
(A) Potato (B) Sweet potato
(C) Egg plant (D) Bitter gourd

Q.71 When axillary buds or terminal buds of stem gets modified into woody straight and pointed structure, it is known as
(A) thorns (B) tendrils
(C) nodes (D) internodes

Q.72 In which plant underground stems spread to new niches and when older parts die new plants are formed?
(A) grasses (B) strawberry
(C) Pistia (D) Both (A) and (B)

Q.73 The stem is the ___ part of the axis bears branches, leaves, flowers and fruits. It develops from the __ part of embryo of germinating seeds.
(A) descending; radicle (B) radicle; descending
(C) ascending; plumule (D) plumule; ascending

Q.74 Stem develops from
(A) epicotyle (B) hypocotyle
(C) plumule (D) radicle

Q.75 Leaves above and a tuft of roots below is found in aquatic plants like –
(A) *Pistia* (B) Eichhornia
(C) Both (A) and (B) (D) None of these

PART - C : THE LEAF

Q.76 Leaf –
(A) is a lateral generally flattened structure borne on the stem.
(B) is a vegetative organ for photosynthesis.
(C) originates from shoot apical meristem.
(D) All of the above

Q.77 Match the following columns.

	Column I (Types of phyllotaxy)	Column II (Name)
a.	Single leaf arises at each node in altenate manner	1. Whorled
b.	Pair of leaf arises at each nodes and arranged opposite to each other	2. Opposite
c.	More than two leaves arises at each node	3. Alternate

(A) a-3, b-2, c-1 (B) a-3, b-1, c-2
(C) a-1, b-2, c-3 (D) a-1, b-3, c-2

Q.78 Leaves of dicotyledon plants generally exhibits
(A) reticulate venation (B) lateral venation
(C) oblique venation (D) parallel venation

Q.79 In some ___, the leaf base may become swollen and is called as ____
(A) monocots, sheathing leaf base
(B) legumes, pulvinus
(C) legumes, sheathing leaf base
(D) monocots, pulvinus

Q.80 Structure of leaf which provide channels of transport for water, minerals and food materials is called
(A) midrib (B) margin
(C) lamina (D) veins

Q.81 Insectivore plants such as pitcher plant, venus fly trap have –
(A) modified leaf (B) modified stem
(C) modified root (D) All of the above

Q.82 Leaf base expands into sheath covering the stem partially or wholly. This is the characteristic of
(A) monocot (B) dicot
(C) pteridophytes (D) gymnosperm

Q.83 Choose the correct matching pair
(A) Pinnately compound leaf : Neem
(B) Palmately compound : Silk cotton
(C) Pinnately compound leaf : Silk cotton
(D) Both (A) and (B)

Q.84 Petiole
(A) helps to hold the leaf blade
(B) allows leaf blades to flutter wind
(C) helps in cooling the leaf
(D) All of the above

Q.85 Match the following columns.

	Column I	Column II
a.	Altemate phyllotaxy	1. China rose
b.	Opposite phyllotaxy	2. *Calotropis*
c.	Whorled phyllotaxy	3. *Alstonia*
		4. Mustard
		5. Sunflower
		6. guava

Codes
(A) a-3,4,5 ; b-2, 3 ; c-1
(B) a-3 ; b-1 ; c-2
(C) a-1,4,5 ; b-2, 6 ; c-3
(D) a-1, 4 ; b-3 ; c-2

PART - D : THE INFLORESCENCE

Q.86 How many types of inflorescence are present in angiosperm depending on whether the apex gets converted into a flower or continues to grow?
(A) three type (B) four type
(C) five type (D) two type

Q.87 In cymose inflorescence
(A) main axis do not terminate in a flower
(B) main axis do not exist
(C) main axis terminate in a flower
(D) main axis modified into flower

Q.88 Main axis continues to grow, the flowers are borne laterally in acropetal succession. This is a characteristic of which type of inflorescence?
(A) Cymose (B) Racemose
(C) Either (A) or (B) (D) Both (A) and (B)

Q.89 Choose the correct statement –
(A) In racemose inflorescence axis shows continue growth for an indefinite period.
(B) In cymose inflorescence flowers are borne in a basipetal order.
(C) Jasmine shows cymose inflorescence.
(D) All of these

PART - E : THE FLOWER

Q.90 The reproductive unit of angiosperms is
(A) inflorescence (B) floral buds
(C) flower (D) flower meristem

Q.91 A typical flower has four different kinds of whorls arranged successively on the swollen end of the stalk or pedicel called
(A) thalamus (B) receptacle
(C) Both (A) and (B) (D) Either (A) or (B)

Q.92 Perianth is the condition in which
(A) calyx and corolla are fused
(B) calyx is present but corolla is absent
(C) corolla is present but calyx is absent
(D) calyx and corolla are indistinct

Q.93 Choose the correct statement –
(i) Calyx is a accessory part of a flower.
(ii) Corolla is a accessory part of a flower.
(iii) Androecium is a reproductive part of a flower.
(iv) Gynoecium is a reproductive part of a flower.
(v) Gynoecium is a accessory part of a flower.
(A) i, ii, iii, iv (B) i, ii, iii, v
(C) i, ii, iii (D) ii, iii

Q.94 Ovary is said to be half inferior in which of the following conditions?
(A) Hypogynous (B) Perigynous
(C) Epigynous (D) Both (B) and (C)

Q.95 Flowers with bracts, (reduced leaf found at the base of pedicel) are called __ and those without bracts, are called __.
(A) bracteate; ebracteate
(B) ebracteate; bracteate
(C) pinnate; palmitate
(D) palmitate; pinnate

Q.96 Choose the correct statement
(A) When carpels are free, they are called apocarpous.
(B) When the carpels fused, they are called syncarpous.
(C) When the carpels fused, they are called apocarpous.
(D) Both (A) and (B)

Q.97 Staminode is –
(A) sterile stamen (B) fertile stamen
(C) redumentary stamen (D) developed stamen

Q.98 Actinomorphic (Radial symmetry) flowers are shown by –
(A) Mustard (B) Datura
(C) Chilli (D) All of these

Q.99 When the ovules are borne on central axis and septa are absent, the placentation is called –
(A) free central (B) marginal
(C) axile (D) parietal

Q.100 When the floral appendages are in multiple of 3, 4, 5, they are respectively called
(A) trimerous, tetramerous, pentamerous
(B) penatmerous, tetramerous, trimerous
(C) tripinnate, tetrapinnate, pentapinnate
(D) tetrapinnate, tripinnate, pentapinnate

Q.101 Zygomorphic (Bilateral symmetry) flowers are shown by
(A) Mustard (B) Datura
(C) Chilli (D) gulmohar

Q.102 *Canna* flowers are –
(A) Actinomorphic (B) Zygomorphic
(C) Asymmetric (D) None of these

Q.103 Arrangement of sepals or petals with respect to the other members of same whorl is known as
(A) gamopetalous (B) polypetalous
(C) aestivation (D) venation

Q.104 Choose the correct statement for hypogynous flower
(A) gynoecium occupies the highest position.
(B) gynoecium is situated in the centre and other parts of flower.
(C) The margin of thalamus grows upward enclosing the ovary completely
(D) All of these

Q.105 Match the following columns.

	Column I	Column II
a.	Ovary	1. Connects ovary to stigma
b.	Stigma	2. Tip of style
c.	Style	3. Enlarged basal part of carpel

Codes
(A) a-1, b-2, c-3 (B) a-3, b-2, c-1
(C) a-2, b-3, c-1 (D) a-3, b-1, c-2

Q.106 I. Members of calyx are called _a_.
II. United members of calyx are called _b_.
III. Free members of calyx are called _c_.
Choose the correct word for the blanks a, b & c.
(A) a-petals, b-gamosepalous, c-polyseptalous
(B) a-sepals, b-gamosepalous, c-polysepalous
(C) a-sepals, b-polysepalous, c-gamosepalous
(D) a-petals, b-polysepalous, c-gamosepalous

Q.107 Placentation is the arrangement of
(A) ovary in gynoecium
(B) ovules within ovary
(C) ovary in ovule
(D) fused carpels in gynoecium

Q.108 Examples of Epigynous flowers are –
(A) mustard (B) guava
(C) cucumber (D) both (B) and (C)

Q.109 Name the type of aestivation when sepals or petals in a whorl just touch one another at the margin without overlapping.
(A) Twisted aestivation (B) Valvate aestivation
(C) Imbricate aestivation (D) Vexillary aestivation

Q.110 Examples of hypogynous flowers are –
(A) mustard (B) china rose
(C) brinjal (D) all of these

Q.111 Which of the following represents the male reproductive organ in a flower?
(A) Androecium (B) Stamen
(C) Both (A) and (B) (D) None of these

Q.112 Choose the correct statement for Corolla
(A) Compose of petals
(B) Usually brightly coloured
(C) May be free
(D) all of these

Q.113 If one margin of the appendages overlaps that of the next one and so on then the aestivation is called
(A) Valvate (B) Twisted
(C) Imbricate (D) Vexillary

Q.114 Match the following columns.

	Column I	Column II
a.	Monoadelophous	1. Citrus
b.	Diadelphous	2. Pea
c.	Polyadelphous	3. China rose

Codes
(A) a-1, b-2, c-3 (B) a-1, b-3, c-2
(C) a-3, b-2, c-1 (D) a-3, b-1, c-2

Q.115 If the margins of sepals or petals overlap one another but not in any particular direction then the aestivation is called
(A) Valvate (B) Twisted
(C) Imbricate (D) Vexillary

Q.116 Male reproductive organ (flower) consists of
(A) stalk (B) thalamus
(C) anther (D) Both (A) and (C)

Q.117 In lady's finger aestivation is
(A) Valvate (B) Twisted
(C) Imbricate (D) Vexillary

Q.118 Perigynous type of ovary is found in
(A) plum (B) rose
(C) peach (D) All of these

Q.119 Placenta is the cushion like structure on which
(A) ovule attached (B) ovary attached
(C) seed attached (D) stamen attached

Q.120 Match the following columns.

	Column I	Column II
a.	Valvate aestivation	1. *Calotropis*
b.	Twisted aestivation	2. China rose
c.	Imbricate aestivation	3. Cotton
d.	Vexillary aestivation	4. *Cassia*
		5. Pea

Codes
(A) a-1, 2 ; b-3, 4 ; c-5 ; d-4
(B) a-5 ; b-2, 3 ; c-1, d-2
(C) a-1 ; b-2, 3 ; c-4 ; d-5
(D) a-2, 3 ; b-1 ; c-5 ; d-4

Q.121 Choose the correct statement for anther
(A) Usually bilobed.
(B) Each lobe has two chambers (pollen sacs)
(C) The chamber (pollen sacs) contains pollen grain.
(D) All of these

Q.122 Choose the correct statement.
(A) When stamens attached to the petals condition is called Epipetalous.
(B) When stamens attached to perianth condition is called Epiphyllous.
(C) When stamens attached to perianth condition is called Staminode.
(D) Both (A) and (B).

Q.123 Example of Apocarpous includes –
(A) Lotus (B) Mustard
(C) Rose (D) (A) and (C)

Q.124 Example of Syncarpous includes –
(A) Lotus (B) Mustard
(C) Rose (D) (A) and (C)

Q.125 Match the following columns.

	Column I (Placentation)	Column II (Examples)
a.	Marginal	1. Pea
b.	Axile	2. China rose
c.	Parietal	3. Tomato
d.	Free central	4. Mustard
		5. *Dianthus*

Codes
(A) a-2 ; b-1 ; c-4 ; d-5
(B) a-3 ; b-2, 3 ; c-5 ; d-4
(C) a-1 ; b-2, 3 ; c-4 ; d-5
(D) a-4 ; b-5 ; c-2 ; d-1

Q.126 Match the following columns.

