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IIT-JEE, NEET AND CBSE EXAMS

CONCERT  
MASTERING

MORPHOLOGY  
OF  
FLOWERING  
PLANTS

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XI NEET

03 MORPHOLOGY

OF  
FLOWERING  
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**NCERT  
 MASTERING**

**NEET KEY NOTES**

- **Morphology** deals with the study of external features, forms and relative position of plant organs.
- Plants adopt various morphological features according to the surrounding environment. The two main plant parts are the underground root system and the above ground shoot system.

**The Root**

- It is the underground, non-green portion of the plant arising from the radicle of seed, mainly involved in absorption of water and minerals from soil, providing proper anchorage to plant parts, storing reserve food and biosynthesis of plant growth regulators.
- From seeds, radicle elongates and grows inside the soil to form **primary root**. In case of dicotyledonous plants, primary root elongates and bears lateral root of several orders known as **secondary or tertiary roots**.
- The root systems are generally of following types
  - (i) **Tap root system** The primary roots and its branches (secondary and tertiary roots) constitute the tap root system. It is seen in dicot plants, e.g. mustard plant.  
 In some plants, tap roots are modified for storage (fleshy roots in carrot), respiration (**pneumatophores** in *Rhizophora*) and for nitrogen-fixation (nodulated roots in legumes).

- (ii) **Adventitious root system** Roots which are produced from any other part of the plant, except the radicle or its branches are called adventitious roots. These roots are mainly found in monocots, e.g. grasses, cereals, sugarcane, etc.

Adventitious roots are modified into **fleshy roots** (for storage, e.g. *Ipomoea*), **prop roots** (e.g. *Ficus benghalensis*), **stilt roots** (e.g. *Zea mays*), **climbing roots** (e.g. *Tecoma*), **assimilatory roots** (e.g. *Trapa*), **haustorial roots** (e.g. *Cuscuta*), etc.

- (iii) **Fibrous root system** In monocotyledonous plants, the primary root is short-lived and is replaced by large number of roots. These roots originate from the base of system and constitute the fibrous root system as seen such as wheat, rice, corn, etc.

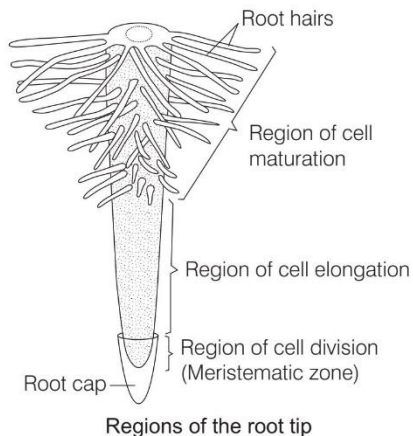
**Regions of the Root**

A typical root consists of four regions namely

- **Root cap** Thimble-like structure which covers the root apex and protects the tender apical part.
- **Region of meristematic activity** Contains actively dividing cells which are small and thin-walled, with dense protoplasm.
- **Region of elongation** Cells of this region increase the length of the roots by undergoing repeated elongation and enlargement.



- **Region of maturation** Constitutes major portion of roots where cells gradually differentiate and mature. Some of the epidermal cells bear **root hairs**.



Regions of the root tip

## The Stem

- It is the aerial part of plant arising from the plumule of germinating seed. It bears **nodes** and **internodes**. Its main function is spreading out shoots bearing leaves, flowers and fruits. It conducts water, minerals and photosynthates.
- Some stems perform the function of storage of food, support, protection and vegetative propagation.
- Stems are modified to perform different functions. These modifications are of three types
- **Underground stem** This type of modification occurs generally for food storage and vegetative propagation. They are of four types
  - **Bulb** It is reduced, disc-shaped stem which bears adventitious roots on the lower side and scaly leaves on the upper side, e.g. onion, garlic, etc.
  - **Rhizome** It forms a horizontally running stem and bears nodes, internodes, buds and scaly leaves, which are used for vegetative propagation, e.g. ginger, turmeric, etc.
  - **Corm** It is a condensed structure which grows vertically into the soil and bears scale leaves, e.g. *Colocasia*, etc.
  - **Tuber** It swells up randomly and bears 'eyes', e.g. potato, etc.
- **Aerial stem** These stems are of following types
  - **Stem tendril** In plants with weak stem, the apical bud is modified into tendril for climbing, e.g. *Passiflora*, cucumber, etc.
  - **Phylloclade** In this, the stem is modified into flat, fleshy and green leaf-like structure, e.g. *Opuntia*, *Coccoloba*, *Ruscus*, etc.
  - **Stem thorn** Axil of the leaf or apex of the branch is modified into pointed structure called **thorn**, e.g. *Citrus*, *Bougainvillea*, etc.

