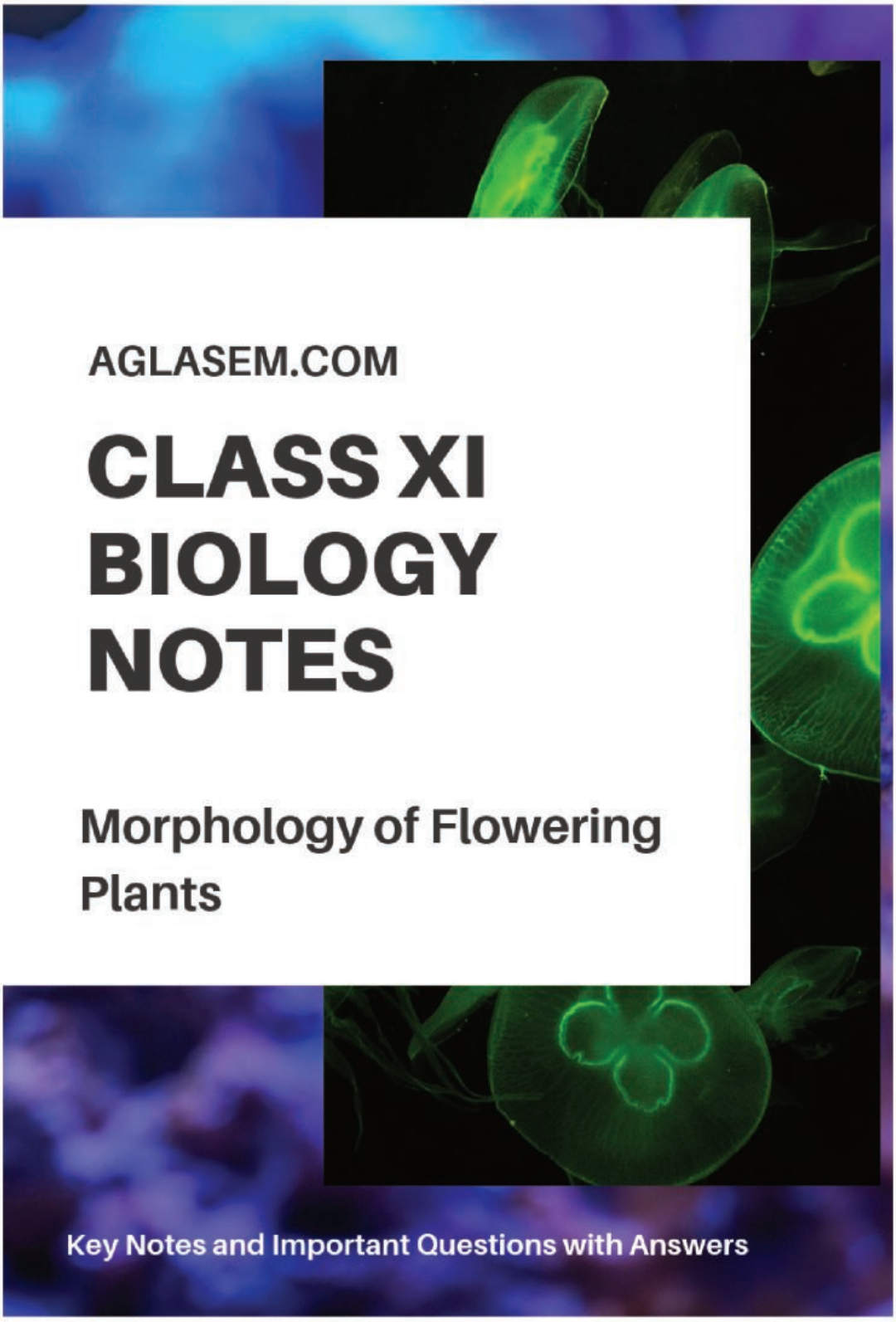


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CLASS XI BIOLOGY NOTES

Morphology of Flowering Plants

Key Notes and Important Questions with Answers



Chapter - 5 Morphology of Flowering Plants

Points to Remember

Morphology : The study of various external features, forms and relative position of different organs of the organism is known as morphology. It may be further divided into internal and external morphology.

External Morphology : It deals with external forms like shape, size, colour, structure and relative position of different organs.