	Column I (Placentation)	Column II (Examples)
a.	Basal	1. *Primrose*
b.	Axile	2. Sunflower
c.	Parietal	3. Marigold
d.	Free central	4. Lemon
		5. *Argemone*

Codes
(A) a-2, 3 ; b-4 ; c-5 ; d-1
(B) a-4 ; b-3 ; c-5 ; d-1
(C) a-2, 3 ; b-4 ; c-1 ; d-5
(D) a-1 ; b-2 ; c-3 ; d-4

PART - F : THE FRUIT

Q.127 Fruit is –
(A) mature ovary developed before fertilisation.
(B) ripened ovary developed after fertilisation.
(C) ripened ovary developed before fertilisation.
(D) mature undeveloped ovary

Q.128 Examples of drupe fruit is/are
(A) mango (B) coconut
(C) Both (A) and (B) (D) None of these

Q.129 Fruit formed without fertilisation of ovary is called
(A) cypsela fruit (B) parthenocarpic fruit
(C) drupe fruit (D) pome fruit

Q.130 Pericarp may be or can be differentiated into
(A) epicarp (B) mesocarp
(C) endocarp (D) All of the above

Q.131 Drupes are called stony fruits because they have hard
(A) epicarp (B) endocarp
(C) mesocarp (D) Both (A) and (B)

Q.132 Choose the correct statement for mango –
(A) Epicarp is thin.
(B) Mesocarp is fleshy and edible.
(C) Endocarp is strong hard.
(D) All of these

PART - G : THE SEED

Q.133 Seeds are –
(A) ovules after fertilisation
(B) ovules before fertilisation
(C) ovary before fertilisation
(D) ovary after fertilisation

Q.134 Monocotyledon seed includes –
(A) Wheat (B) Gram
(C) Maize (D) Both (A) and (C)

Q.135 The plumule and radicle are enclosed in sheath which are called
(A) aleurone layer, scutellum
(B) aleurone layer, coleoptile
(C) coleoptile, coleorhiza
(D) aleurone layer, coleorhiza

Q.136 Scar on the seed coat through which seeds are attached to the fruit is called
(A) testa (B) tegmen
(C) micropyle (D) hilum

Q.137 Dicotyledon seed includes –
(A) Gram (B) Pea
(C) Castor (D) all of these

Q.138 The outer covering of endosperm separates the embryo by a proteinous layer called
(A) plumule (B) radicle
(C) aleurone layer (D) scutellum

Q.139 At the two ends of the embryonical axis
(A) radicle is present (B) plumule is present
(C) Both (A) and (B) (D) None of these

Q.140 (i) Seed coat has __ layers.
(ii) Outer covering is called __ .
(iii) Inner covering is called __ .
(A) 3, testa, tegmen (B) 2, testa, tegmen
(C) 2, tegmen, testa (D) 3, tegmen, testa

Q.141 Endosperm is the result of
(A) single fertilisation (B) partial fertilisation
(C) double fertilisation (D) triple fertilisation

Q.142 Which of the following monocotyledonous seed is non-endospermic?
(A) Maize (B) Wheat
(C) Coconut (D) Orchid

Q.143 Choose the correct statement –
(A) In plants such as bean, gram and pea seeds are called nonendospermic or exalbumious.
(B) In castor bean (dicot) seeds are called endospermic or albuminous seed.
(C) In plants such as bean, gram and pea seeds are called endospermic or albuminous seed.
(D) Both (A) and (B)

PART - H : SEMI-TECHNICAL DESCRIPTION

Q.144 In floral formula, 'K' and 'C' stands for
(A) K-Corolla, C-Calyx
(B) K-Calyx, C-Corolla
(C) K-Calyx, C-Calyx
(D) K-Corolla, C-Corolla

Q.145 ♂♀ stands for ....a...
⊕ stands for ...b...
% stands for ...c...
Choose the correct word for a, b and c.
(A) a-bisexual plant, b-actinomorphic, c-zygomorphic
(B) a-unisexual, b-actinomorphic, c-zygomorphic
(C) a-unisexual, b-zygomorphic, c-actinomorphic
(D) a-bisexual plant, b-zygomorphic, c-actinomorphic

Q146 ♂♀ stands for (in plants)
(A) perfect flower (B) bisexual flower
(C) Either (A) or (B) (D) imperfect flower

Q.147 $\underline{G}$ and $\overline{G}$, respectively stands for
(A) superior ovary, inferior ovary
(B) inferior ovary, superior ovary
(C) superior ovary, intermediate ovary
(D) intermediate ovary, inferior ovary

PART - I : IMPORTANT FAMILIES

Q.148 Fabaceae
(A) was earlier called Papilionoideae
(B) was a sub family of Leguminosae
(C) is distributed all over the world
(D) All of the above

Q.149 Potato family is called
(A) Cruciferae (B) Brassicaceae
(C) Solanaceae (D) Poaceae

Q.150 $\oplus \, ♀♂ P_{3+3} A_{3+3} \underline{G}_{(C)}$ is the floral formula of
(A) Malvaceae (B) Solanaceae
(C) Cruciferae (D) Liliaceae

Q.151 % $♀♂ K_{(5)} C_{1+2+(B)} A_{(9)+1} \underline{G}_1$ is the floral diagram of the family
(A) Fabaceae (B) Solanaceae
(C) Liliaceae (D) Papaveraceae

Q.152 $\oplus \, ♀♂ K_{(5)} \widehat{C_{(5)} A_5} \, \underline{G}_{(B)}$ is the floral formula of
(A) Poaceae (B) Solanaceae
(C) Asteraceae (D) Musaceae

Q.153 Liliaceae
(A) is commonly called lily family
(B) is a representative of monocotyledonous plants
(C) is a representative of dicotyledonous plants
(D) Both (A) and (B)

Q.154 Select the correctly match pair.
(i) *Colchicum autumnale* : Liliaceae
(ii) *Petunia* : Liliaceae
(iii) *Gloriosa* : Liliaceae
(iv) *Trifolium* : Solanaceae
(v) *Sesbania* : Fabaceae
(A) i, iii, v (B) ii, iv
(C) i (D) iv

Q.155 Identify the missing words (a, b, c and d) and select the correct option.

Family	Inflorescence	Flower	Stamens	Gynoecium
Fabaceae	a	b	10	d
Solanaceae	Solitary, axillary or cymose	Actino-morphic	5	Bicarpellary
Lilaceae	Solitary, cymose or racemose	Actino-morphic	c	Tricarpellary

(A) a-Racemose, b-Zygomorphic, c-3 + 3, d- Monocarpellary
(B) a-Racemose, b-Actinomorphic, c-5, d-Bicarpellary
(C) a-Cymose, b-Zygomorphic, c-3+3, d-Tricarpellary
(D) a-Cymose, b-Actinomorphic, c-5, d-Multicarpellary

Q.156 Soyabean belongs to –
(A) Liliaceae (B) Solanaceae
(C) Fabaceae (D) None of these

Q.157 Chilli belongs to –
(A) Liliaceae (B) Solanaceae
(C) Fabaceae (D) None of these

EXERCISE - 2 (LEVEL-2)

Choose one correct response for each question.

Q.1 Smallest region of the root is
(A) root cap
(B) region of elongation
(C) region of meristematic activity
(D) region of maturation

Q.2 Which is correct pair for edible part –
(A) Tomato - Thalamus
(B) Maize - Cotyledons
(C) Guava - Mesocarp
(D) Date palm - Pericarp

Q.3 Ginger is an underground stem. It is distinguish from roots because it
(A) lacks chlorophyll
(B) stores food
(C) has nodes and internodes
(D) has xylem and vessels

Q.4 Match Column-I with Column-II and select the correct option from the codes given below.

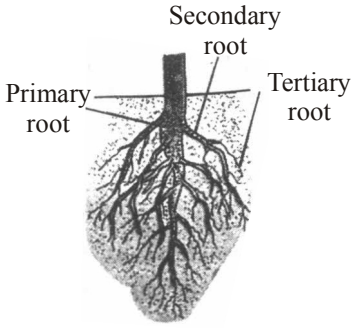
	Column-I	Column-II
a.	Marginal	(i) Sunflower, marigold
b.	Parietal	(ii) Pea
c.	Axile	(iii) Mustard, *Argemone*
d.	Free central	(iv) *Hibiscus*, tomato, lemon
e.	Basal	(v) *Dianthus, Primrose*

(A) a-(ii), b-(iii), c-(iv), d-(v), e-(i)
(B) a-(i), b-(iii), c-(ii), d-(v), e-(iv)
(C) a-(i), b-(ii), c-(iii), d-(iv), e-(v)
(D) a-(iii), b-(ii), c-(iv), d-(v), e-(i)

Q.5 Main difference between creepers and trailers is
(A) creepers are rooted at node while trailers don't
(B) creepers are not rooted at node while trailers do.
(C) creepers have internodes while trailers don't.
(D) creepers have node while trailers don't.

Q.6 The fourth whorl of flower is of
(A) Petals (B) Stamens
(C) Carpels (D) Sepals

Q.7 Refer the given figure and select the incorrect statement regarding this.



(A) This type of root system develops from radicle of embryo.
(B) Lateral roots arising from the main root are exogenous in origin.
(C) Rootlets are the ultimate root branches that bear root hair for absorption.
(D) Secondary and tertiary roots are borne in acropetal succession.

Q.8 The side of a flower facing the mother axis is called
(A) Anterior side (B) Posterior side
(C) Dorsal side (D) Ventral side

Q.9 Read the given statements and select the correct ones.
(i) Root caps are present in prop roots.
(ii) Pneumatophores help to get oxygen for respiration.
(iii) Edible part of ginger is underground stem.
(iv) Hydrophytes usually possess a well developed root system.
(A) (i) and (ii) (B) (ii) and (iii)
(C) (i), (ii) and (iii) (D) (i), (ii), (iii) and (iv)

Q.10 Add the missing floral organs in the given floral formula of family Fabaceae.

$\%\overset{\uparrow}{\underset{+}{\bigcirc}}K_{(5)}—A_{(9)+1}\underline{G}_1$

(A) C_{1+2+2} (B) $C_{1+2+(B)}$
(C) C_{1+2+3} (D) C_5

Q.11 Stilt roots are reported from
(A) *Pandanus* (B) Radish
(C) Mango-ginger (D) *Bryophyllum*

Q.12 Edible part of Sweet potato is
(A) Stem tuber (B) Unripe fruit
(C) Adventitious root tuber (D) Rhizome

Q.13 Roots are used in vegetative propagation in
(A) Potato (B) Sweet potato
(C) Ginger (D) Onion

Q.14 Which modification of root does not store food
(A) Tuberous (B) Napiform
(C) Conical (D) Stilt

Q.15 Respiratory roots are found in
(A) *Sonneratia* and *Heritiera*
(B) *Trapa*
(C) Rhizophores
(D) *Eichhornia*

Q.16 Roots have thorny branches in
(A) *Vanilla* (B) *Asparagus*
(C) *Acanthorhiza* (D) *Pothos*

Q.17 Which one is a fleshy root
(A) *Ficus benghalensis* & *Solanum tuberosum*
(B) *Raphanus sativus* and *Daucus carota*
(C) *Colocasia* and *Allium*
(D) *Chrysanthemum* and *Musa*

Q.18 In *Opuntia*, the function of phyotosynthesis is carried out by
(A) Cladode (B) Phylloclade
(C) Phyllode (D) Bulb

Q.19 In symmetry, the flower of chilli is –
(A) actinomorphic (B) zygomorphic
(C) irregular (D) None of these

Q.20 The weak stemmed plants which can climb with the help of thorns, spines, prickles are
(A) Scramblers (B) Stolons
(C) Straggling (D) Lianas

Q.21 In sweet pea, the tendrils are modified
(A) Stem branches (B) Leaflets
(C) Leaves (D) Stipules

Q.22 Choose the correct matching –

Column I (Family)	**Column II (Androcium stamen)**
(a) Fabaceae	(i) 5
(b) Solanaceae	(ii) 6
(c) Lilaceae	(iii) 10

Codes :
(A) a-(i), b-(ii), c-(iii) (B) a-(iii), b-(i), c-(ii)
(C) a-(iii), b-(ii), c-(i) (D) a-(ii), b-(iii), c-(i)

Q.23 Pinnately parallel venation is found in
(A) *Canna* (B) *Grass*
(C) *Zizyphus* (D) Castor

Q.24 Name the plant having reticulate venation
(A) *Musa* (B) *Mangifera*
(C) *Oryza* (D) *Canna*

Q.25 The most important function of inflorescence is to help in
(A) Forming large number of fruits
(B) Attracting insects for cross pollination
(C) Dispersal of seeds
(D) Release of pollen grains

Q.26 The flowers in the raceme/racemose are arranged
(A) Acropetally (B) Basipetally
(C) Centripetally (D) Centrifugally

Q.27 In 'Tulsi' (*Ocimum*) of labiatae the inflorescence is
(A) Cyathium (B) Verticillaster
(C) Hypanthodium (D) Raceme of Racemes

Q.28 Thalamus is
(A) Base of flower
(B) Base of ovary
(C) Modification of pollen
(D) Modification of petal

Q.29 Stamens attached to petals are
(A) Antipetalous (B) Epipetalous
(C) Epiphyllous (D) Episepalous

Q.30 A plant with both male and female flowers borne over it is –
(A) Monoecious (B) Dioecious
(C) Unisexual (D) Bisexual

Q.31 In Maize, the flowers are –
(A) Absent
(B) Unisexual but on different plants
(C) Bisexual
(D) Unisexual but on the same plant

Q.32 The perianth is the term used when
(A) Androecium and gynoecium are similar
(B) Androecium and calyx are similar
(C) Corolla and gynoecium are similar
(D) Calyx and corolla are similar

Q.33 Flowers of Liliaceae, Malvaceae & Solanaceae are
(A) Hypogynous (B) Perigynous
(C) Epigynous (D) Amphigynous

Q.34 Corolla in China rose are :
(A) 5, gamopetalous, twisted
(B) 5, gamopetalous valvate
(C) 5, polypetalous valvate
(D) 5, polypetalous contorted

Q.35 The plant whose seeds are known to have longest viability period is
(A) *Nelumbo nucifera* (lotus)
(B) *Triticum vulgare* (wheat)
(C) *Zizyphus jujuba* (ber)
(D) *Carica papaya* (papaya)

Q.36 Which one of the following is an endospermic seed
(A) Pea (B) Bean
(C) Gram (D) Castor

Q.37 In non-endospermic seeds, food is stored in
(A) Seed coat (B) Endosperm
(C) Cotyledons (D) Ovule

Q.38 Edible part of tomato is
(A) Epicarp (B) Pericarp & placenta
(C) Mesocarp (D) Thalamus

Q.39 Edible part in litchi is
(A) Pericarp (B) Mesocarp
(C) Endosperm (D) Fleshy aril

Q.40 Name the plant from seeds of which oil is obtained
(A) *Cicer arietinum*
(B) *Saccharum officinarum*
(C) *Saccharum munja*
(D) *Arachis hypogea*