- **Cladode** It is a type of phylloclade consisting of one internode only. The stem is modified into leaf-like structure, e.g. *Asparagus*.
- **Bulbil** A multicellular structure, functions as organ of vegetative reproduction, e.g. *Oxalis*, *Dioscorea*, etc.
- **Sub-aerial stem** These stems are recognised into four types
  - **Offset** This is a short horizontal branch with a bunch of leaves on the upper portion and bunch of roots on the lower portion, e.g. *Pistia*, *Eichhornia*, etc.
  - **Stolon** These stem modifications initially grow upwards and then arch down to develop new daughter plants, when come in contact with soil, e.g. *Colocasia*, strawberry, etc.
  - **Runner** It is a weak stem or branch that grows horizontally above the soil surface and develops adventitious roots at each nodes, e.g. *Cynodon*, *Oxalis*, *Hydrocotyle*, etc.
  - **Sucker** It grows horizontally under the soil initially and later grows obliquely upwards, e.g. rose, mint, *Chrysanthemum*, etc.

## The Leaf

- It is a green, flat lateral appendage, located on node of stem, which is exogenous in origin. Leaves mainly involved in photosynthesis and **axillary buds** are found in their axil. The buds later develops into a branch.
- It consists of following parts
  - **Leaf base** (Hypopodium) Through which leaf attaches to stem, may bear stipules. If it gets swollen, it is known as **pulvinus**.
  - **Petiole** (Mesopodium) holds lamina with the base. Sessile leaves do not possess petiole.
  - **Lamina** (Epipodium) or the **Leaf blade** Green, flattened part of leaf, which helps in photosynthesis, transpiration and respiration.

## Venation

Distribution of vein and veinlets in the lamina of leaf is called venation. It is of following types

- **Reticulate venation** The veinlets are irregularly distributed to form a network, e.g. dicot plants.
- **Parallel venation** The veins are arranged parallel to each other, e.g. monocot plants.

## Types of Leaves

On the basis of incision of lamina, the leaves are of two types

- **Simple leaves** In this, there is a single lamina, which is usually entire, e.g. mango, guava, *Cucurbita*, etc.
- **Compound leaves** In this type of leaf, the incision of lamina, reach up to midrib or petiole, e.g. rose, neem, lemon, etc.



- These are of two types
  - **Pinnately compound leaves** A number of leaflets are present on common axis, the **rachis** which represents the midrib of the leaf as in neem.
  - **Palmately compound leaves** The leaflets are attached at a common point, i.e. as the tip of petiole, as in silk cotton.

## Phyllotaxy

It is the pattern of arrangement of leaves on the stem or branch. This is usually of three types

- **In alternate type of phyllotaxy**, a single leaf arises at each node in alternate manner, e.g. *Mangifera indica* (mango), *Hibiscus rosa-sinensis* (China rose), *Brassica campestris* (mustard), *Nicotiana tabacum* (tobacco).
- **In opposite type of phyllotaxy**, each node gives rise to two leaves lying opposite to each other, e.g. *Calotropis*, guava.
- **In whorled phyllotaxy**, more than two leaves arise at a node and form a whorl, e.g. *Alstonia*, *Nerium*, *Vangueria*, etc.

## Modifications of Leaves

Leaves are often modified to perform functions other than photosynthesis.

- **Leaf tendrils** These are thread-like sensitive structures, which can coil around a support to help the plant in climbing, e.g. wild pea (*Lathyrus aphaca*), *Pisum sativum* (sweet pea) and *Gloriosa superba* (glory lily).
- **Phyllode** It is a green, short-lived and flattened petiole or rachis of a leaf, which performs the function of photosynthesis, e.g. Australian *Acacia*. Phyllodes develop usually vertically and possess fewer stomata hence, reduce transpiration.
- **Bladder** The segments of the leaf modify into bladder-like structures, which trap small insects for nutrition, e.g. bladderwort (*Utricularia*).
- **Pitcher** It is a petiole modified into a tendril to hold the pitcher upright. The leaf base is expanded to carry out photosynthesis. The leaf apex is modified into a lid, e.g. *Nepenthes*, *Dischidia* and *Sarracenia*.
- **Leaf spines** The entire leaf or a part of a leaf may be modified into a pointed structure called a **spine**, as in *Opuntia* or cacti.
- **Scale leaves** These are thin, membranous leaves found at the nodal region. Each scale leaf contains an axillary bud in its axil, e.g. *Zingiber officinale* (ginger).

## Inflorescence

It is the arrangement of flowers on the floral axis of stem.