Internal Morphology : Further divided into anatomy and histology.

Anatomy : It deals with the study of internal structure exposed after dissection and opening of various parts of an organ.

Histology : The study of tissues, their composition and structure.

Adaptation : Any alteration in the structure or function of an organism or any of its part that results from natural selection and by which the organism becomes better fitted to survive and multiply in its environment.

The Root : The root is underground part of the plant and develops from elongation of radicle of the embryo.

Characteristics : It is inside the soil, chlorophyll is absent, absence of nodes, internodes, leaves and buds; positive geotropic and hydrotropic and negative phototropic.

Main functions of root system :

1. Absorption of water and minerals from the soil.

2. Provides anchorage to plant parts.

3. Stores reserve food material and synthesises plant growth regulators (cytokinins)

Various types of root

↓

Tap root	Fibrous root	Adventitious root
↓	↓	↓
Originates from radical	Originates from base of the stem	Originates from parts of the plant other than radicle
Dicotyledonous plants, *e.g.,* gram, pea, mango, mustard.	Monocotyledonous plants, *e.g.,* wheat, paddy, grasses.	Banyan tree (Prop roots) Maize (stilt roots) Rhizophora (Respiratory roots)

Regions of Roots

Root Cap : The root is covered at the apex by the thimble-like structure which protect the tender apical part.

Region of meristematic activity : Cells of this region have the capability to divide; cells are small, thin walled with dense protoplasm.

Region of elongation : Cell of this region are elongated and enlarged.This region is responsible for the growth of root in length.

Region of Maturation : This region has differnentiated and matured cells. Some epidermal cells form very fine and delicate thread like structures called *root hairs*.

Modifications of Root : Roots are modified for support, storage of food, respiration.

- **For support :** *Prop* roots in banyan tree, *stilt* roots in maize and sugarcane.
- **For respiration :** Pneumatophores in *Rhizophora* (Mangrove).
- **For storage of food :** Fusiform (radish), Napiform (turnip), Conical (carrot), Fasiculated fleshy roots (Asparagus).

The Stem : Stem is the aerial part of the plant and develops from plumule of the embryo. It bears nodes and internodes.

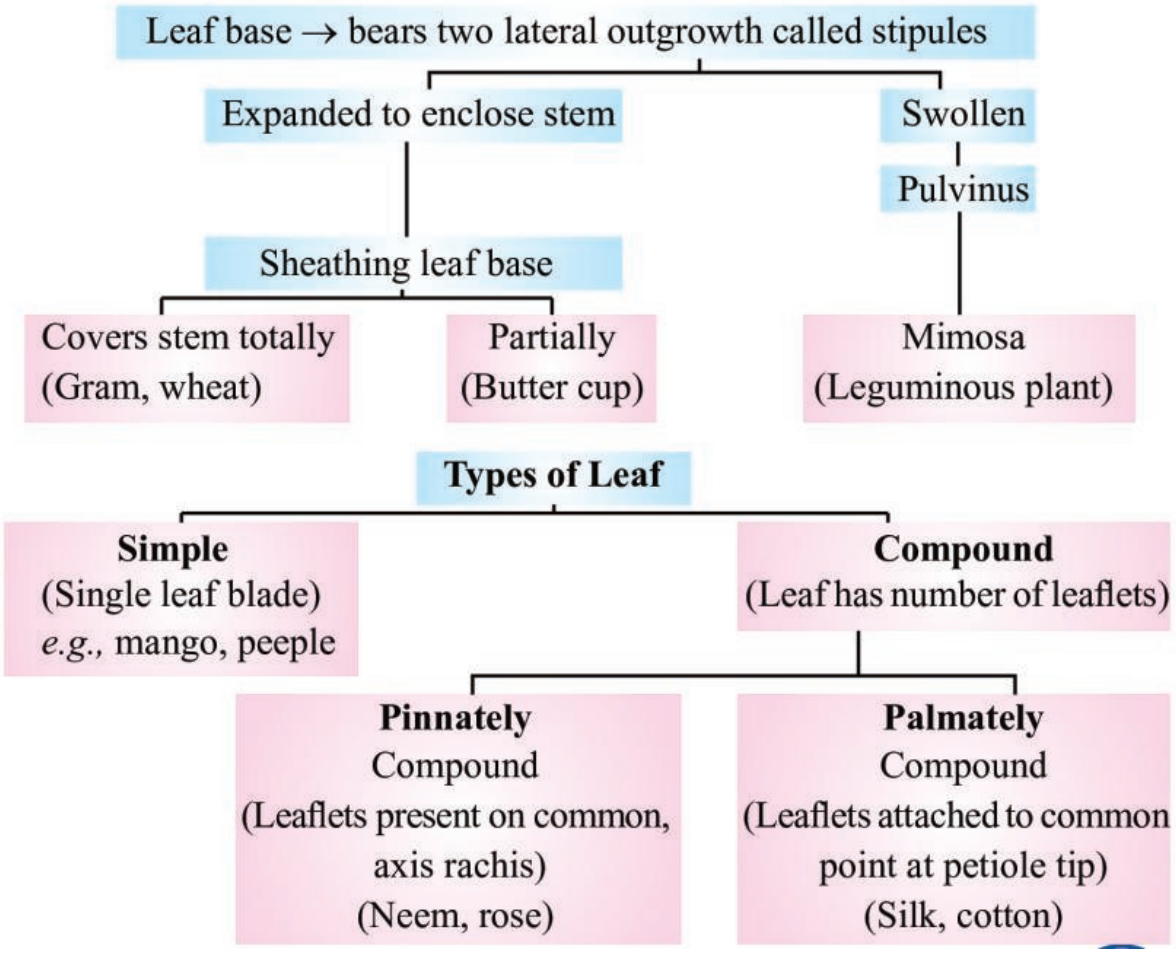
Functions of stem : Exposure of leaves, conduction of water and minerals, translocation of food, exposure of flowers and fruits.