Q.41 The fleshy fruits with hard and stony endocarp are called
(A) Drupe (B) Berry
(C) Pepo (D) Pome

Q.42 Which of the following families is characterised by the presence of perianth
(A) Malvaceae (B) Liliaceae
(C) Cruciferae (D) Solanaceae

Q.43 Axile placentation occurs in
(A) Asteraceae and Fabaceae
(B) Brassicaeae and Solanaceae
(C) Solanaceae and Liliaceae
(D) Brassicaceae and Solanaceae

Q.44 A diagnostic trait for identification of fabaceous flower is –
(A) Tetradynamous androecium
(B) Inferior ovary
(C) Cruciform corolla
(D) Vexillary aestivation

Q.45 Name the family having (9)+1 arrangement of stamens
(A) Solanaceae (B) Asteraceae
(C) Liliaceae (D) Fabaceae

Q.46 Familiar examples of family Liliaceae are
(A) *Allium cepa, Aloe vera* & *Tamarindus indica*
(B) *Saraca indica, Allium cepa* and *Aloe vera*
(C) *Allium sativum, Allium cepa* and *Aloe vera*
(D) *Tamarindus indica, Allium cepa* and *Allium sativum*

Q.47 Which one is odd
(A) *Allium cepa* (B) *Helianthus annuus*
(C) *Brassica juncea* (D) *Arachis hypogea*

Q.48 Choose the correct statement –
(A) Whorled Phyllotaxy : *Alstonia*
(B) Monoadelphous : china rose
(C) Basal placentation : Sunflower
(D) All of these

Q.49 Pulses are obtained from
(A) Fabaceae (B) Asteraceae
(C) Poaceae (D) Solanaceae

Q.50 *Lycopersicum esculentum* is the name of
(A) Tomato (B) Potato
(C) Cabbage (D) Brinjal

Q.51 Which of the following is correct with reference to flowers of family solanaceae
(A) Pentamerous, actinomorphic, unisexual, hypogynous
(B) Pentamerous, zygomorphic, bisexual, epigynous
(C) Pentamerous, bisexual, actinomorphic, hypogynous
(D) Trimerous, actinomorphic, bisexual, hypogynous

Q.52 Which of the family does not possess axile placentation
(A) Solanaceae (B) Malvaceae
(C) Leguminosae/Cruciferae (D) Liliaceae

Q.53 Perigynous condition is common among
(A) Liliaceae (B) Solanaceae
(C) Leguminosae (D) Malvaceae

Q.54 Diadelphous stamens are the characteristic features of
(A) Ranunculaceae (B) Fabaceae
(C) Poaceae (D) Malvaceae

Q.55 Oblique ovary is found in family
(A) Brassicaceae (B) Compositae
(C) Leguminosae (D) Solanaceae

Q.56 Stem tendrils occur in
(A) cucumber (B) pumpkins
(C) watermelon (D) all of these

Q.57 Thorn is a stem structure because it
(A) develops from stipule
(B) arises from leaf directly
(C) develops from axillary bud
(D) is structure of defence

Q.58 Select the mismatched pair.
(A) Tap root system – Dicots
(B) Fibrous root system – Monocots
(C) Fasciculated roots – *Curcuma*
(D) Stilt roots – Sugarcane

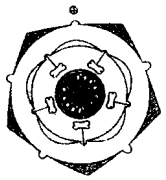
Q.59 A simple leaf can be differentiated from the pinnae of a compound leaf on the basis of presence or absence of
(A) number of pinnae (B) shape of lamina
(C) axillary bud (D) lateral buds

Q.60 In ____ aestivation, sepals or petals in a whorl just touch one another at the margins, without overlapping, as is found in ___.
(A) valvate, *Calotropis* (B) valvate, *Hibiscus*
(C) twisted, *Calotropis* (D) twisted, *Hibiscus*

Q.61 Which plant parts in garlic and onion are edible?
(A) Underground stem (B) Fleshy scale leaves
(C) Tunic (D) Adventitious roots

Q.62 Edible part of apple and pear is
(A) epicarp (B) mesocarp
(C) endocarp (D) thalamus

Q.63 Study carefully the given floral diagram and select the option which correctly represents the related floral formula (F.F).



(A) $\%\,\bigcirc\!\!\!\!+\,K_{(5)}C_{1+2+(2)}A_5\bar{G}_{(2)}$
(B) $\oplus\,\bigcirc\!\!\!\!+\,K_{(5)}\overset{\frown}{C_5\ A_5}\underline{G}_{(2)}$
(C) $\oplus\,\bigcirc\!\!\!\!+\,P_{5+5}A_{(5)}\underline{G}_{(2)}$
(D) $\oplus\,\bigcirc\!\!\!\!+\,K_{(5)}\overset{\frown}{C_{(5)}\ A_5}\underline{G}_{(2)}$

Q.64 In __ flowers, margin of thalamus grows upward enclosing the ovary completely and getting fused with
(A) hypogynous (B) perigynous
(C) epigynous (D) both (B) and (C)

Q.65 Monocotyledonous seeds possess a single cotyledon which is represented by
(A) tegmen (B) endosperm
(C) scutellum (D) aleurone

Q.66 Endosperm, a product of double fertilization in angiosperms is absent in the seeds of
(A) Gram (B) Orchids
(C) Maize (D) Castor

Q.67 The placenta is attached to the developing seed near –
(A) Testa (B) Hilum
(C) Micropyle (D) Chalaza

Q.68 Choose the correct matching related to food storage

(a)	Carrot	(i) Tap roots
(b)	Cotocesie	(ii) Stem
(c)	Sweet potato	(iii) Roots
(d)	Asparagus	(iv) Adventitious roots

(A) a-i, b-ii, c-iii, d-iii (B) a-ii, b-i, c-iii, d-iii
(C) a-i, b-ii, c-ii, d-iv (D) a-iv, b-i, c-iii, d-ii

Q.69 An example of axile placentation is:
(A) Dianthus (B) Lemon
(C) Marigold (D) Argemone

Q.70 The correct floral formula of chilli is

(A) $\oplus \male\!\!\female K_2\overset{\curvearrowleft}{C_5}A_{(5)}\underline{G_2}$ (B) $\oplus \male\!\!\female K_{(5)}C_5A_5\underline{G_2}$

(C) $\oplus \male\!\!\female K_{(5)}\overset{\curvearrowleft}{C_{(5)}}A_5\underline{G_2}$ (D) $\oplus \male\!\!\female K_{(5)}C_{(5)}A_{(5)}\underline{G_2}$

EXERCISE - 3 (LEVEL-3)

Choose one correct response for each question.

Q.1 Identify in order, the plants showing alternate, opposite and whorlled phyllotaxy
(A) China rose, *Calotropis, Nerium*
(B) China rose, *Nerium, Calotropis*
(C) *Nerium,* China rose, *Calotropis*
(D) *Nerium, Calotropis,* China rose

Q.2 Which one of the following conditions is seen in the roots of a plant having sub-merged assimilatory roots and spongy petioles?
(A) Triarch (B) Monarch
(C) Tetrarch (D) Diarch

Q.3 The edible part of cauliflower is :
(A) Mesocarp (B) Cotyledons
(C) Endosperms (D) Inflorescence

Q.4 Match the following columns.

	Column I	Column II
a.	Tubercular storage roots	1. *Tinospora*
b.	Pneumatophores	2. Heritiera
c.	Haustoria	3. *Asparagus*
d.	Prop roots	4. Viscum
e.	Assimilatory roots	5. Screwpine

(A) a-2, b-3, c-4, d-5, e-1
(B) a-3, b-4, c-5, d-1, e-2
(C) a-3, b-1, c-2, d-5, e-4
(D) a-3, b-2, c-4, d-5, e-1

Q.5 Long filamentous threads protruding at the end of the young cob of maize are
(A) styles (B) ovaries
(C) hairs (D) anthers

Q.6 Pineapple (ananas) fruit develops from
(A) a multipistillate syncarpous flower
(B) a cluster of compactly borne flowers on a common axis
(C) a multilocular monocarpellary flower
(D) a unilocular polycarpellary flower

Q.7 The fruit is chambered, developed from inferior ovary and has seeds with succulent testa in
(A) Cucumber (B) Pomegranate
(C) Orange (D) Guava

Q.8 The fleshy receptacle of syconus of fig encloses a number of
(A) Mericarps (B) Achenes
(C) Samaras (D) Berries

Q.9 Cotyledons & testa respectively are edible parts in:
(A) walnut and tamarind
(B) french bean and coconut
(C) cashew nut and litchi
(D) groundnut and pomegranate

Q.10 Sucking roots are present in the plant
(A) *Betel* (B) *Cuscuta*
(C) *Mangifera* (D) *Solanum*

Q.11 Match the following columns.

	Column I	Column II
a.	Entire leaf modified into spines.	1. *Clematis*
b.	Leaf excepts stipules modified into a tendril.	2. *Citrus*
c.	Stipules modified into tendril,	3. *Euphorbia*
d.	First leaf of axillary bud modified into spines.	4. *Lathyrus* 5. *Smilax*

(A) a-3, b-4, c-5, d-2 (B) a-3, b-1, c-4, d-2
(C) a-2, b-3, c-1, d-5 (D) a-5, b-2, c-1, d-3

Q.12 Given below is the floral diagram of a flower. Which of the following descriptions of the flower matches the floral diagram?

(A) Homochlamydeous, polypetalous, pentamerous and bisexual.
(B) Homochlamydeous, gamopetalous, tetramerous and unisexual.
(C) Heterochlamydeous, gamopetalous, pentamerous and bisexual.
(D) Heterochlamydeous, gamopetalous, tetramerous and bisexual.

Q.13 The Floral formula $\oplus\ \delta\ K_5C_{(5)}\ A_5\ G_2$ is that of –
(A) Hibiscus (B) Banana
(C) Tulip (D) Vinca

Q.14 China rose have five fused carpels at the base. This condition is called
(A) pentacarpellary, syncarpous, monoadelphous
(B) pentacarpellary, apocarpous, monoadelphous
(C) polycarpellary, syncarpous, monoadelphous
(D) pentacarpellary, syncarpous, monoadelphous

Q.15 Identify the set of characteristics related to plants belonging to family Fabaceae from the following
(A) Actinomorphic flower, syncarpous ovary and marginal placentation.
(B) Persistent calyx, epipetalous stamens and leguminous fruit.
(C) Papilionaceous corolla, axile placentation and leguminous fruit.
(D) Vexillary aestivation of corolla, diadelphous stamens and monocarpellary, unilocular ovary.

Q.16 Choose the correct matching

(i) $\oplus\ \varphi\ K_{(5)}\ C_{(5)}\ A_{(5)}\ G_{(2)}$ (a) *Hibiscus rosa-sinensis*

(ii) $\oplus\ \varphi\ K_{(5)}\ C_{1+2+(2)}\ A_{(9)+1}\ G_{\underline{1}}$ (b) *Pisum sativum*

(iii) $\oplus\ \varphi\ K_5\ C_5\ A_{5+5}\ G_{(5)}$ (c) Solanaceae family

(A) i-a, ii-b, iii-c (B) i-b, ii-c, iii-a
(C) i-c, ii-b, iii-a (D) i-a, ii-c, iii-b

Q.17 Match the following columns.

	Column I	Column II
a.	Gamosepalous	1. Flower of lily
b.	Polysepalous	2. Sterileanther
c.	Gamopetalous	3. Free petals
d.	Polypetalous	4. Free sepals
e.	Epiphyllous	5. Fused petals
f.	Staminode	6. Fused sepals

Codes
(A) a-6, b-4, c-5, d-3, e-1, f-2
(B) a-1, b-2, c-3, d-4, e-5, f-6
(C) a-6, b-5, c-4, d-3, e-2, f-1
(D) a-1, b-3, c-2, d-5, e-4, f-6

Q.18 Which one of the following is NOT true about monocotyledonae ?
(A) embryo has single cotyledon.
(B) leaves show parallel venation.
(C) flowers are generally trimerous.
(D) vascular bundles are conjoint, collateral and open.

Q.19 X is a scar on the seed coat through which the developing seeds were attached to the fruit; above the X is a small pore called Y. Identify X and Y and select the correct option.
(A) X = Micropyle, Y = Hilum
(B) X = Hilum, Y = Micropyle
(C) X = Testa, Y = Tegmen
(D) X = Chalaza, Y = Micropyle

Q.20 Match the following columns.

	Column I	Column II
a.	Apple	1. Outer portion of receptacle
b.	Coconut	2. Fleshy thalamus
c.	Jackfruit	3. Thalamus and pericarp
d.	Guava	4. Endosperm
e.	Pineapple	5. Bract, perianth and seed

Codes
(A) a-2, b-3, c-4, d-5, e-1
(B) a-5, b-3, c-1, d-4, e-2
(C) a-2, b-3, c-1, d-5, e-4
(D) a-2, b-4, c-5, d-3, e-1

Q.21 Choose the correct statement
(i) Belladonna belongs to Liliaceae family.
(ii) Indigofera belongs to Fabaceae family.
(iii) Solitary / cymose inflorescence is found in Fabaceae family.
(iv) Ovary superior in Fabaceae family.
(A) ii and iv (B) i and iii
(C) ii and iii (D) i and iv

Q.22 Coleorhiza and coleoptile are the protective sheaths covering ____ and _____ respectively.
(A) radicle, plumule (B) plumule, radicle
(C) plumule, hypocotyl (D) epicotyl, radicle

Q.23 Match the following columns.