- **Racemose** The main axis continues to grow; flowers are borne laterally in acropetal or centripetal succession. Racemose inflorescence further constitutes the following types
  - **Raceme**, e.g. mustard.
  - **Panicle**, e.g. gulmohur.
  - **Corymb**, e.g. candytuft.
  - **Spike**, e.g. bottle brush.
  - **Spikelet**, e.g. wheat.
  - **Spadix**, e.g. palm.
  - **Catkin**, e.g. mulberry.
  - **Umbel**, e.g. coriander.
  - **Capitulum**, e.g. sunflower.
  - **Capitate**, e.g. *Acacia*.
- **Cymose** The main axis terminates in flower; flowers are borne in basipetal succession (e.g. *Calotropis*). Cymose inflorescence has been further categorised as
  - **Monochasial**, which constitutes
    - ♦ **Scorpioid**, e.g. *Ranunculus*.
    - ♦ **Helicoid**, e.g. *Begonia*.
  - **Dichasial**, e.g. *Clerodendrum*.
  - **Polychasial**, e.g. *Dianthus*.
  - **Cymose head**, e.g. *Anthocephallus*.
- **Mixed inflorescence** It is formed when two or more types of inflorescence get mixed up to form an inflorescence. It includes
  - **Panicle of spikelets**, e.g. oat, wheat
  - **Spike of spikelets**, e.g. rice
  - **Corymb of capitula**, e.g. *Ageratum*
  - **Thyrus**, e.g. grapevine
- **Special type of inflorescence** includes
  - **Cyathium**, e.g. *Euphorbia*
  - **Hypanthodium**, e.g. fig, peepal
  - **Verticillaster**, e.g. *Ocimum*.

## The Flower

Flower is the reproductive unit in the angiosperms. It is meant for sexual reproduction. Morphologically, it is considered as a shoot bearing nodes and modified floral leaves.

- A flower arises in the axil of a leaf-like structure called **bract**. Flowers with bracts are called **bracteate** and those without bracts are called **ebracteate**.
- The terminal part of the axis of the flower is the **receptacle** or **thalamus**. The receptacle contains sepals, petals, stamens and carpels. If the leaves are present on the pedicel, they are called **bracteoles**.
- A flower is either **unisexual** (having either stamen or pistil) or **bisexual** (having both stamen and pistil).



- On the basis of the number of floral appendages present, a flower may be **trimerous**, **tetramerous** or **pentamerous**.
  - **Insertion of floral parts** (forms of thalamus) Based on the position of ovary with respect to other floral whorls (calyx, corolla and androecium), the flowers are of following three types
    - **Hypogynous flower** Ovary is present at the top of thalamus.
    - **Perigynous flower** Margin of thalamus grows upwards forming a cup-like structure.
    - **Epigynous flower** Having fused thalamus and ovary.
  - **Symmetry of a flower** The symmetry of a flower depends upon the shape, size and arrangement of the floral parts. On the basis of this, it can be **actinomorphic** (radial symmetry, e.g. *Datura*) or **zygomorphic** (bilateral symmetry, e.g. *Cassia*).
  - **Placentation** is the arrangement of ovules inside an ovary. **Placenta** refers to the parenchymatous cushion present inside the ovary where ovules are borne. These may be **marginal** (e.g. peas), **axile** (e.g. China rose), **parietal** (e.g. *Cucurbita*), **free-central** (e.g. *Dianthus*) and **basal** (e.g. *Aster*).
3. **Androecium** (stamen), male reproductive part of flower. Each stamen consists of a filament and an anther. The anther contains pollen sacs where pollen grains are formed.
    - On the basis of cohesion and adhesion of their parts, stamens may be **monadelphous** (filaments united to form one bundle, e.g. *Hibiscus*), **diadelphous** (filaments united to form two bundles, e.g. *Pisum*), **polyadelphous** (filaments united to form more than two bundles, e.g. *Citrus*), **syngenesious** (only anthers are united in bundle, e.g. *Helianthus*), **synandrous** (both anthers and filament united to form bundle, e.g. *Cucurbita*).
    - When stamens are adhered to either tepals or petals the conditions are known as **epiphyllous** (e.g. *Quisqualis*) or **epipetalous** (e.g. *Solanum*), respectively. If stamens or anthers are attached to gynoecium condition is known as **gynandrous** (e.g. *Calotropis*).
  4. **Gynoecium** (pistils or carpels), female reproductive part of flower consisting of the receptive and sticky **stigma**, the elongated stalk **style** and the enlarged base **ovary** that bears ovules. When more than one carpels are present they may be **apocarpous** (free) as in *Viscum* or **syncarpous** (united) as in *Hibiscus*.

## Parts of a Flower

- A typical flower consists of four distinct parts, i.e. the calyx, corolla, androecium and gynoecium. The calyx and corolla are accessory or non-essential parts and the androecium and gynoecium are essential parts.
- Different parts of flowers are as follows
  1. **Calyx** is the outermost, green in colour, leaf-like whorl that protects the bud stage of flower. The individual members are sepals. The calyx may be **gamosepalous** or **polysepalous**.
  2. **Corolla** is the whorl of brightly coloured petals to attract insects for pollination. Petals are also either **fused** (gamopetalous) or **free** (polypetalous).
    - **Aestivation** It is the arrangement of sepals or petals in relation to one another in a floral bud.
      - **Valvate** Units in a whorl just touch at margin, without overlapping, e.g. *Calotropis*.
      - **Twisted** One margin of unit overlaps that of the next one, e.g. *Hibiscus*.
      - **Imbricate** Both margins of one petal/sepal overlaps and another petal/sepals are overlapped, rest other are twisted, e.g. *Cassia*.
      - **Vexillary** Large petal (standard) overlaps the two lateral petals (wings), which in turn overlap the two smallest anterior petals (keel), e.g. *Pisum*.