Modifications of Stem :

In some plants the stems are modified to perform the function of storage of food, support, protection and vegetative propagation.

- **For food storage :** *Rhizome* (ginger, turmeric), *Tuber* (potato), *Bulb* (onion), *Corm* (Colocasia, Amorphophallus/Zamin-kand)
- **For support :** Stem *tendrils* of watermelon, grapevine, cucumber, pumpkins.
- **For protection :** Axilliary buds of stem of Citrus, *Bougainvillea* get modified into pointed *thorns*. They protect the plants from animals.
- **For vegetative propagation :** Underground stems of grass (runner), strawberry (stolons), leateral branches of mint and jasmine, Eichhornia (offsets).
- **For assimilation of food :** Flattened stem of Opuntia and cylindrical stem of Euphorbia contains chlorophyll and performs photosynthesis.

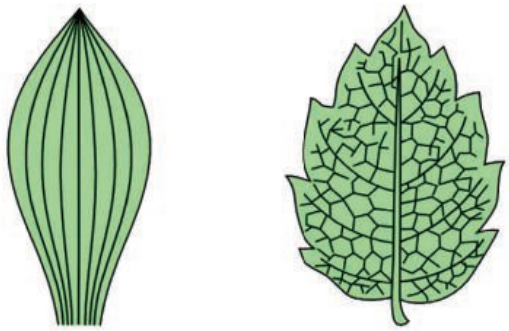
The Leaf : Develops from shoot apcial meristem, flattened, green structure acropetally arranged manufacture the food by photosynthesis. It has bud in axil. A typical leaf has *leaf base*, *petiole and lamina* (leaf blade). In some leguminous plants the leaf base may become swollen which is called as pulvinus.



Venation : The arrangement of veins and veinlets in the lamina of leaf.

Types of Venation :

1. **Reticulate :** Veinlets form a network as in leaves of dicotyledonous plants (China rose, peepal).
2. **Parallel :** Veins are parallel to each other as in leaves of monocotyledonous plants (grass, maize,sugarcane).