	Column I	Column II
a.	Coleorhiza	1. Grapes
b.	Food storing tissue	2. Mango
c.	Parthenocarpic fruit	3. Maize
d.	Single seed developed from monocarpellary superior ovary	4. Radicle
e.	Membranous seed coat	5. Endosperm

(A) a-4, b-5, c-1, d-2, e-3
(B) a-4, b-2, c-5, d-1, e-3
(C) a-5, b-1, c-3, d-4, e-2
(D) a-3, b-1, c-4, d-2, e-5

Q.24 Largest flower is
(A) *Rafflesia arnoldi*
(B) *Helianthus annus*
(C) *Welwitschia mirabilis*
(D) *Nelumbo nucifera*

Q.25 Marginal placentation is generally found in family
(A) Leguminosae (B) Cucurbitaceae
(C) Malvaceae (D) Brassicaceae

Q.26 In an inflorescence where flowers are borne laterally in an acropetal succession, the position of the youngest floral bud shall be –
(A) Proximal (B) Distal
(C) Intercalary (D) Any where

Q.27 A plant has androecium with monoadelphous stamens, monothecous and reniform anthers, the corolla exhibits contorted aestivation. The plant could
(A) *Rauwolfia* (B) *Vinca*
(C) *Nerium* (D) *Hibiscus*

Q.28 $\underline{G}_{(B)}$ represents
(A) gynoecium, bicarpellary, apocarpous, superior
(B) gynoecium, bicarpellary, syncarpous, inferior
(C) gynoecium, bicarpellary, apocarpous, inferior
(D) gynoecium, bicarpellary, syncarpous, superior

Q.29 Smallest angiospermic flower is
(A) *Wolffia* (B) Rose
(C) China rose (D) *Rafflesia*

Q.30 Two plants A and B belonging to Solanaceae were observed. In plant 'A', the number of locules in the ovary of a flower was half of that of its carpel number. In plant B, the number of locules in the ovary of a flower was double the number of carpels. Identify plants 'A' and 'B' respectively.
(A) Capsicum, Datura
(B) *Cestrum, Petunia*
(C) *Withania, Solanum*
(D) *Lycopersicon, Nicotiana*

Q.31 Match the following columns.

	Column I	Column II
a.	Edible mesocarp	1. Coconut
b.	Endospermous seed	2. Mango
c.	Fibrous mesocarp	3. Bean
d.	Non-endospermous seed	4. Castor
e.	Ovules	5. Future fruit
f.	Ovary	6. Future seed

Codes
(A) a-1, b-2, c-3, d-4, e-5, f-6
(B) a-6, b-5, c-4, d-2, e-2, f-1
(C) a-2, b-4, c-1, d-3, e-6, f-5
(D) a-5, b-6, c-3, d-1, e-4, f-2

Q.32 Match Column-I with Column-II select the correct option.

	Column - I	Column - II
(a)	Vegetative buds	(i) Buds develop in axils of leaves
(b)	Floral buds	(ii) Buds produce leafy shoots
(c)	Axillary buds	(iii) Reproductive buds that produce flowers
(d)	Accessory buds	(iv) Additional buds borne at leaf bases

(A) (a) - (ii), (b) - (iii), (c) - (i), (d) - (iv)
(B) (a) - (iii), (b) - (ii), (c) - (i), (d) - (iv)
(C) (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i)
(D) (a) - (i), (b) - (ii), (c) - (iv), (d) - (iii)

Q.33 Which of the following floral formulae corresponds to family Liliaceae?

(A) $Br\oplus\delta\,P_{3+3}A_{3+3(2)}\bar{G}_{(3)}$ (B) $Br\oplus\varphi P_{3+3}A_0\underline{G_{(3)}}$

(C) $Br\oplus\delta P_3A_3\underline{G_{(3)}}$ (D) $Br\oplus\delta P_{3+3}\ A_{3+3}\underline{G_{(3)}}$

Q.34 In plants like mint and jasmine, a slender lateral branch arises from the base of the main axis and after growing aerially for sometime, arch downwards to touch the ground. This slender branch is called

(A) sucker (B) stolon
(C) offset (D) scramblers

Q.35 Parallel venation is a characteristic of monocots. Which of the following is an exception to this generalization?

(A) *Smilax* (B) *Colocasia*
(C) *Alocasia* (D) All of these

Q.36 Endospermic seeds are found in

(A) barley (B) castor
(C) both (A) and (B) (D) pea

Q.37 Sub-aerial stem modification with long internodes is –

(A) tuber (B) phyllode
(C) phylloclade (D) runner

Q.38 A small rootless aquatic herb in which a portion of leaf forms a tiny sack or bladder which traps water insects is

(A) *Dionaea* (B) *Utricularia*
(C) *Sarracenia* (D) *Drosera*

Note (Q.39-Q.49) :

(A) Statement- 1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement -1
(B) Statement -1 is True, Statement -2 is True ; Statement-2 is NOT a correct explanation for Statement - 1
(C) Statement - 1 is True, Statement- 2 is False
(D) Statement -1 is False, Statement -2 is False.

Q.39 **Statement 1 :** Bud may form leaves and flowers.
Statement 2 : Bud is a condensed shoot.

Q.40 **Statement 1 :** A simple leaf has undivided lamina.
Statement 2 : Leaves showing pinnate and palmate venation have various type of incisions.

Q.41 **Statement 1 :** Citrus is a palmate compound leaf.
Statement 2 : Citrus has single functional leaflet.

Q.42 **Statement 1 :** Whole compound leaf of Clematis converts into tendril.
Statement 2 : Gloriosa superba shows whole leaf tendril.

Q.43 **Statement 1 :** Leaves of Bryophyllum, Begonia help in vegetative multiplication.
Statement 2 : Leaves of these plants possess adventitious buds.

Q.44 **Statement 1 :** Adiantum caudatum is a walking fern.
Statement 2 : Adiantum grows vegetatively by their leaf tips.

Q.45 **Statement 1:** In corymb, all the flowers lie at the same level.
Statement 2 : Pedicels of all the flowers are of same length.

Q.46 **Statement 1 :** An incomplete flower can be perfect.
Statement 2: Perfect flowers (incomplete) are called neuter.

Q.47 **Statement 1 :** A plant having unisexual flowers are called dioecious.
Statement 2 : Mango is a polygamous plant.

Q.48 **Statement 1 :** Ginger has a prostrate-growing rhizome.
Statement 2 : Shoot growth is not effected by gravity.

Q.49 **Statement 1 :** Coconut tree is distributed in coastal areas over a large part of the world.
Statement 2 : Coconut fruit can float and get dispersed over thousands of kilometers before losing viability.

EXERCISE - 4 (PREVIOUS YEARS AIPMT/NEET EXAM QUESTIONS)

Q.1 Among bitter gourd, mustard, brinjal, pumpkin, china rose, lupin, cucumber, sunnhemp, gram, guava, bean, chilli, plum, petunia, tomato, rose, *Withania*, potato, onion, aloe and tulip how many plants have hypogynous flower? **[NEET 2013]**
(A) Fifteen (B) Eighteen
(C) Six (D) Ten

Q.2 In China rose the flowers are **[NEET 2013]**
(A) zygomorphic, hypogynous with imbricate aestivation.
(B) zygomorphic, epigynous with twisted aestivation.
(C) actinomorphic, hypogynous with twisted aestivation.
(D) actinomorphic, epigynous with valvate aestivation.

Q.3 Seed coat is not thin, membranous in : **[NEET 2013]**
(A) Gram (B) Maize
(C) Coconut (D) Groundnut

Q.4 Placenta and pericarp are both edible portions in **[AIPMT 2014]**
(A) apple (B) banana
(C) tomato (D) potato

Q.5 When the margins of sepals or petals overlap one another without any particular direction, the condition is termed as **[AIPMT 2014]**
(A) vexillary (B) imbricate
(C) twisted (D) valvate

Q.6 An example of edible underground stem is **[AIPMT 2014]**
(A) carrot (B) groundnut
(C) sweet potato (D) potato

Q.7 An aggregate fruit is one which develops from **[AIPMT 2014]**
(A) multicarpellary syncarpous gynoecium
(B) multicarpellary apocarpous gynoecium
(C) complete inflorescence
(D) multicarpellary superior ovary.

Q.8 Which one of the following statements is correct? **[AIPMT 2014]**
(A) The seed in grasses is not endospermic
(B) Mango is a parthenocarpic fruit
(C) A proteinaceous aleurone layer is present in maize grain
(D) A sterile pistil is called a staminode

Q.9 $\oplus \overset{+}{\underset{\nearrow}{O}} K_{(5)} \overset{\frown}{C_{(5)}} A_5 \underline{G}_{(2)}$ is the floral formula of **[AIPMT 2015]**
(A) *Petunia* (B) *Brassica*
(C) *Allium* (D) *Sesbania*

Q.10 Perigynous flowers are found in **[AIPMT 2015]**
(A) china rose (B) rose
(C) guava (D) cucumber

Q.11 Leaves become modified into spines in **[AIPMT 2015]**
(A) onion (B) silk Cotton
(C) *Opuntia* (D) pea

Q.12 The wheat grain has an embryo with one large, shield shaped cotyledon known as – **[AIPMT 2015]**
(A) scutellum (B) coleoptile
(C) epiblast (D) coleorhiza

Q.13 Among china rose, mustard, brinjal, potato, guava, cucumber, onion and tulip, how many plants have superior ovary? **[AIPMT 2015]**
(A) Three (B) Four
(C) Five (D) Six

Q.14 Axile placentation is present in **[AIPMT 2015]**
(A) pea (B) *Argemone*
(C) *Dianthus* (D) lemon

Q.15 Keel is the characteristic feature of flower of : **[AIPMT 2015]**
(A) *Indigofera* (B) *Aloe*
(C) Tomato (D) Tulip

Q.16 Roots play insignificant role in absorption of water in : **[RE-AIPMT 2015]**
(A) Pistia (B) Pea
(C) Wheat (D) Sunflower

Q.17 The standard petal of a papilionaceous corolla is also called **[NEET 2016 PHASE 1]**
(A) Carina (B) Pappus
(C) Vexillum (D) Corona

Q.18 Tricarpellary, syncarpous gynoecium is found in flowers **[NEET 2016 PHASE 1]**
(A) Liliaceae (B) Solanaceae
(C) Fabaceae (D) Poaceae

Q.19 Proximal end of the filament of stamen is attached to the **[NEET 2016 PHASE 1]**
(A) Anther (B) Connective
(C) Placenta (D) Thalamus or petal

Q.20 Which of the following is not a stem modification? **[NEET 2016 PHASE 1]**
(A) Pitcher of *Nepenthes*
(B) Thorns of citrus
(C) Tendrils of cucumber
(D) Flattened structures of Opuntia

Q.21 Stems modified into flat green organs performing the functions of leaves are known as **[NEET 2016 PHASE 1]**
(A) Cladodes (B) Phyllodes
(C) Phylloclades (D) Scales

Q.22 Radial symmetry is found in the flowers of **[NEET 2016 PHASE 2]**
(A) *Brassica* (B) *Trifolium*
(C) *Pisum* (D) *Cassia*

Q.23 Free-central placentation is found in **[NEET 2016 PHASE 2]**
(A) *Dianthus* (B) *Argemone*
(C) *Brassica* (D) *Citrus*

Q.24 The term 'polyadelphous' is related to **[NEET 2016 PHASE 2]**
(A) Gynoecium (B) Androecium
(C) Corolla (D) Calyx

Q.25 How many plants among *Indigofera, Sesbania, Salvia, Allium, Aloe*, mustard, groundnut, radish, gram and turnip have stamens with different lengths in their flowers? **[NEET 2016 PHASE 2]**
(A) Three (B) Four
(C) Five (D) Six

Q.26 In *Bougainvillea* thorns are the modifications of
(A) Stipules (B) Adventitious root
(C) Stem (D) Leaf **[NEET 2017]**

Q.27 The morphological nature of the edible part of coconut is **[NEET 2017]**
(A) Perisperm (B) Cotyledon
(C) Endosperm (D) Pericarp

Q.28 Root hairs develop from the region of –
(A) Maturation (B) Elongation **[NEET 2017]**
(C) Root cap (D) Meristematic activity

Q.29 Pneumatophores occur in **[NEET 2018]**
(A) Carnivorous plants
(B) Free-floating hydrophytes
(C) Halophytes
(D) Submerged hydrophytes

Q.30 Sweet potato is a modified **[NEET 2018]**
(A) Tap root (B) Adventitious root
(C) Stem (D) Rhizome

Q.31 Placentation in which ovules develop on the inner wall of the ovary or in peripheral part, is **[NEET 2019]**
(A) Basal (B) Axile
(C) Parietal (D) Free central

ANSWER KEY

EXERCISE-1 (SECTION-1&2)

(1) (A) **(2)** (B) **(3)** (C)
(4) (A) **(5)** (B) **(6)** (D)
(7) Reticulate venation **(8)** Parallel venation
(9) Stipule **(10)** Simple leaf
(11) Compound leaf **(12)** Axil
(13) Pinnately compound **(14)** Monocotyledons
(15) Racemose Inflorescences
(16) Cymose Inflorescences **(17)** Filament
(18) Anther **(19)** Stigma **(20)** Drupe

EXERCISE - 1 [SECTION-3 & 4]

Q	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
A	B	D	A	C	C	B	A	A	C	C	A	C	B	B	B	B	A	A	B	C	A	A	A	B	A
Q	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
A	D	A	B	D	A	B	A	B	C	C	A	C	A	D	C	D	A	A	C	A	B	C	D	D	A
Q	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
A	A	D	C	C	C	D	A	A	B	D	A	A	D	D	C	D	C	B	D	C	D	D	A	B	A
Q	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
A	D	A	D	A	A	D	C	C	A	B	B	B	D	B	D	B	D	B	C	C	D	B	D	A	C
Q	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145
A	D	D	D	B	C	A	B	C	B	D	B	D	A	D	C	D	D	C	C	B	C	D	D	B	A
Q	146	147	148	149	150	151	152	153	154	155	156	157													
A	B	A	D	C	D	A	B	D	A	A	C	B													

EXERCISE - 2

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
A	C	D	C	A	A	C	B	B	C	B	A	C	B	D	A	C	B	B	A	A	B	B	A	B	B
Q	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
A	A	B	A	B	A	D	D	A	D	A	D	C	B	D	D	A	B	C	D	D	C	A	D	A	A
Q	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70					
A	C	C	C	B	D	D	C	C	C	A	B	D	D	C	C	B	D	A	B	C					

EXERCISE - 3

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
A	A	B	D	D	A	B	B	B	D	B	A	D	D	A	D	C	A	D	B	D	A	A	A	A	A
Q	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	
A	B	D	D	A	A	C	A	D	B	D	C	D	B	A	B	B	C	A	A	C	C	B	B	B	

EXERCISE - 4

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
A	A	C	C	C	B	D	B	C	A	B	C	A	D	D	A	A	C	A	D	A	C	A	A	B	B
Q	26	27	28	29	30	31																			
A	C	C	A	C	B	C																			

SOLUTIONS

EXERCISE-1

(1) (A) **(2)** (B) **(3)** (C)
(4) (A) **(5)** (B) **(6)** (D)

(7) **Reticulate venation :** The venation, where the veins are arranged in the form of a complex network.