## Fruit

- It is the mature ovary developed after fertilisation. It consists of pericarp and seeds.
- **True fruits** develop from the ovary.
- **False fruits** develop from other floral parts along with the ovary.
- **Parthenocarpic fruits** develop from the ovary without fertilisation.
- Fruits have been broadly categorised into three types
  1. **Simple fruits** develop from a mono or multicarpellary syncarpous ovary. These have been further divided into two groups
    - (i) **Dry fruits**, which further include
      - **Dehiscent fruits** constituting
        - Pod or Legume, e.g. pea
        - Follicle, e.g. *Calotropis*
        - Siliqua, e.g. mustard
        - Silicula, e.g. *Capsella*
        - Capsule, e.g. poppy
      - **Indehiscent fruits** constituting
        - Achene, e.g. *Ranunculus*
        - Caryopsis, e.g. wheat
        - Cypsela, e.g. sunflower
        - Nut, e.g. litchi
        - Samara, e.g., *Holoptelea*



- **Schizocarpic fruits** constituting
  - Lomentum, e.g. *Acacia*
  - Cremocarp, e.g. *Cuminum*
  - Regma, e.g. castor
  - Cacerulus, e.g. *Ocimum*
  - Double samara, e.g. *Acer pseudoplatanus*
- (ii) **Succulent fruits** are further categorised into
  - Drupe, e.g. mango
  - Berry, e.g. grape
  - Pome, e.g. apple
  - Hesperidium, e.g. orange
  - Pepo, e.g. *Cucurbita*
  - Balausta, e.g. pomegranate
  - Amphisarca, e.g. wood apple
- 2. **Aggregate fruits** develop from multicarpellary apocarpous ovary, e.g. raspberry, rose.
- 3. **Composite fruits** develop from a complete inflorescence, e.g. pineapple, banyan.

## Seed

- It is developed from fertilised ovules. These may be monocotyledonous (e.g. wheat) or dicotyledonous (e.g. gram) and endospermic (e.g. coconut) or non-endospermic (e.g. beans).
- **Dicotyledonous seeds** possess
  - Two seed coats, i.e. the outer **testa** and inner **tegmen**.
  - Seed is attached to fruit through **hilum** and has a small pore called **micropyle**.
  - Two cotyledons present are fleshy.
  - **Endosperm** is formed as a result of double fertilisation.
  - Seeds of bean, gram and pea are non-endospermic.

- **Monocotyledonous seeds** are
  - Endospermic (except orchids).
  - Seed coat is membranous and fused with cell wall.
  - Outer covering of endosperm called **aluerone layer** is present, which separates the embryo from endosperm.
  - Embryo is small and shield-shaped. Cotyledon present is called **scutellum** and has a short axis with a **plumule** and a **radicle**.
  - **Coleoptile** covers plumule, while radicle is enclosed by **coleorhiza**.

## Semi-Technical Description of a Typical Flowering Plant

- Flower is the distinct identifying feature of a plant. To describe the characteristics of a flower in brief, floral formula and floral diagram are used. They use some specific symbols as

Br	–	Bracteate	P	–	Perianth (Unit-tepals)
Ebr	–	Ebracteate	A	–	Androecium (Unit-stamens)
⊕	–	Actinomorphic or regular flower	G	–	Gynoecium (Unit-carpels)
%	–	Zygomorphic or irregular flower	$\overline{G}$	–	Superior ovary
♂	–	Bisexual flower	$\overline{G}$	–	Inferior ovary
♀	–	Female flower	1, 2, 3, 4, ... ∞	–	Number of units
♂	–	Male flower	()	–	Fused
K	–	Calyx (Unit-sepals)			
C	–	Corolla (Unit-petals)	$\widehat{C}A$	–	Epipetalous condition

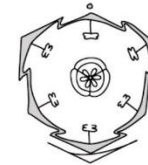
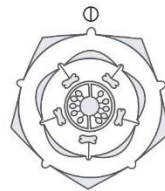
### Description of Some Important Families

Characteristics	Fabaceae	Solanaceae	Liliaceae
<b>General description</b>	The family also termed as <b>pea family</b> . It is distributed all over the world.	Commonly known as <b>potato family</b> . It is distributed in tropics and subtropics.	Commonly called as <b>lily family</b> . It is a representative of monocots.
<b>Plant structure</b>	Tree, shrub and herb.	Herb, shrub and small trees.	Perennial herb.
<b>Stem structure</b>	Erect or Climber.	Herbaceous, rarely woody, hairy, hollow, underground (potato).	Stem may be underground partially.
<b>Inflorescence</b>	Racemose.	Solitary, axillary or cymose.	Solitary/cymose often umbellate clusters.
<b>Flower</b>	Bisexual and zygomorphic.	Bisexual and actinomorphic, rarely zygomorphic.	Bisexual and actinomorphic.
<b>Calyx</b>	Five, gamosepalous imbricate.	Five united, persistent, valvate.	Perianth [6 tepals arranged in two whorls (3 + 3). Free or rarely united, valvate].