1. Reticulate 2. Parallel

Types of Venation

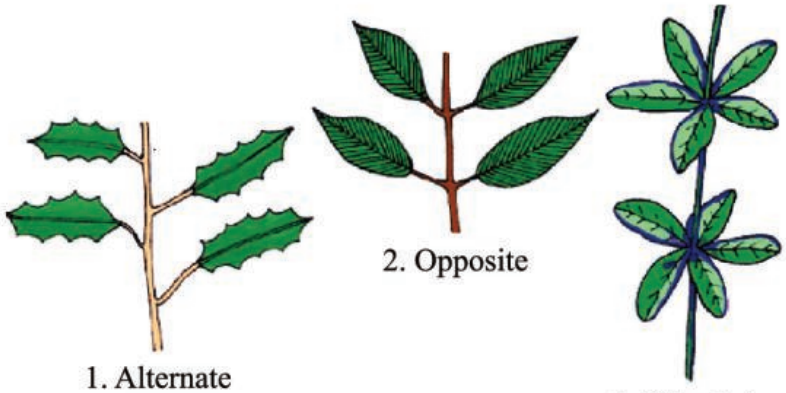
Phyllotaxy : The pattern of arrangement of leaves on the stem or branch.

Types of phyllotaxy

Alternate	Opposite	Whorled
(Single leaf at a node)in alternate manner *e.g.,* China rose Mustard,	(Two leaves at a node) in opposite manner *e.g., Calotropis,* guava	(More than two leaves in a whorl at a node) *e.g., Nerium, Alstonia*

Functions of Leaf

photosynthesis, gaseous exchange, transpiration, protection of buds and conduction.



1. Alternate 2. Opposite 3. Whorled

Types of Phyllotaxy

Modifications of Leaves :

Type		Function		Example
• Tendrils	:	(Climbing)	—	Sweet Pea, Pea
• Spines	:	(Protection)	—	*Aloe, Opuntia, Argemone*
• Pitcher	:	(Nutrition)	—	*Nepenthes*
• Hook	:	(Support)	—	Cat's nail
• Fleshy Leaves	:	(Storaged food)	—	Onion and Garlic

Inflorescene : The arrangement of flowers on the floral axis (Peduncle)

Main types of Inflorescence

Main types of Inflorescence

Racemose

1. It is indefinite inflorescene
2. Main axis continues to grow and flowers borne in *acropetal* succession
   e.g. : Radish, Mustard, *Amaranthus*

Cymose

1. It is definite inflorescence
2. Main axis terminates in flowers and the flowers borne in *basipetal* succession
   e.g. : Cotton, Jasmine, *Calotropis*

Special Inflorescence type—Ficus, Salvia, Euphorbia,Sunflower

Flower—Modified shoot meant for reproduction

On the basis of *symmetry* flower can be :

Actinomorphic (Radial symmetry)	Zygomorphic (Bilateral symmetry)	Asymmetric (Irregular)
Flower can be divided into two equal halves in any radial plane passing through centre eg : Mustard, Datura, Chilli	Flower can be divided into two similar halves only in one plane eg : Pea, bean, Gulmohar, cassia	Flower cannot be divided in two similar halves by any vertical plane passing through centre eg : Canna

On the basis of floral appendages flower can be :

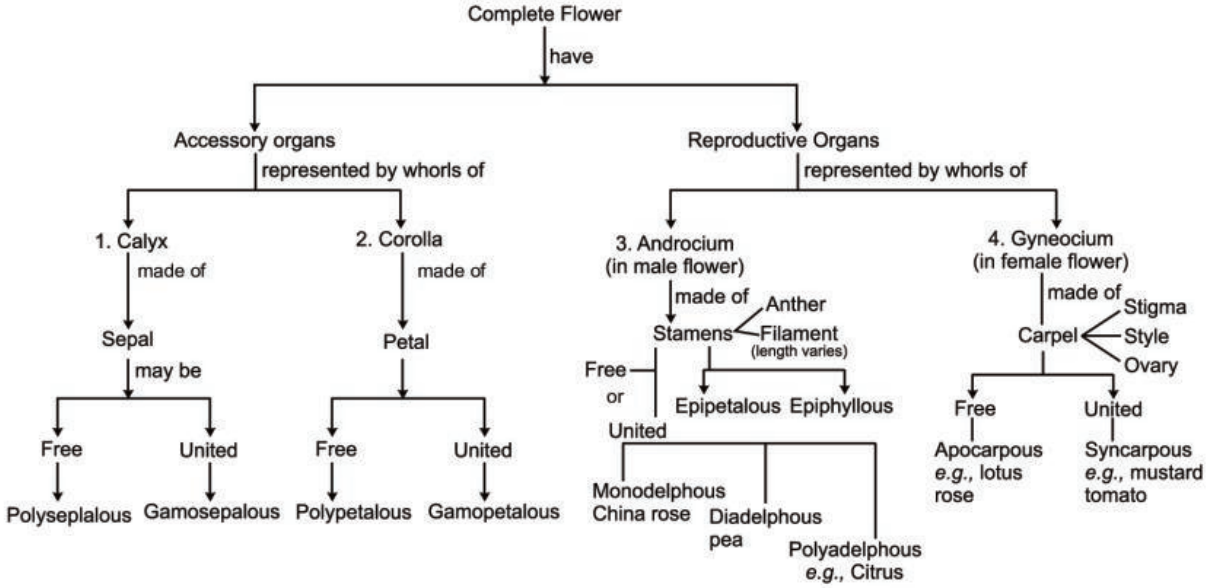
Trimerous	Tetramerous	Pentamerous
(multiples of 3)	(multiples of 4)	(multiples of 5)