(8) **Parallel venation :** The venation, where the veins are arranged parallely.

(9) **Stipule :** Small leaf-like structure present commonly in pair at the base of a petiole.

(10) **Simple leaf :** A leaf, where a single lamina is present on a petiole.

(11) **Compound leaf :** A leaf, where lamina divides into a number of small leaflets.

(12) The space between a petiole (or blade) and the stem is called an **axil.**

(13) If the leaflets are arranged in pairs along a common axis (the axis is called a rachis—the equivalent of the main central vein, or midrib, in simple leaves), the leaf is **pinnately compound.**

(14) The **monocotyledons** have one cotyledon (seed leaf) in the seed.

(15) **Racemose Inflorescences :** the axis of the inflorescence is indeterminate(continues to grow).

(16) **Cymose Inflorescences :** Upward growth of the floral axis is stopped early by the development of a terminal flower.

(17) **Filament :** Thin stalk that attaches the anther to the rest of the flower.

(18) **Anther :** Lobed, oblong, bag-like appendage at the top of the filament that produces the pollen grains that develop the male germ cells.

(19) **Stigma :** The tip of the pistil especially adapted to receive the pollen grains.

(20) **Drupe:** "stone fruit", a simple fruit produced from a single carpel.

(21) **(B).** A-Node, B-Internode, C-Bud, D-Primary root, E-Secondary root

(22) **(D).** Primary roots and its branches constitutes the tap root system as seen in mustard plants (fig.a).
Roots originate from the base of the stem and constitutes the fibrous root system as seen in wheat plant (figure b).

(23) **(A).**

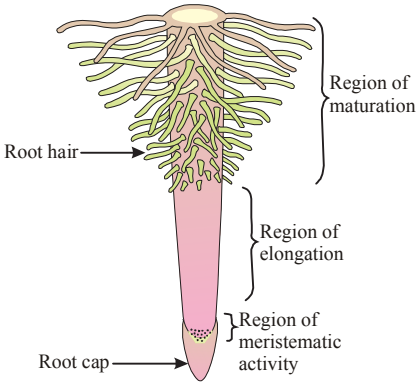
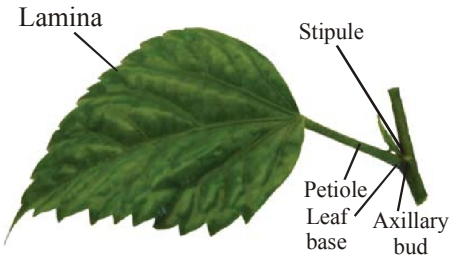


Figure : The regions of the root-tip

(24) **(C).** Pneumatophores are found in the plant inhabitants of the marshy area, e. g., Rhizophora. These type of roots performs the function of respiration.

(25) **(C).** a - Storage, b - Support
c - Protection, d- Reproduction
From the given diagram, c represent thorn, which helps in protection for plant.

(26) **(B).**



Structure of a leaf showing different parts

(27) **(A).** Reticulate venation are found in dicotyledonous. Parallel venation are found in monocotyledonous.

(28) **(A). Compound Leaves**
(i) Pinnately Compound leaves : Number of leaflet around common axis. e.g., neem
(ii) Palmately Compound Leaves : Leaflets are attached at a common point. e.g., cotton silk.

(29) **(C).** Types of phyllotaxy
a. **Alternate** Single leaf arises at each node in alternate manner, e.g., China rose.
b. **Opposite :** Pair of leaves arises at each node, e.g., *Calotropis*.

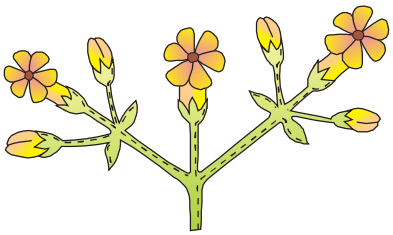
c. **Whorled :** More than two leaves at each interval, e.g.: *Alstonia.*

(30) (C). Figure a represent leaf tendrills, which help the plant in supporting around other plant for climbing. Figure b represent leaves modified into spines, which protect the plant and c is fleshy leaves, which store the food.

(31) (A). In the given diagram, there is no flower at the tip of shoot. So, it would have indefinite growth. The flower borne laterally.

Racemose inflorescence

In cymose, the shoot tip ends with a terminal flower so it have limited growth.



Cymose inflorescence

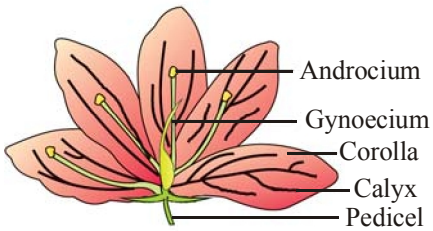
(32) (C).

(i) **Hypogynous flower** Gynoecium occupies its highest position. This is called the superior ovary. e.g., mustard, China rose, brinjal.

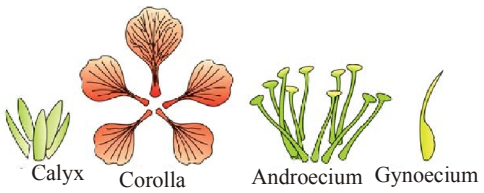
(ii) **Perigynous flower** Gynoecium is situated in the centre and other parts are situated at the same level. This condition is called half inferior ovary. e.g., plum, rose, peach.

(iii) **Epigynous flower** The other part lies above the ovary. This condition is called the inferior ovary. e.g., guava, cucumber, sunflower.

(33) (B).



(34) (B).



Calyx : Outer part of flower which is generally used for the protection of flower. It is sometime fused with the corolla and used for special functions.

Corolla : It is the brightly coloured (generally) which is used for the attraction of insect for pollination.

Androecium : Male reproductive part containing stamen. In stamen, there are pollen sac which contain pollens.

Gynoecium : Female reproductive part which contains stigma, style and ovary.

(35) (B). a-Valvate, b-Twisted, c-Imbricate, d-Vexillary

(36) (B). Aestivation

a - Valvate, e.g., *Calotropis procera.*

b - Twisted, e.g., lady's finger and cotton.

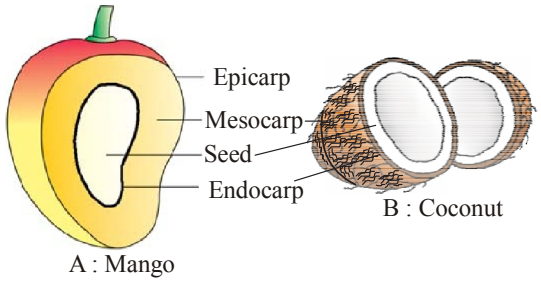
c - Imbricate, e.g., *Cassia* and gulmohar.

d - Vexillary, e.g., bean and pea.

(37) (A). Types of placentation

a-Marginal, b-Axile, c-Parietal, d-Free central, e-Basal

(38) (A). Parts of fruit



(39) (B).

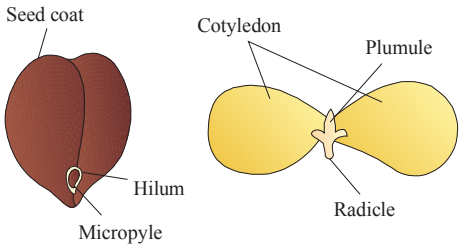


Figure : Structure of dicotyledonous seed

(40) (C).

(41) **(A).**

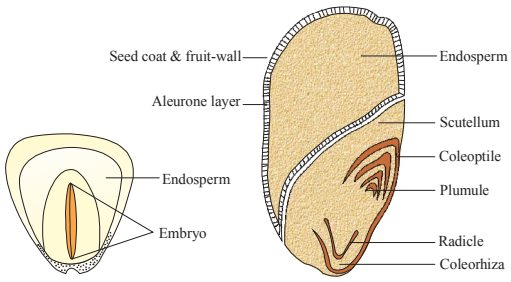


Figure : Structure of a monocotyledonous seed

(42) **(A).** Brassica - Ebr $\oplus$ $\delta^{\uparrow}$ K_{2+2} C_4 A_{2+4} $\underline{G}$(B)
Ebracteate, actinomorphic, bisexual.
Calyx-4- (two whorl of each two).
Corolla-4- (Free).
Androecium-6- (tetradynamous in two whorl one with two, second with four).
Gynoecium-Bicarpellary, syncarpous, superior.

(43) **(A).** Pea plants belongs to Fabaceae family.

(44) **(B).** **Inflorescence:** racemose
Flower: bisexual, zygomorphic
Calyx: sepals five, gamosepalous; 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: ten, diadelphous, anther dithecous
Gynoecium: ovary superior, mono carpellary, unilocular with many ovules, style single
Fruit: legume; seed: one to many, non-endospermic.
Floral Formula:

$\%$ $\delta^{\uparrow}$ $K_{(5)}$ $C_{1+2+(B)}$ $A_{(9)+1}$ $\underline{G}_1$

(45) **(A).** In Solanaceae, gynoecium is bicarpellary, syncarpous, ovary is superior, bilocular.

(46) **(D).** **Perianth** Onion flower have 6 tepals in two alternate whorl of three each, polyphyllous.
Androecium Six stamens in two whorls of three each opposite the tepals; antipetalous.
Gynoecium Tricarpellary, syncarpous ovary, trilocular with 2 ovules in each locules. So, from this description it is clear that the given flora diagram is of onion plant.

(47) **(A).** Inflorescence of onion is cymose, i.e., inflorescence axis terminated into flower. Each individual flower is made up of six stamens, three carpels and six perianth segment so the given figure is of onion.

(48) (B) **(49)** (D) **(50)** (A)

(51) **(B).** In majority of the dicotyledonous plants, the direct elongation of the radicle leads to the formation of primary roots, which grows inside the soil. It bears lateral roots of several orders that are referred to as secondary, tertiary root etc. The primary roots and its branches constitute the tap root system as seen in mustard plant.

(52) **(A).** **Stilt Root :** These are also called brace roots. They are short but thick supporting roots, which develop obliquely from the basal nodes of stem. In sugarcane, maize, pennisetum and sorghum, the stilt roots grow in whorls. After penetrating the soil, they provide support to plants.

(53) **(B).**

(54) **(C).** From the region of maturation, 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.

(55) **(C).**

(56) **(A).** **Taproot System :** The first root produced from seed is called radicle. In dicotyledonous plant this root became more prominent and is known as tap root and many small branches of root arise from this by forming tap root system.

(57) **(C).**

(58) **(A).** In some plants such as Rhizophora (growing in swampy areas) many roots came out of the ground and grow vertically upwards. Such roots are called pneumatophores, which helps to get oxygen for respiration.

(59) **(D).** In monocotyledonous plant, the primary root is short lived and is replaced by large number of roots. Those roots originate from the base of the stem and constitutes the fibrous root system, as seen in the wheat or rice plant.

(60) **(C).**

(61) **(D).**

(62) **(A).** In some plants like grass, Monstera and the banyan tree, roots arise from parts of the plant other than the radicle are called adventitious roots.

(63) **(A).** Roots in some plants change their shape and structure and become modified to perform functions other than absorption and conduction of water and minerals. They are modified for support, storage of food, respiration, etc. The tap roots of carrot, turnip and adventitious roots of sweet potato get swollen and store food.

(64) **(C).**

(65) **(A).** Prop or Pillar Roots They are thick pillar-like adventitious root, which grow from and support heavy horizontal branches of banyan tree. Initially, these roots are aerial and hygroscopic. As the root reaches to the soil, they become thick and pillar-like.