Characteristics	Fabaceae	Solanaceae	Liliaceae
<b>Corolla</b>	Five, polypetalous, papilionaceous.	Five united, valvate.	—
<b>Androecium</b>	Ten, diadelphous, anther ditheous.	Stamens five, epipetalous.	Stamens 6 (3 + 3), epipetalous
<b>Gynoecium</b>	Ovary superior, monocarpellary and unilocular.	Bicarpellary, syncarpous and superior.	Tricarpellary, syncarpous and superior.
<b>Fruit</b>	Legume.	Berry or Capsule.	Capsule and rarely berry.
<b>Seed</b>	One to many non-endospermic.	Many and endospermic.	Endospermic.
<b>Floral formula</b>	$\% \overset{\oplus}{\text{K}}_{(5)} \text{C}_{1+2+(2)} \text{A}_{(9)+1} \underline{\text{G}}_1$	$\oplus \overset{\oplus}{\text{K}}_{(5)} \overset{\oplus}{\text{C}}_{(5)} \overset{\oplus}{\text{A}}_{(5)} \underline{\text{G}}_{(2)}$	$\text{Br} \oplus \overset{\oplus}{\text{P}}_{(3+3)} \overset{\oplus}{\text{A}}_{3+3} \underline{\text{G}}_{(3)}$
<b>Economic importance</b>	Plants of this family are source of pulses (e.g. gram, arhar, sem, moong and soybean) and edible oil (e.g. soybean and groundnut). Dye is extracted from <i>Indigofera</i> .	Plants of this family are source of food (potato underground stem), tomato and brinjal, spices (chilli), medicines ( <i>Belladonna</i> ), fumigatory (tobacco).	Plants of this family are used as ornament and medicines <i>Aloe</i> , vegetable ( <i>Asparagus</i> ) and colchicine ( <i>Colchicum autumnale</i> ).

Floral diagram



# Mastering NCERT

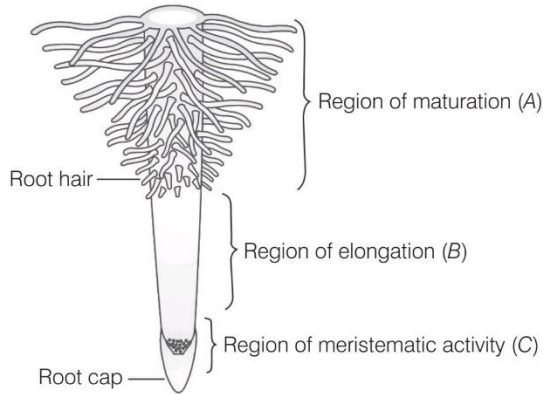
## MULTIPLE CHOICE QUESTIONS

### TOPIC 1 ~ The Root

- Roots formed from prolongation of radicle is
  - primary root
  - secondary root
  - tertiary root
  - seminal root
- Primary roots and its branches constitute
  - adventitious root system
  - tap root system
  - fibrous roots
  - seminal roots
- In monocotyledonous 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
  - prop roots
  - pneumatophores
  - napiform
  - fibrous roots
- Which plant amongst following bears fibrous root system?
  - Mustard plant
  - Wheat plant
  - Monstera*
  - Banyan tree
- Which amongst the following options contains mismatched pair?
  - Direct elongation of radicle – Primary roots
  - Root system originating from the stem's base–Fibrous roots
  - Roots not arising from the radicle–Stilt roots
  - Constitution of primary root and its branches – Tap root system
- Which of the following is incorrect?
  - Roots help in water and mineral absorption from soil
  - Roots provide a proper anchorage
  - Roots store food material and synthesise plant growth regulators
  - Roots lack meristematic activity
- Which of the following is the smallest region of the root?
  - Root cap
  - Region of elongation
  - Region of meristematic activity
  - Region of maturation



- 8** Root hairs develop from the region of **NEET 2017**  
 (a) maturation (b) elongation  
 (c) root cap (d) meristematic activity
- 9** Which of the following options is correct with respect to the given figure showing different zones of a typical root?



- (a) Part B mainly helps in absorption of water  
 (b) Quiescent centre is present in part B  
 (c) Part A is most suitable for anatomical studies of root  
 (d) Differentiation of cells can be observed in part C

- 10** Tap roots of which of the following get swollen and store food?  
 (a) *Daucus carota* (b) *Brassica rapa*  
 (c) Both (a) and (b) (d) *Ipomoea batatas*
- 11** Select the group of plants that possess stilt roots.  
 (a) *Zea mays*, *Saccharum officinarum*  
 (b) *Pandanus odoratissimus*, *Ficus benghalensis*  
 (c) *Rhizophora mangle*, *Hedera helix*  
 (d) *Ficus benghalensis*, *Pisum sativum*
- 12** Identify the mismatched pair.  
 (a) Prop roots — Provide support  
 (b) Stilt roots — Originate from stem's nodal part  
 (c) Pneumatophores — Help in storing food  
 (d) Edible roots — Sweet potato
- 13** A type of modified ...A... root that arises from the internode of stem, grows and becomes fleshy and tuberous, serving as storage for reserve food material is observed in ...B... .