On the basis of position of Calyx, corolla and androecium in respect of ovary, flower can be—

of position of Calyx, corolla and androecium

Hypogynous (Superior Ovary)	Perigynous (Half inferior ovary)	Epigynous (inferior ovary)
Mustard, China rose, Brinjal	Plum, Rose, Peach	Guava, Cucumber ray florets (sun flower)

Thalamus/Receptacle : Swollen end of flower stalk (pedicel) which bears four whorls of flower viz., Calyx (K), Corolla (C), Androecium (A) and Gynoecium (G).



Flower can be

Bisexual	Unisexual	
if have both Androecium and Gynoecium	Staminate flower (Male flower)	Pistillate flower (Female flower)
	have only Androecium/Stamen	have only Gynoecium Carpel

Bract—Reduced leaf base found at the base of pedicel. Flowers with bracts are called bracteale and without bracts are called ebracteate.

Perianth : If calyx and corolla are not distinguishable, they are called perianth.

Example : Lily

Aestivation: The mode of arrangement of sepals or petals infloral bud.

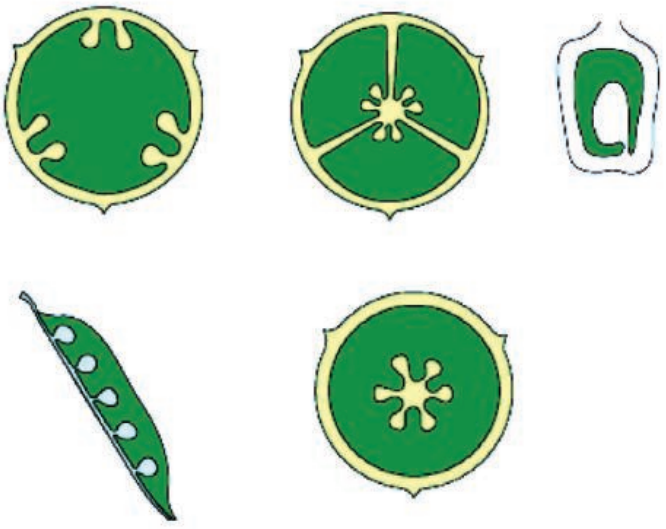
Types of aestivation :

1. **Valvate :** Sepals or petals just touch one another at the margin, withut overlapping. *e.g., Calotropis*
2. **Twisted :** Sepals or petals overlap the next sepal or petal *e.g.,* China rose, Cotton, lady's finger.
3. **Imbricate :** The margins of sepals or petals overlap one another but not in any definite direction, *e.g., Cassia,* Gulmohar.
4. **Vexillary :** The largest petal overlaps the two lateral petals which in turn overlap two smallest anterior petals, *e.g.,* Bean, Pea.

Placentation : The arrangement of ovules within the ovary.

Types of Placentation :