(66) **(B).**Sem tendrils which develops from axillary buds are slender and spirally coiled and helps the plant to climb such as in gourds (cucumber, pumpkins, watermelon) and grapevines.

(67) **(C).**

(68) **(D).** The stem may not always be typically like what they are expected to be. They are modified to perform different functions. Underground stem of potato, ginger, turmeric, zaminkand, *Colocasia* are modified for storing food in them. They also acts as organs of penetration to tide over the conditions unfavourable for growth.

(69) **(D).**

(70) **(A).** Edible stem : potato

(71) **(A).** Axillary buds of stem may also get modified into woody, straight and pointed thorns. Thorns are found in many plants such as *Citrus*, *Bougainvillea*. They protect the plant from browsing animals.

(72) **(D).** Runners are special narrow, green, above ground horizontal or prostate branches which develop at the bases of erect shoots called crowns. They replace the old parts, e. g., grass, strawberry.

(73) **(C).** A-Ascending, B-Plumule
During seed germination the radical of embryo develops into root, while the plumule develops into stem.

(74) **(C).** Stem develops from the plumule part of embryo. Root develops from the radicle part of embryo.

(75) **(C).** They are one internode long small runners, which are found in rosette plants at the ground or water land, e. g. , *Pistia* (water lettuce), *Eichhornia* (water hyacinth).

(76) **(D).** The leaf is a lateral, generally flattened structure borne on the stem. It develops at the node and bears a bud in its axil. The axillary bud later develops into a branch. Leaves originate from shoot apical meristems and are arranged in an acropetal order. They are the most important vegetative organs for photosynthesis.

(77) **(A).**

(78) **(A).**

(79) **(B).** In many legumes leaf base is swollen, it is known as pulvinus.

(80) **(D).** The lamina or the leaf blade is the green expanded part of the leaf with veins and veinlets. There is usually, a middle prominent vein, which is known as the midrib. Veins provide rigidity to the leaf blade and acts as channels of transport for water, minerals and food materials. The shape, margin, apex, surface and extent of incision of lamina varies in different leaves.

(81) **(A).**

(82) **(A).** In monocotyledons, the leaf base expands into a sheath covering the stem totally or partially. In some leguminous plants, the leaf base may become swollen which is called pulvinus.

(83) **(D).** The compound leaf may be of two kind.
Pinnately Compound Leaf :A number of leaflets are present on the common axis, the rachis represents the midrib of the leaf as in neem.
Palmately Compound Leaf : In palmately compound leaves, the leaflets are attached to common point, e.g, silk cotton.

(84) **(D).** Petiole is a cylindrical stalk of the leaf which fits into lamina above the level of stem so as to provide it with maximum exposure. Petiole helps to hold the blade to light. Long thin flexible petioles allow leaf blades to flutter in wind, thereby cooling the leaf and bringing fresh air to the leaf surface.

(85) **(C).** Phyllotaxy is generally of three types –
Alternate : A single leaf arises at each node in altemate method e.g., China rose, mustard, sunflower.
Opposite : In this a pair of leaves arise at each node and lie opposite to each other as in *Calotropis* and guava.
Whorled : If two or more leaves arise at the node and form a whorl. It is called whorled phyllotaxy as in *Alstonia*.

(86) **(D).** Inflorescence.
Depending on whether the apex gets converted into flower or continues to grow.
Racemose : Main axis continues to grow flower grow laterally. e.g., radish, mustard.
Cymose : The main axis terminates in flower hence limited growth. e.g., jasmine, *Calotropis*.

(87) **(C).**

(88) **(B).** Racemose

(89) **(D).** In racemose inflorescence the axis do not terminate in a flower so have unlimited growth and flower are arranged in acropetal manner.
In cymose inflorescence flowers are borne in a basipetal order.
Cymose-Jasmine, *Calotropis*.

(90) **(C).** The flower is a reproductive unit in the angiosperms, is meant for sexual reproduction.

(91) **(D).** Pedicel of flower is called thalamus or receptacle

(92) **(D).** Sometimes calyx and corolla of the flower are not distinct. This condition is called perianth. Example lily.

(93) **(A).**Flower generally has four whorls.

Accessory part	**Reproductive part**
Calyx	Androecium
Corolla	Gynoecium

When a flower has both androecium and gynoecium, it is bisexual. A flower having either only stamens or only carpels is unisexual.

(94) **(B).** Ovary is said to be half inferior in perigynous.

(95) **(A).** bracteate; ebracteate

(96) **(D).** When carpels are free, they are called apocarpous.
When the carpels fused, they are called syncarpous.

(97) **(A).** A sterile stamen (incapable of producing fertile pollen) is called staminode.

(98) **(D).** Actinomorphic (Radial symmetry) - e.g., mustard, datura, chilli.

(99) **(A).**

(100) **(A).** A flower may be trimerous, tetramerous or pentamerous when the floral appendages are in multiples of 3, 4 or 5 respectively.

(101) **(D).** Zygomorphic (Bilateral symmetry) - e.g., pea, gulmohar, bean, *Cassia.*

(102) **(C).** Asymmetric (Irregularshape) - e.g., *Canna.*

(103) **(C).** Aestivation : The mode of arrangement of sepals or petals in floral buds with respect to other members of the same whorl is known as aestivation.

(104) **(A).** Hypogynous : When gynoecium occupies the highest position, it is called superior ovary.

(105) **(B).** Ovary – Enlarged basal part of carpel
Stigma – Tip of style
Style – Connect ovary to stigma

(106) **(B).** Calyx is composed of sepals if sepals are free(polysepalous) or united (gamosepalous).

(107) **(B).** Ovules arranged differently in a ovary according to the type of fruit or flower. The arrangement of ovule in the ovary is called placentation.

(108) **(D).** 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.

(109) **(B).** Valvate aestivation.

(110) (D). 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.

(111) (B). Androecium is composed of stamens. Each stamen which represents the male reproductive organ consists of stalk or a filament and an anther.

(112) (D). Corolla is composed of petals. Petals are usually brightly coloured to attract insects for pollination. Like calyx, corolla may be free(Polypetalous) or united (gamopetalous). The shape and colour of corolla vary greatly in plants. Corolla may be tubular, bell-shaped, funnel-shaped or wheel-shaped.

(113) (B). Twisted : If one margin of the appendages overlaps that of the next one and so on. e.g., China rose, cotton, lady's finger.

(114) (C). The stamens in a flower may either remain free (polyandrous) or may be united in varying degrees. The stamens may be united into one bunch or one bundle (monoadelphous) as in China rose or two bundles (diadelphous) as in pea or into more than two bundles (polyadelphous) as in *Citrus*. There may be a variation in the length of filaments within a flower, as in *Salvia* and mustard.

(115) (C). Imbricate : If the margins of sepals or petals overlap one another but not in any particular direction, e.g., *Cassia* and gulmohar.

(116) (D). Male reproductive organ stamen consises of stalk and anther.

(117) (B). Twisted : If one margin of the appendages overlaps that of the next one and so on. e.g., China rose, cotton, lady's finger.

(118) (D). In perigynous ovary, the gynoecium is situated in the centre and other part are located on the rim of thalamus having same level. This type of ovary is called half inferior. e.g., plum, rose and peach.

(119) (A). Each ovary bears one or more ovules attached to flattened, cushion like structure, called placenta.

(120) (C). Valvate aestivation – *Calotropis*
Twisted aestivation – Cotton, China rose
Imbricate aestivation – *Cassia*
Vexillary aestivation – Pea

(121) (D). Each anther is usually bilobed and each lobe has two chambers, the pollen-sacs.
The pollen grains are produced in pollen-sacs.

(122) (D). Stamens of flower may be united with other members such as petals or among themselves. When stamens are attached to the petals, they are epipetalous as in brinjal or epiphyllous when attached to the perianth as in the flowers of lily.

(123) (D). Each ovary bears one or more ovules attached to the flattened cushion-like placenta. When more than one carpels are present, they may be free (as in the lotus and rose) and are called apocarpous.

(124) (B). Syncarpous : when carpels are fused as in mustard and tomato.

(125) (C).

(126) (A). Types of placentation are marginal, axile, parietal, free central and basal. 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 axile and the ovules are attached to it in a multilocular ovary, the placentation 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 the single ovule is attached to it, as in the sunflower and marigold.

(127) (B). The fruit is a characteristic feature of the flowering plant. It is a mature or ripened ovary developed after the fertilisation.

(128) (C). Drupe : The pericarp is differentiated into epicarp, mesocarp and endocarp. Endocarp is stony. Hence, the drupes are also called stone fruits. Drupe develops from monocarpellary superior ovaries and are one seeded.

(129) (B). Fruit formed without fertilisation of ovary is called parthenocarpic fruit.

(130) (D). Generally, the fruit consists of a wall or pericarp and seed. The pericarp may be dry or fleshy. When pericarp is thick and fleshy, it is differentiated into outer epicarp, the middle mesocarp and the inner endocarp.

(131) (B). Drupe is a fleshy, one or more chambered and one or more seeded fruit developing from monocarpellary syncarpous pistil with pericarp differentiated into mesocarp (fleshy) and the endocarp (stony and hard). Therefore, it is so, called as stone fruit,e.g, mango, peach, coconut, etc.

(132) (D). In mango the pericarp is well differentiated into an outer thin pericarp, a middle fleshy edible mesocarp and an inner stony hard endocarp. In coconut which is also a drupe, the mesocarp is fibrous.

(133) (A). The ovule after fertilisation develops into seed. Seed is made up of seed coat and embryo. Embryo is made up of plumule, embryonal axis, radicle and cotyledon.

(134) (D). Monocotyledon plant are those, which have one cotyledon example wheat, maize.

(135) (C). In monocotyledonous seeds, the embryo is small and situated in a groove at one end of the endosperm. Embryo consists of one large and shield shaped cotyledon known as scutellum and a short axis with a plumule and a radicle. The plumule and radicle are enclosed in sheaths which are called coleoptile and coleorhiza, respectively.

(136) (D). Scar on the seed coat through which seeds are attached to the fruit is called hilum.

(137) (D). Dicotyledon plant are those, which have two cotyledons example, gram, pea, castor.

(138) (C). The outer covering of endosperm separates the embryo by a proteinous layer called the aleurone layer.

(139) (C). The place of attachment of cotyledons on the embryo axis bears radicle or embryonic root. The other end contains plumule or embryonic bud.

(140) (B). The outermost covering of a seed is the seed coat. The seed coat has two layers, the outer testa and inner tegmen.

(141) (C). Endosperm is formed as a result of double-fertilisation.

(142) (D). Generally in the monocotyledons, the food is commonly stored inside the endosperm. But in the orchid, the seeds are non-endospermic.

(143) (D). Endosperm nourishes the developing embryo during seed development. In plants such as bean, gram and pea, the endosperm is not present in the mature seed because the endosperm is completely consumed during development of seed. Such seeds are called nonendospermic or exalbumious.
In monocots and castor bean (dicot), embryo do not consume all endosperm during seed development. So it persists in the mature seeds. Such seeds are called endospermic or albuminous seed.

(144) (B). K-Calyx, C-Corolla

(145) (A). a- Bisexual, b-Actinomorphic
c-Zygomorphic

(146) (B). Bisexual flower

(147) (A). $\underline{G}$ = Superior ovary (hypogynous flower)
$\overline{G}$ = Inferior ovary (epigynous flower)

(148) (D). **Fabaceae :** Earlier it was called Papilionoideae a sub-family of family Leguminosae. It is distributed all over the world.

(149) (C). Solanaceae is also called 'potato family'. It is widely distributed in tropics, subtropics and even in temperate zones.

(150) (D). Floral characters of lily family
Inflorescence Solitary/cymose; often umbellate clusters.
Flower Bisexual; actinomorphic.
Perianth Tepal six (3 + 3), often united into tube; valvate aestivation.
Androecium Stamen six, (3 + 3).
Gynoecium Tricarpellary, syncarpous, ovary superior, trilocular with many ovules;

axile placentation.
Fruit Capsule, rarely berry.
Seed Endospermous.
Floral Formula

$\oplus\ \delta^{\uparrow}\ P_{3+3}\ A_{3+3}\ \underline{G}_{(C)}$

(151) (A). **Floral characters of family**-Fabaceae.
Inflorescence Racemose.
Flower Bisexual, zygomorphic.
Calyx Sepals five, gamosepalous; 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 Ten, diadelphous, anther dithecous.
Gynoecium Ovary superior, monocarpellary, unilocular with many ovules, style single.
Fruit Legume, seed, one to many, non-endospermic.

(152) (B). Floral characters of family-Solanaceae
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, syncarpous, ovary, superior biocular, placenta swollen with- many ovules.
Fruits Berry or capsule
Seeds Many, endospermous

Floral Formula $\oplus\ \delta^{\uparrow}\ K_{(5)}\ \widehat{C_{(5)}A}_{5}\ G_{(B)}$

(153) (D). Liliaceae is commonly called lily family and is a characteristic of monocotyledonous family.

(154) (A). (i) *Colchicum autumnale* : Liliaceae
(ii) *Petunia* : Solanaceae
(iii) *Gloriosa* : Liliaceae
(iv) *Trifolium* : Fabaceae
(v) *Sesbania* : Fabaceae

(155) (A). A-Racemose, B-Zygomorphic, C-3 + 3, D- Monocarpellary.