- | A                | B            |
|------------------|--------------|
| (a) Adventitious | sweet potato |
| (b) Tap          | sweet potato |
| (c) Adventitious | ginger       |
| (d) Tap          | turmeric     |

## TOPIC 2 ~ The Stem

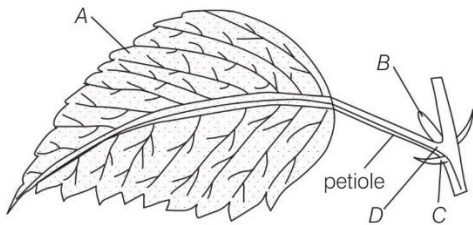
- 14** The stem is the ...A... part of the axis, which bears branches, leaves, flowers and fruits. It develops from the ...B... part of the embryo of a germinating seed. Appropriate options for A and B is  
 (a) A—descending; B—radicle (b) A—radicle; B—descending  
 (c) A—ascending; B—plumule (d) A—plumule; B—ascending
- 15** Nodes are the region of stem where  
 (a) food is stored by plants  
 (b) leaves are borne  
 (c) xylem and phloem are present  
 (d) axillary buds develop
- 16** Which of the following options represents the functions of stem in plants?  
 (a) To bear leaves and branches  
 (b) Conduction of water and minerals and photosynthates  
 (c) Storage of food, protection and vegetative propagation  
 (d) All of the above
- 17** In *Bougainvillea*, thorns are the modifications of **NEET 2017**  
 (a) stipules (b) adventitious root  
 (c) stem (d) leaf
- 18** In which plant the underground stem spreads to new niches and when older parts die new plants are formed?  
 (a) grasses (b) strawberry  
 (c) *Pistia* (d) Both (a) and (b)
- 19** In plants like mint and jasmine, a slender lateral branch arises from the base of the main axis and after growing aurally for some time, arch downwards to touch the ground. This slender branch is called  
 (a) sucker (b) stolon (c) offset (d) scramblers
- 20** Lateral branches with short internodes and each node bearing a rosette of leaves above and a tuft of roots below is found in aquatic plants like *Pistia* and *Eichhornia*. These lateral branches are called  
 (a) suckers (b) offsets  
 (c) stolons (d) rhizome
- 21** In banana, pineapple and *Chrysanthemum*, the lateral branches originate from the basal and underground portion of main stem and then come obliquely upward giving rise to leafy shoots  
 (a) runner (b) corm (c) bulb (d) sucker
- 22** Stem modification seen in *Opuntia* and *Euphorbia* is  
 (a) phylloclades (b) thorns  
 (c) tendrils (d) runners
- 23** Identify which of them is the modification of axillary buds into tendrils and thorns.  
 I. *Hugonia* II. *Duranta* III. *Passiflora* IV. *Dioscorea*  
 (a) I and II (b) II and III  
 (c) III and I (d) IV and I





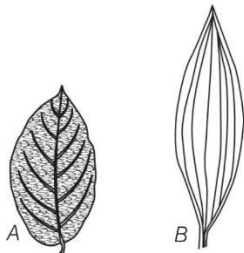
## TOPIC 3 ~ The Leaf

- 24** In plants, leaves  
 (a) originate from shoot apical meristem  
 (b) are arranged in an acropetal order  
 (c) are the most important vegetative organs for photosynthesis  
 (d) All of the above
- 25** Given below is the diagram of a typical leaf. In which of the following all the four parts labelled as *A*, *B*, *C* and *D* are correctly identified?



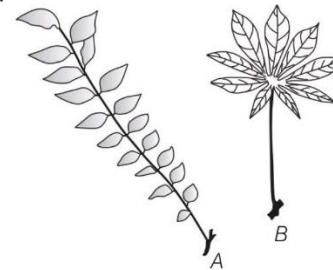
A	B	C	D
(a) Lamina	Axillary bud	Stipule	Leaf base
(b) Lamina	Stipule	Axillary bud	Leaf base
(c) Lamina	Axillary bud	Stipule	Pedicel
(d) Leaflet	Axillary bud	Stipule	Leaf base

- 26** Leaf base expands into sheath covering the stem partially or wholly. This is the characteristic of  
 (a) dicot (b) monocot  
 (c) pteridophytes (d) gymnosperm
- 27** Swollen leaf base is called  
 (a) lamina (b) petiole (c) pulvinus (d) leaf blade
- 28** 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
- 29** Identify the type of venation in the given diagram (*A* and *B*).