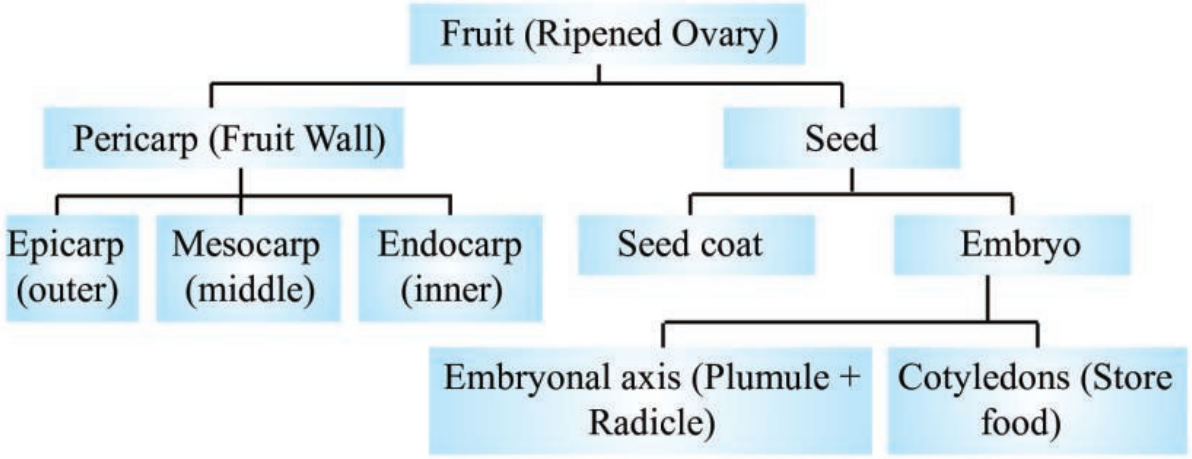
1. **Marginal :** Placenta forms a ridge along the ventral suture of ovary, *e.g.,* Pea.
2. **Axile :** Margins of carpels fuse to form central axis, *e.g.,* China rose, Tomato, Lemon
3. **Perietal :** Ovules develop on inner wall of ovary, *e.g.,* Mustard, *Argemone*
4. **Free central :** Ovules borne on central axis, lacking septa, *e.g., Dianthus, Primrose*



5. **Basal :** Placenta develop at the base of ovary, *e.g.,* Sunflower, Marigold

Placenta : Parenchymatous flattened cushion inside ovary where ovules are borne.

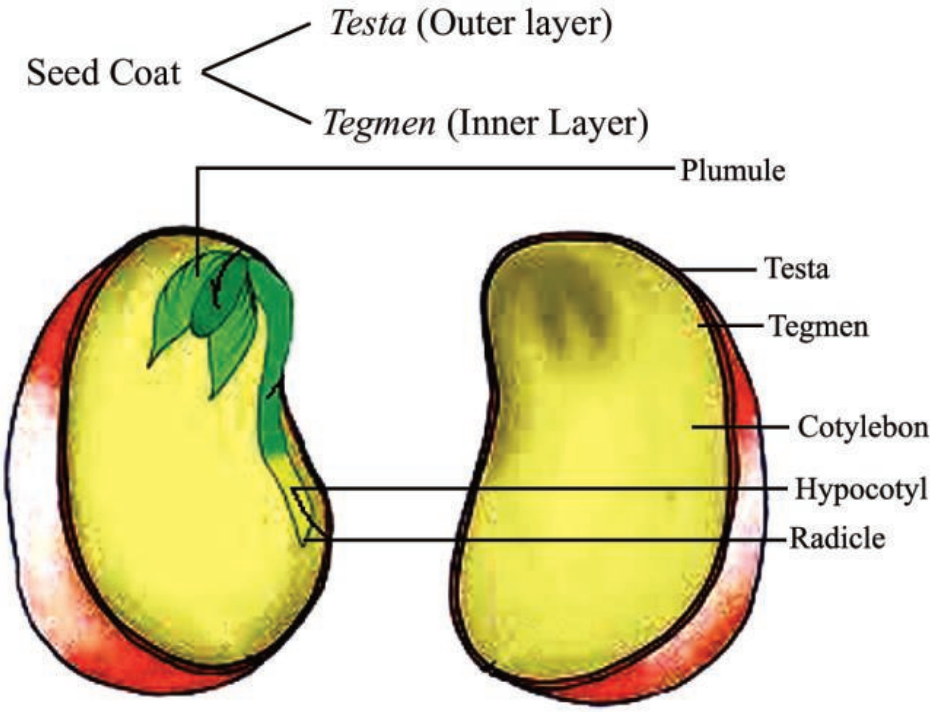
The fruit : After fertilisation, the mature ovary develops into fruit. The parthenocarpic fruits are formed from ovary without fertilisation (seedless fruit-Banana)



Monocotyledonous seed—Endosperm bulky and stores food, covered by proteinaceous *Aleurone layer.* Seed has single large cotyledon–*scutellum*.