(156) (C). Soyabean belongs to Fabaceae family.

(157) (B). Chilli belongs to Solanaceae family.

EXERCISE-2

(1) (C). Smallest region of root is meristematic or growing point. In this, the cells are very small and actively dividing, having dense cytoplasm.

(2) (D). Date palm - Pericarp

(3) (C). Ginger is an underground stem, it is distinguished from root because it has nodes and internodes.

(4) (A). a-(ii), b-(iii), c-(iv), d-(v), e-(i)

(5) (A). Prostate or Sub-ariel Weak Stems : The weak stem take the support of ground for spreading and proper exposure of leaves and reproductive organs. They are of two categories-trailers and creepers. Creepers root at intervals while trailers do not do so. Breaking of the different rooted parts help in vegetative reproduction in creepers.

(6) (C).

(7) (B). Given figure represents tap roots system. Lateral branches of the roots develop from interior (usually pericycle) of the parent root. Such an origin is called endogenous.

(8) (B).

(9) (C). Hydrophytes are plants adapted for growing in water, water logged soil or on a substrate that becomes inundated on a regular basis. In hydrophytes, roots are of secondary importance so they are poorly developed.

(10) (B). $\%\delta^{\downarrow}\ K_{(5)}C_{1+2+(B)}A_{1+(9)}\underline{G}_{1}$
This floral formula is of family Fabaceae (Papilionaceae). Flower is zygomorphic and papilionaceous. Calyx 5, gamosepalous with odd sepal anterior. Corolla 5, petals unequal and differentiated into 1 standard, 2 alae and a keel or carina made up of two partially fused petals. The petals are arranged in descending imbricate aestivation. Androecium diadelphous 1+(9). Gynoecium monocarpellary, ovary superior, unilocular with marginal placentation.

(11) **(A).** In some plants roots arise from lower nodes of stem and enter the soil to provide extra support. They behave as ropes of a tent. Such roots are called stilt or brace roots *e.g., Pandanus*.

(12) **(C).** Adventitious roots store food material hence it is edible part of sweet potato.

(13) **(B).** Reproductive roots are present in sweet potato. The adventitious roots may develop adventitious buds and help in vegetative propagation.

(14) **(D).** Stilt roots give extrasupport to the long unbranched stem. It does not store food.

(15) **(A).** Pneumatophores or Respiratory roots are upright aerial and negatively geotropic roots which occur in many mangrove plants, *e.g., Sonneratia*, *Heritiera*.

(16) **(C).** In *Pothos armatus, Acanthorhiza* and *Iriartea*, some adventitious roots from the base of stem become hard, pointed and thorn like. Those roots are called root-thorns.

(17) **(B).** Conical and fusiform roots are found in *Daucos carota* and *Raphanus sativus* which are fleshy/storage tap roots.

(18) **(B).** Phylloclades are modification of stem. These are green fleshy leaf like structure having nodes and internodes. Stem performs the function of photosynthesis.

(19) **(A).** When a flower can be divided into two equal radial halves in any radial plane passing through the centre, it is said to be actinomorphic, e.g., mustard, *datura*, chilli.

(20) **(A).** Scramblers the climbers cling to the support by means hard structures like prickles (*e.g.,* climbing roses), spines (*e.g.,* climbing *Asparagus*) curved thorns (*e.g., Bougainvillea*).

(21) **(B).** Terminal leaflets modified in to tendril. *e.g., Lathyrus odoratus* (Sweet pea).

(22) **(B).** **Fabaceae:** Androecium - ten, diadelphous, anther dithecous.
Solanaceae : Androecium -stamens five, epipetalous ;
Lilaceae : Androecium - stamen six, (3+3)

(23) **(A).** Pinnate or Unicostate parallel venation: The leaf lamina possesses single prominent vein which gives rise to a large number of lateral veins. All the lateral veins run parallel towards margin. *e.g.,* Canna, Banana, *Curcuma* etc.

(24) **(B).** Because *Mangifera* (mango) is a dicot plant and reticulate venation found in dicots.

(25) **(B).** The most important function of inflorescence is it makes flower more conspicuous to pollinating agents (insects/birds) so that chances of cross pollination are high.

(26) **(A).** Flowers are arranged in acropetal succession, *i.e.,* older flowers are towards the base and younger ones are towards the apex of the peduncle.

(27) **(B).** It is a raceme of verticels or (whorls of flowers) borne on rectangular axis in the axils of opposite leaves. At each node there are two verticles. Each whorl consists of two clusters of 3-9 flowers *e.g., Ocimum* (Tulsi), *Salvia, Leucas*.

(28) **(A).** The broadened base of flower which lies at the tip of pedicel is called torus or thalamus or receptacle.

(29) **(B).** When stamens adnate or unite with petals. This condition is known as epipetalous. *e.g., Petunia*, *Datura*.

(30) **(A).** A plant bearing flowers of both sexes, *i.e.,* Staminate and pistillate flowers, *e.g., Ricinus*, *Zea mays* (maize) and Cucurbits.

(31) **(D).** In Maize, flowers are unisexual but plant is monoecious.

(32) **(D).** Perianth is the collective name of the nonessential floral organs if there is no distinction between sepals and petals.

(33) **(A).** Hypogynous flower (hypo = below; gyny = ovary). Thalamus is conical or convex with gynoecium at top and other part below it, ovary is superior and other parts inferior. *e.g.*, Liliaceae, Malvaceae and Solanaceae.

(34) **(D).** Petals are 5, free, and twisted aestivation are found in china rose.

(35) **(A).** Viability of seeds : Ability of seed to have power of germination over a period of time is called viability. It is maximum in Lotus (*Nelumbo nucifera*)*i.e.,*400–2000 years.

(36) **(D).** Castor is an endospermic (Albuminous seed). In albuminous seeds, embryo not consumed all endosperm. So it persists in the mature seed. In these seeds food stored in endosperm.

(37) **(C).** Non-endospermic or Exalbuminous seed : Endosperm is completely consumed by the developing embryo and the mature seeds are without endosperm. The food is stored in cotyledons. *e.g., Gram, pea, Bean* etc.

(38) **(B).** Berry type of simple succulent fruits the pericarp divided in to three layers – a thin delicate outer epicarp, a soft middle mesocarp and an inner layer known as endocarp. Both endocarp and mesocarp are fleshy. The slippery, oval, orange, coloured seeds are attached by stalks to the placenta. *e.g.,* Tomato, Brinjal.

(39) **(D).** In Litchi (*Nephelium*) the pericarp is hard, brittle and spiny. The single seed is covered by a white, juicy, edible fleshy mass named aril.

(40) **(D).** Cotyledons of seeds of *Arachis hypogea* (Ground nut / peanut) are source of groundnut oil. Seeds yield oil (43-50%) and proteins (31%).

(41) **(A).** The pericarp of drupe consists of a thin epicarp (forms the skin), a fleshy mesocarp (forms the edible part) and hard and stony endocarp *e.g., Cocos nucifera*.

(42) **(B).** Liliaceae commonly called lily family; belong to monocotyledons. Perianth (calyx and corolla undifferentiated), biseriate (2-whorled) and petaloid.

(43) **(C).** Axile placentation : In a multicarpellary syncarpous gynoecium the fusing margins grow inwards to meet in the center of the ovary to form an axis thus making the ovary multilocular. The ovules are borne on the central axis. *e.g.,* Family Solanaceae and Liliaceae.

(44) **(D).** In Fabaceous (Papilionaceous) corolla has petals 5, polypetalous, the posterior petal is largest (standard) and two laterals are wing and inner two anterior are fused to form a boat shaped structure called kell or carina.

(45) **(D).** In Fabaceae, 10 stamens, diadelphous, 9 fused with each other on anterior side, one free on posterior side (9) + 1.

(46) **(C).** *Allium sativum* (onion), *Allium cepa* (garlic) and *Aloevera* (shrit kumari) belongs to family Liliaceae.

(47) **(A).** *Allium cepa* belongs to monocot family – Liliaceae, when remaining three are dicot.

(48) **(D).** If more than two leaves arise at a node and form a whorl, it is called whorled, as in *Alstonia*. The stamens may be united into one bunch or one bundle (monoadelphous) as in china rose.
In basal placentation, the placenta develops at the base of ovary and a single ovule is attached to it, as in sunflower, marigold.

(49) **(A).** All pulses belong to family Fabaceae. This family is known for protein rich pulses.

(50) **(A).** Tomato belongs to Solanaceae family.

(51) **(C).** Flower of family Solanaceae is bracteate or ebracteate, pedicellate, complete, hermaphrodite, actinomorphic, pentamerous, hypogynous.

(52) **(C).** Leguminosae family possess marginal and Cruciferae possess parietal placentation.

(53) **(C).** In Leguminosae ovary is superior.

(54) **(B).** In diadelphous condition, stamens are arranged in two bundles. Diadelphous stamens are the characteristic features of family Fabaceae.

(55) **(D).** In family Solanaceae gynoecium is bicarpellary, syncarpous, bilocular axile placentation, ovary obliquely placed in the flower.

(56) **(D).** Stem tendrils which develop from axillary buds, are slender and spirally coiled and help plants to climb such as in gourds (cucumber, pumpkins, watermelon) and grapevines.

(57) **(C).** Axillary buds of stems get modified into woody, straight and pointed thorns.

(58) **(C).** Fasciculated fleshy roots are modified adventitious roots, in which swollen roots or root tubers occur in clusters from lower nodes of stem e.g., *Dahlia* and *Asparagus*. In *Curcuma*, nodulose roots are found where the swellings occur only near the tips.

(59) **(C).** A compound leaf is that where the lamina is completely broken up into distinct segments or leaflets which are separately articulated at base. Leaflets resemble leaf in having base, stalks, blade. Leaflets differ from the whole leaves in the absence of axillary buds, basal stipules and origin in the same plane.

(60) **(A).** In valvate aestivation, margins of the adjacent petals touch each other but without overlapping e.g., corolla of *Brassica, Calotropis*.

(61) **(B).** Bulb is a type of stem modification. In bulb the stem is highly reduced and can be seen only as a disc like structure. On this disc are present numerous fleshy scaly leaves covering a central terminal bud. Both the disc and scaly leaves are collectively called bulb. The leaves are food and water storage organ that overlap and cover the bud e.g., Onion.

(62) **(D).** Apple and pear are pome type of fruits. Pome is a false (or accessory) simple succulent fruit that develops from an inferior compound ovary. The fruit contains seeds inside. The outer fleshy part of the fruit is thalamus, which is the edible part.

(63) **(D).** The given floral diagram is of family Solanaceae (potato family). Its flower is bisexual and actinomorphic, ebracteate or bracteate, pentamerous, cyclic. Calyx 5, gamosepalous, persistent. Corolla 5, gamopetalous, often plicate in bud. Androecium 5, polyandrous and epipetalous. Gynoecium bicarpellary and syncarpous. Ovary superior placed obliquely, placentation axile with swollen-placenta. Fruit is berry or capsule.

(64) **(C).** In epigynous flowers, the thalamus is hollowed out in the form of a flask but its internal wall is fused with wall of the ovary. Only the style and stigma of the pistil are observable from the upper side. Other floral organs are borneat the top of ovary. The ovary or gynoecium is said to be inferior while other floral organs are superior.
e.g. Apple, sunflower,cucumber etc.

(65) **(C).** The single cotyledon of monocotyledonous seed (e.g., maize grain) is called scutellum. It occupies the major portion of the embryo regions of grains.

(66) **(B).**

(67) **(D).** The outer or the only seed coat (if one is present)is called testa while the inner one is named as tegmen. Surface of the seed possessesa fine pore at one end called micropyle. Hilum is a place where funiculus or stalk of seed is borne. Some seeds also show chalaza (place of origin of seed coats) and raphe (part of funiculus tosed with seed wall).

(68) **(A).** Carrot : Tap roots
Cotocesie : Stem
Sweet potato : Roots
Asparagus : Roots

(69) **(B).** An example of axile placentation is lemon.

(70) **(C).** Chilli belongs to Solanaceae.

EXERCISE-3

(1) **(A).**

(2) **(B).** *Trapa natans* is a hydrophyte. It has monarch (one xylem strand) condition in slender root and spongy petioles. Hydrophytes don't have developed conducting channels.

(3) **(D).**

(4) **(D).** Tubercular storage root : *Asparagus*
Pneumatophores : Heritiera
Haustoria : Viscum
Proproots : Screw-pine
Assimilatory roots : *Tinospora*

(5) **(A).** In a cob of maize, each ovary has a long silky (hairy) style, called as corn silk. Collectively these styles protrude at the end of a young cob. The grains are formed on the cob which remain covered by the leafy bracts.

(6) **(B).**

(7) **(B).**

(8) **(B).** Syconus is fruit type in fig which is composed of many acheneal fruitlets.

(9) **(D).**

(10) **(B).** Parasitic plants develop roots which penetrate into the tissue of the host plant to absorb nutrition. Thus, these roots function as haustoria. Such roots are known as sucking roots e. g. , *Cuscuta*.

(11) **(A).**

Modification of Leaf	**Example**
Entire leaf modified into spine	Euphorbia
Leaf except stipules modified into a tendril	Lathyrus
Stipules modified into a tendril	Smilax
First leaf of axillary bud modified into a spine	Citrus

(12) **(D).**

(13) **(D).** i.e., bicarpellary condition

(14) **(A).** In China rose (*Hibiscus rosa sinesis*), gynoecium is pentacarpellary, syncarpous, pentalocular, ovary superior, axile placentation, two ovules in each locule, style passes through the staminal tube branching into five branches, each ending into a prominent scarlet red knob-like stigma.