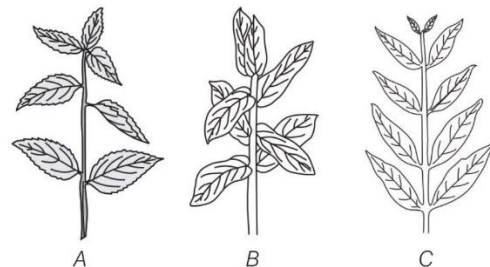


- (a) A–Reticulate (dicotyledons); B–Parallel (monocots)  
 (b) A–Reticulate (monocots); B–Parallel (dicots)  
 (c) A–Parallel (dicots); B–Reticulate (monocots)  
 (d) A–Parallel (monocots); B–Reticulate (dicots)

- 30** Leaf having single or undivided lamina is called  
 (a) compound leaf  
 (b) simple leaf  
 (c) Either (a) or (b)  
 (d) general leaf
- 31** Leaf having completely divided lamina with distinct segments or leaflets is called  
 (a) petiole (b) phyllotaxy  
 (c) compound leaf (d) simple leaf
- 32** In a pinnately compound leaf (as seen in neem), a number of leaflets are present on a common axis, the rachis. The rachis represents the  
 (a) vein (b) midrib  
 (c) petiole (d) axillary bud
- 33** 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)
- 34** Stems modified into flat green organs performing the function of leaves are known as **NEET 2016**  
 (a) phyllode (b) phylloclade  
 (c) scales (d) cladodes
- 35** Study the given figures and identify the kind of phyllotaxy.





- | A                      | B                   | C                   |
|------------------------|---------------------|---------------------|
| (a) Alternate          | Opposite superposed | Opposite decussate  |
| (b) Alternate          | Opposite decussate  | Opposite superposed |
| (c) Opposite decussate | Alternate           | Whorled             |
| (d) Opposite decussate | Whorled             | Alternate           |

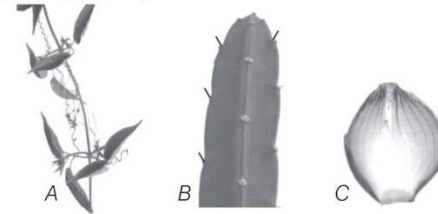
**36** Which of the following shows whorled phyllotaxy?  
**NEET (Odisha) 2017**

- (a) Mustard  
 (b) China rose  
 (c) *Alstonia*  
 (d) *Calotropis*

**37** Which of the following is an incorrect pair?

- (a) Tendrils – Peas  
 (b) Phylloclade – Australian *Acacia*  
 (c) Spines – *Cacti*  
 (d) Fleshy leaves – Garlic

**38** Identify the type of leaf modification in the given diagram (A to C).



- (a) A–Support (spines), B–Protection (tendrils), C–Storage (fleshy leaves)  
 (b) A–Support (tendrils), B–Protection (spine), C–Storage (fleshy leaves)  
 (c) A–Protection (tendrils), B–Support (spine), C–Storage (fleshy leaves)  
 (d) A–Protection (spine), B–Support (tendrils), C–Storage (fleshy leaves)

**39** Leaf tendrils are found in **AIIMS 2018**

- (a) grapevine (b) peas (c) cucumber (d) All of these

## TOPIC 4~ Inflorescence and The Flower

**40** In ...A... type of inflorescence, main axis terminates in a flower, hence is limited in growth and flowers are borne in ...B... succession. Choose the correct option to replace A and B.

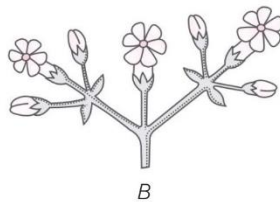
- | A            | B         |
|--------------|-----------|
| (a) racemose | acropetal |
| (b) racemose | basipetal |
| (c) cymose   | acropetal |
| (d) cymose   | basipetal |

**41** Identify the types of inflorescence shown in figure and select the correct option for A and B.



A

- (a) Cymose  
 (b) Racemose  
 (c) Racemose  
 (d) Cymose



B

- (a) Racemose  
 (b) Cymose  
 (c) Racemose  
 (d) Cymose

**42** Verticillaster inflorescence is found in **JIPMER 2019**

- (a) mustard (b) *Ocimum*  
 (c) China rose (d) sunflower

**43** Find odd one out. **JIPMER 2019**

- (a) stamen (b) stigma  
 (c) style (d) ovary

**44** The standard petal of a papilionaceous corolla is also called **NEET 2016**

- (a) pappus (b) vexillum  
 (c) corona (d) carina

**45** Perianth is the condition in which

- (a) calyx and corolla are not distinct  
 (b) calyx is present, but corolla is absent  
 (c) corolla is present, but calyx is absent  
 (d) calyx and corolla are not present

**46** Keel is the characteristic feature of the flower of **CBSE-AIPMT 2015**

- (a) tomato (b) tulip  
 (c) *Indigofera* (d) *Aloe*

**47** Which of the following represent zygomorphic symmetry? **AIIMS 2019**

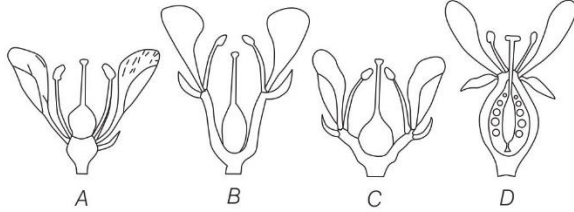
- (a) *Canna*, Mustard, Chilli, *Datura*  
 (b) Mustard, *Canna*, Pea, *Datura*  
 (c) Pea, Bean, *Cassia*, Gulmohar  
 (d) Pea, Bean, *Canna*, Chilli