Plumule is enclosed in Coleoptile and Radicle is enclosed in Coleorrhiza.

Dicotyledonous Seed—



Hilum —is a scar on the seed coat through which seeds attached to the fruit.

Micropyle—small pore, above hilum

Cotyledons—two; fleshy, full of preserve food materials

Embryonal axis—Radicle and plumule.

Endospermous seed—endosperm present in mature seed. eg. castor

Non-endospermous seed—endosperm not present in mature seeds, eg. bean,

Questions

Very Short Answer Question (1 mark each)

1. Which part of Opuntia is modified to form spines ?
2. Name one plant in which leaf is pinnately compound.
3. In mangroves, pneumatophores are the modified adventitious roots. How are these roots helpful to the plant ?
4. Which part in Ginger and Onion are edible ?
5. Why do various plants have different type of phyllotaxy ?
6. State the main function of leaf tendril.
7. Which plant family represent the following floral formula :

$$\oplus \; \underset{+}{\overset{\nearrow}{\bigcirc}} \; \overset{\curvearrowleft}{P_{3+3}} \; A_{3+3} \; \underline{G_{(3)}}$$

8. The endosperm is formed as a result of double fertilisation (triple fusion). What is its function ?
9. Which type of venation do you observe in dicot leaf ?
10. In pea flower, the aestivation in corolla is known as vexillary. Give reason.
11. What is the name given to the cotyledon in case of Monocots.
12. Name the part modified for food storage in the following (a) carrot (b) Radish (c) Potato (d) Dahlia (e) Turmeric (f) Sweet potato

Short Answer Questions-I (2 marks each)

13. Flower is a modified shoot Justify.
14. Name the type of root of the following :
    (a) Roots performing the function of photosynthesis.
    (b) Roots come above the surface of the soil to absorb air.
    (c) The pillar like roots developed from lateral branches for providing mechanical support.
    (d) Roots coming out of the lower nodes of the stem and provide the support to the plant.
15. Identify the type of tendrils found in the following plants—
    (a) Cucumber (b) Pea (c) Grape vines (d) Water Melon
16. Fill up the blank spaces (a), (b), (c) and (d) in the table given below :

Type of flower	Position of calyx, corolla and respect of the ovary on thalamus	Type of ovary
Hypogynoius	..... (a)	Superior
Perigynous	On the rim of the thalamus almost at the same level of ovary.	.....(b).....
..... (c)	..... (d)	Inferior

17. Provide the scientific terms for the following :
    (i) The leaf without a petiole (stalk).
    (ii) The flat and expanded portion of a leaf.
    (iii) Orderly arrangement of leaves on the node.
    (iv) Lateral appendages on either side of the leaf.
18. Differentiate between peduncle and Pedicel

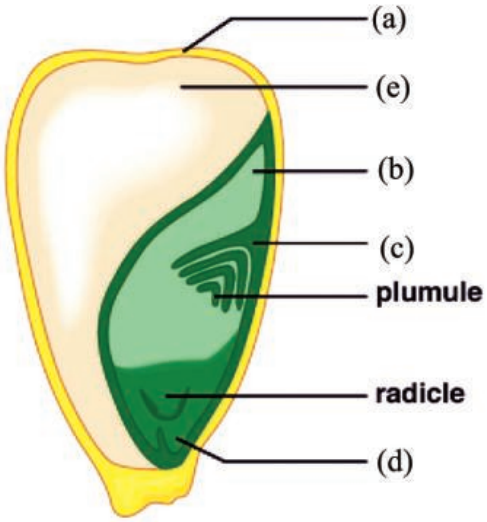
Short Answer Question-II (3 marks each)

19. Observe the given figure showing various types of placentration. Identify the type of placentation. Give one example of each.



(a) (b) (c)

20. 'Potato is a stem and sweet potato is a root.' Justify the statement on the basis of external features.
21. Define aestivation. Which type of aestivation is found in China rose, Calotropis Gulmohar and Pea.
22. Give two example of each type of phyllotaxy.
23. Differentiate between :
    (a) Actinomorphic flower and Zygomorphic flower
    (b) Apocarpous ovary and Syncarpous ovary
    (c) Racemose inflorescence and Cymose inflorescence
24. In the given structure of a Monocotyledonous seed label the parts a, b, c, d, e. Give the function of part 'a'.