(15) **(D).** Plants belonging to the family Fabaceae shows descending imbricate aestivation of corolla, stamens 10 ((9) + 1 condition) and marginal placentation.

(16) **(C).**

(i) It is the floral formula of Solanaceae family, i.e., *Solanum tuberosum* (patato).

(ii) It is the floral formula of *Pisum sativum* (pea).

(iii) It is the floral formula of *Hibiscus rosa-sinensis* (rose).

(17) **(A).** Gamosepalous : Fused sepals
Polysepalous : Free sepals
Gamopetalous : Fused petals
Polypetalous : Free petals
Epiphyllous : lily flower
Staminode : Sterile anther

(18) **(D).** The vascular bundles in monocots are closed.

(19) **(B).** The outermost covering of a dicotyledonous seed is the seed coat. The seed coat has two layers, the outer testa and the inner tegmen. The hilum is a scar on the seed coat through which the developing seeds were attached to the fruit. Above the hilum is a small pore called the micropyle. Within the seed coat is the embryo, consisting of an embryonal axis and two cotyledons.

(20) **(D).**

(21) **(A).**

(i) Belladonna belongs to Solanaceae family.

(ii) Indigofera belongs to Fabaceae family.

(iii) Solitary / cymose inflorescence is found in Liliaceae family.
Racemose inflorescence in Fabaceae family.

(iv) Ovary superior in Fabaceae family.

(22) **(A).** The embryonal axis is differentiated into radicle and plumule. In monocot seeds, the radicle is protected by a sheath called coleorhiza and the plumule is protected by coleoptile whereas in dicot seeds, the radicle and plumule are not protected by such sheaths.

(23) **(A).** (i) Coleorhiza - Radicle (root)

(ii) Food storing tissue - Endosperm (double fertilisation)

(iii) Parthenocarpic fruit - Grapes (no seed)

(iv) Single seed developed from monocarpellary superior ovary - Mango (drupe)

(v) Membranous seed coat-Maize (monocotyledon plant)

(24) **(A).**

(25) **(A).** In marginal placentation one or two alternate rows of ovules occur longitudinally along the ridge in the wall of the ovary in the area of fusion of its two margins or ventral suture. A true placenta is believed to be absent. Ovary is unilocular. Marginal placentation is found in monocarpellary pistils of Leguminosae (e.g., Pea, *Cassia, Acacia*) and other plants (e.g., Larkspur).

(26) **(B).** In acropetal succession, the youngest floral bud is towards growing point and oldest is towards the base.

(27) **(D).** The plant could be Hibiscus or China rose. Family-Malvaceae possesses stamens indefinite, monoadelphous, stamens form a staminal tube around the style, epipetalous, anther monothecous, reniform, basifixed. The corolla exhibits inferior twisted aestivation.

(28) **(D).** $\underline{G}_{(B)}$ represents gynoecium, bicarpeilary, syncarpous and superior.

(29) **(A).** *Wolffia* (duck weed) is a floating aquatic angiospermic plant. It has the smallest flower of about 1 mm diameter. While Rafflesia arnoldi (total root parasite) has the largest flower of about 1 m in diameter.

(30) **(A).** In *Datura stramonium*, gynoecium is bicarpellary, syncarpous, ovary is superior, bilocular, becomes tetralocular due to the formation of false septa.
Therefore, plant B is datura. In capsicum, gynoecium is bicarpellary, syncarpous and ovary is superior. The cross wall ovary is unilocular in the upper part.

(31) **(C).**
(i) Edible mesocarp → Mango
(ii) Endospermous seed → Castor
(iii) Fibrous mesocarp → Coconut
(iv) Non-endospermous seed → Bean
(v) Ovules → Future seed
(vi) Ovary → Future fruit

(32) **(A).**

(33) **(D).** Flowers of Liliaceae family are bracteate or ebracteate, actinomorphic, bisexual, trimerous, hypogynous and pentacyclie. Calyx and corolla are undifferentiated and called perianth. Perianth 6, in two alternate whorls (3 + 3). Androecium 6, polyandrous, arranged in two whorls, antitepalous, often epitepalous. Gynoecium is tricarpellary, syncarpous, superior, ovary trilocular with axile placentation.

(34) **(B).** They are elongated horizontal or arched runners, which can cross over small obstacles. Each stolon has one or more nodes possessing scale leaves and axillary buds.

(35) **(D).** In case of parallel venation the veins run parallel to each other and network is not formed, This type of venation is the characteristic features of monocots. There are few exceptions, e.g., *Smilax, Colocasia, Alocasia, Dioscorea*, etc.

(36) **(C).** Food storing tissue of a seed is endosperm. In flowering plants it is produced as a result of double fertilization. In most monocots and some dicot seeds, the food reserve remains in the endosperm. They are called endospermic or albuminous seeds, e.g., cereals, castor bean, coconuts, rubber. In majority of dicot seeds (e.g., pea, gram, bean, mustard, groundnut) and some monocot seeds (e.g., orchids, *Sagittaria*), the endosperm is consumed during seed development and the food is stored in cotyledons and other regions. They are called non-endospermic or exalbuminous seeds.

(37) **(D).** In subaerial modification the stem are delicate, thin, weak and unable to stand erect. Runners grow prostate in all direction above the soil level. It has a creeping stem with long internodes. On the lower side nodes bear adventitious roots.

(38) **(B).** Leaf bladders occur in the aquatic carnivorous plants of *Utricularia* (Bladderwort). Some of the leaf segments are modified to form small bladders. A bladder has sensitive hair, branched trigger bristles, a trap valve, internal and external glands for trapping and digesting small animals (e.g., water fleas).

(39) **(A).** A bud is a condensed immature or embryonic shoot having a growing point surrounded by closely placed immature leaves. The largest bud is cabbage.
According to their nature, buds can be vegetative, reproductive and mixed.

(40) **(B).** A leaf having a single or undivided lamina is called simple leaf. The lamina can have different types of incisions, which may reach upto half (-fid), more than half (-partite) or near the base or midrib (-sect). Depending upon the pinnate or palmate venation, the incisions are known as pinnatifid, palmatifid, pinnatipartite, palmatipartite, pinnatisect and palmatisect.

(41) **(B).** The palmate compound leaf is one in which the petiole bears leaflets at the tip like the fingers of the palm. Citrus is actually a palmate compound leaf where the two lateral leaflets have been suppressed and only the central leaflet is functional.

Such a palmate compound leaf, with one functional leaflet is called unifoliate compound leaf.

(42) **(C).** The petiole, rachis and the stalks of the leaflets in Clematis are sensitive to contact and can coil around the support to help the plant in climbing. In whole leaf tendril, the whole leaf is modified into a tendril for climbing. The leaf apices of Gloriosa superba are greatly elongated to function like the tendrils.

(43) **(A).** Leaves of a number of plants develop or possess adventitious buds for vegetative propagation, e.g., Bryophyllum. Begonia leaf develops buds only when the leaf is injured or detached.

(44) **(A).** Walking ferns (e.g., Adiantum caudatum) reproduce vegetatively by their leaf-tips. Leaves bow down to the ground, their tip strikes roots and forms a bud which grows into a new plant.

(45) **(C).** In corymb, the main axis is shortened and lower flowers have much longer stalks or pedicels than the upper ones so that all the flowers are brought more or less to the same level. Corymb inflorescence is found in Cassia sp.

(46) **(C).** A flower is regarded as complete if it has all the four floral whorls, i.e., calyx, corolla, androecium and gynoecium. If any of these whorl in missing the flower is described as incomplete. An incomplete flower can either be perfect, having male as well as female sex organs or imperfect with either of the sexes missing. When both the essential organs are absent, the flower is spoken as neuter.

(47) **(B).** When a plant bears only one type of unisexual flowers, it is termed as dioecious. Some plants possess three types of flowers - perfect (intersexual), staminate and female or neuter. They are called polygamous. Polygamous plants as for example, mango and Cashewnut bear perfect and imperfect flowers on the same individual.

(48) **(B).** Ginger is horizontal in position and generally branched and producing aerial leaves or shoots aboveground and adventitious roots on lower side in favourable season. Thus shoot growth is not effected by gravity.

(49) **(B).** Coconut require the hot and wet climate hence it is grown in coastal areas. It is widely grown in coastal and deltic regions of tropical and subtropical countries.
Coconut fruit show hydrochory i.e., the dispersal takes place through water medium. Being the habitat of coastal area the fruit is so adapted that it can float and dispersed over thousand of kilometers before losing viability.

EXERCISE-4

(1) **(A).** 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. All the given plants except bitter gourd, pumpkin, cucumber, guava, plum and rose have hypogynous flower.

(2) **(C).** In China rose the flowers are actinomorphic i.e., it can be divided into two equal radial halves in any radial plane passing through the centre; they are hypogynous, i.e., the gynoecium occupies the highest position, while the other parts are situated below it; they have twisted aestivation i.e., one margin of petal overlaps that of the next one and so on.

(3) **(C).** Coconut–Thick
Groundnut, gram, Maize–thin, membranous

(4) **(C).** A true fruit consists of a pericarp (fruit wall) formed from ovary wall and seeds formed from ovules. Pericarp is divisible into epicarp, mesocarp and endocarp. Tomato is a berry fruit derived from bicarpellary, syncarpous, bi-to tetralocular ovary with swollen placentae.

(5) **(B).** Imbricate aestivation – *Cassia*, gulmohur.

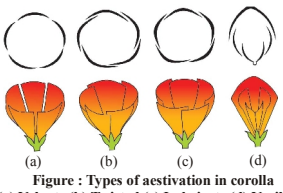


Figure : Types of aestivation in corolla
(a) Valvate (b) Twisted (c) Imbricate (d) Vexillary

(6) **(D).** Carrot and sweet potato are root modifications while edible part of groundnut is seeds. Potato is an edible underground stem.

(7) **(B).** An aggregate fruit or etaerio is a group of simple fruitlets that develop from free ovaries (apocarpus condition) of a single flower (single gynoecium).

(8) **(C).** Mango – seeded fruit
Sterile stamen – staminode
Seeds in grasses – endospermic

(9) **(A).** The given floral formula is of Family Solanaceae. Among the given options, only *Petunia* belongs to Family Solanaceae. *Allium* is a member of Family Liliaceae, *Sesbania* is of Family Leguminosae and *Brassica* is a member of Family Brassicaceae or Cruciferae.

(10) **(B).** 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.

(11) **(C).** In xerophytic plants, the leaves modify into sharp, pointed spines e.g. *Aloe, Solanum surattense, Opuntia, Asparagus* etc. This modification is either for protection of plant or to lessen transpiration, or for both.

(12) **(A).** The seeds of monocotyledonous plants have only one cotyledon. In family Poaceae (e.g., wheat, maize etc.), this cotyledon is called scutellum, situated towards lateral side of embryonal axis. It provides nourishment to the developing embryo.

(13) **(D).** China rose, mustard, brinjal, potato, onion and tulip are the plants that have superior ova whereas in guava and cucumber, ovary is inferior.

(14) **(D).** Axile placentation occurs in syncarpous pistils. The ovary is partitioned into two or more chambers. Placentae occur in the central region where the septa meet so that an axile column bearing ovules is formed e.g., shoe flower (pentalocular), lemon (multilocular), etc.

(15) **(A).** Keel is petal is vexillary aestivation, which is a characteristic of family-Fabaceae, i.e Indigofera. tomato belongs to family-Solanaceae, tulip & while aloe to Liliaceae.

(16) **(A).** Pistia is hydrophyte where absorption of water by root is insignificant.

(17) **(C).** The standard petal of a papilionaceous corolla is also called vexillum.

(18) **(A).** Liliaceae represents $\underline{G}(B)$.

(19) **(D).** The proximal end of filament is attached to thalamus or petal of the flower.

(20) **(A).** Pitcher of *Nepenthes* is modified leaf.

(21) **(C).** Phylloclades are modified stem, i.e., green flat structure as in Opuntia.

(22) **(A).** Radial or actinomorphic symmetry is found in flowers like mustard, *Datura*, Chilli.

(23) **(A).** *Dianthus, Primrose*–Free central placentation.
Argemone – Parietal placentation.
Citrus – Axile placentation.

(24) **(B).** The stamens may be united into one bundle (monoadelphous), or two bundles (diadelphous) or into more than two bundles (polyadelphous).

(25) **(B).** Brassicaceae, $A_{2+4} \rightarrow$ Mustard, Radish, Turnip Lamiaceae, $A_{2+2} \rightarrow$ Salvia

(26) **(C).** Thorns are hard, pointed straight structures for protection. These are modified stem.

(27) **(C).** Coconut has double endosperm with liquid endosperm and cellular endosperm.

(28) **(A).** In roots, the root hairs arise from zone of maturation. This zone is differentiated zone thus bearing root hairs.

(29) **(C).** Halophytes like mangrooves have pneumatophores.
* Apogeotropic (–vely geotropic) roots having lenticels called pneumathodes to uptake O_2.

(30) **(B).** Sweet potato is a modified adventitious root for storage of food. Rhizomes are underground modified stem. Tap root is primary root directly elongated from the redicle.

(31) **(C).** In parietal placentation the ovules develop on the inner wall of ovary or in peripheral part. eg. Mustard, *Argemone* etc.