25. Maize grain usually called as a fruit and not a seed. Why ?

Long Answer Questions (5 marks each)

26. Describe various stem modifications associated with food storage, climbing and protection.

Answers

Very Short Answers (1 mark each)

1. Leaves
2. Neem, Rose', Acacia.
3. Pneumatophores is mangroves help in respiration.
4. **Ginger**–Rhizome and **Onion**–bulb
5. For proper exposure of leaves to get sunlight.
6. The leaf tendrils help the plant for climbing.
7. Lilliaceae
8. Endosperm stores the food.
9. Reticulate venation.
10. In peas, there are five petals. The largest one (standard) overlaps the two lateral petals (wings) which in turn overlap the two smallest anterior petals (keel).
11. Scutellum.
12. (a) and (b) Fleshy tap root (c) Stem tuber (d) root tuber
    (e) Rhizome (f) Fleshy root tuber

Short Answers-I (2 marks each)

13. The flower is considered to be a modified shoot because the internodes in flower are highly condensed and the appendages such as sepals, petals, stamens and carpels(pistil) are generally large in number.
14. (a) Assimilatory roots (b) Respiratory roots
    (c) Prop roots (d) Stilt roots
15. (a) Stem tendril (b) leaf tendril
    (c) and (d) both stem tendrils
16. (a) Floral parts are situated below the ovary.
    (b) Half inferior
    (c) Epigynous
    (d) Floral parts are situated above the ovary.
17. (i) Sessile
    (ii) Lamina
    (iii) Phyllotaxy
    (iv) Stipules

Short Answers-I (3 marks each)

18. **Penduncle** is the axis of inflorescence which generally bears a number of flowers.

    Pedicel is the stalk of the flower which bears a single flower.

Short Answers SA-II (3 marks each)

19. (a) Marginal placentation — Pea
    (b) Parietal placentation — Mustard, *Argemone*
    (c) Free central plancentation — *Dianthus, Primrose*
20. Potato is the swollen tip of an underground stem branch (stolon). It has nodes (eyes) which consist of one or more buds subtended by a leaf scar. Adventitious roots also arise during sprouting. On the other hand sweet potato is a swollen adventitious root (tuberous root). It has no nodes, internodes and buds like a stem.
21. The mode of arrangement of sepals or petals in a floral bud is known as aestivation.

    China rose – twisted *Calotropis* – valvate

    Gulmohar – imbricate Pea – vexillary

22.

Type of phyllotaxy	Examples
(i) Alternate	China rose, mustard
(ii) Opposite	*Calotropis,* guava
(iii) Whorled	Nerium, *Aistonia*

23. (a)

Actinomorphic Flower	Zygomorphic flower
(1) Two equal halves are formed by any vertical division passing through the centre.	(1) Two equal havles are produced only by one vertical division
(2) It has a radial symmetry.	(2) It has a bilateral symmetry.

(b)

Apocarpous Ovary	Syncarpous Ovary
(1) The flower has several free free carpels (ovary).	(1) The flower has fused carpels.
(2) On maturity it forms fruitlet of aggregate type.	(2) On maturity it forms a single fruit.

(c)

Racemose inflorescence	Cymose inflorescence
(1) The main axis has unlimited growth.	(1) The main axis has a limited growth.
(2) Flowers are arranged acropetally *i.e.,* the lower flower are younger	(2) Flowers are arranged basipetally *i.e.,* the lower flowers are older

24. (a) Endosperm (b) Scutellum
(c) Coleoptile (d) Coleorrhiza
(e) Aleurone layer
Function of (a)—Provide nutrition.

25. Maize grain is a single seeded fruit in which the seed covering or testa is fused with pericarp or fruit wall. A micropyle is not found but base of style is present.

Long Answers (5 marks each)

26. **Stem Modification :**

- **For food storage :** Ginger (Rhizome), Potato (Tuber), Onion (Bulb), *Colocasia* (Corm).
- **For climbing (support) :** Sterm tendril (cucumber,grapevine,watermelon)
- **For protection :** Thorn (*Bougainvillea,* Citrus, *Duranta*) **Description :** Refer page 68, NCERT, Text Book of Biology for Class XI.