**48** Radial symmetry is found in the flowers of **NEET 2016**

- (a) *Brassica* (b) *Trifolium*  
 (c) *Pisum* (d) *Cassia*



**49** On the basis of relative position of different floral parts on the thalamus, a flower can be hypogynous, perigynous or epigynous. With respect to the given figures (A, B, C and D), select the correct option.

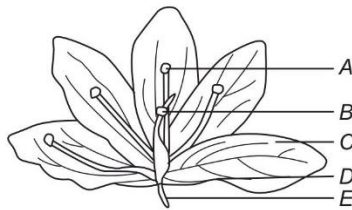


- |     |            |            |            |            |
|-----|------------|------------|------------|------------|
|     | A          | B          | C          | D          |
| (a) | Hypogynous | Perigynous | Perigynous | Epigynous  |
| (b) | Hypogynous | Epigynous  | Epigynous  | Perigynous |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

**50** Which of the following is correct? **AIIMS 2019**

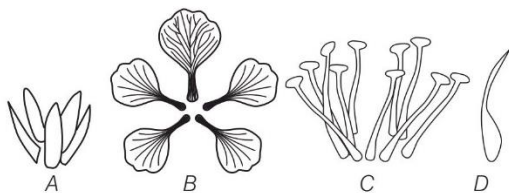
- (a) Perigynous—Plum, peach, rose  
(b) Epigynous—Guava and cucumber  
(c) Hypogynous—Mustard and rose  
(d) Both (a) and (b)

**51** Identify the flower parts A to E in the given diagram.



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

**52** Identify flower parts A to D in the given diagrams correctly.

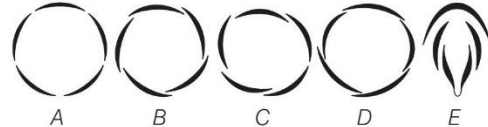


- (a) A—Corolla, B—Calyx, C—Androecium, D—Gynoecium  
(b) A—Calyx, B—Corolla, C—Androecium, D—Gynoecium  
(c) A—Calyx, B—Corolla, C—Gynoecium, D—Androecium  
(d) A—Corolla, B—Calyx, C—Gynoecium, D—Androecium

**53** Choose the incorrect pair.

- (a) Aestivation—Arrangement of sepals or petals in a floral bud  
(b) Valvate—No overlapping of sepals or petals; *Calotropis*  
(c) Imbricate aestivation—Overlapping margins, but in particular direction; Cotton  
(d) Vexillary aestivation – Also called papilionaceous aestivation; Pea

**54** Arrange in correct order according to the given figures. **AIIMS 2018**



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

**55** Complete the paragraph given below by replacing A and B with correct terms.

Androecium is composed of A, which represents the male reproductive organ. It consists of a stalk and B, which is usually bilobed and each lobe has two chambers, the pollen sacs. The pollen grains are produced in pollen sacs.

- (a) A – stamens; B – anther (b) A – stigma; B – filament  
(c) A – axile; B – anther (d) A – stamens; B – filament

**56** Select the incorrect pair out of the following.

- (a) Monadelphous – *Hibiscus*  
(b) Diadelphous – *Cucurbita*  
(c) Polyadelphous – *Citrus*  
(d) Epiphyllous – Lily

**57** The term 'polyadelphous' is related to **NEET 2016**

- (a) gynoecium (b) androecium  
(c) corolla (d) calyx

**58** Identify the incorrect match.

- (a) Stamens attached to petals – Epipetalous  
(b) Stamens attached to perianth – Episepalous  
(c) Free stamens – Polyandrous  
(d) Sterile stamen – Staminode

**59** I. When carpels are free, they are called ...A... as in lotus and rose.

II. When carpels are fused, they are called ...B... as in mustard and tomato.

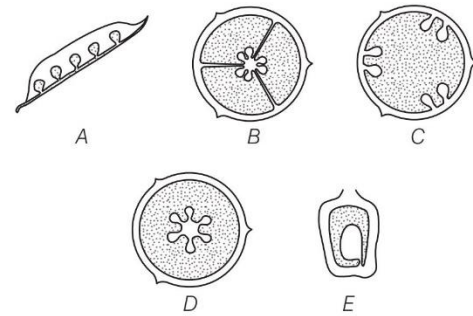
Here, A and B refer to

- (a) A—syncarpous; B—apocarpous  
(b) A—apocarpous; B—syncarpous  
(c) A—monocarpous; B—multicarpous  
(d) A—multicarpous; B—monocarpous



- 60** 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**  
 (a) Three (b) Four (c) Five (d) Six
- 61** Placentation can be defined as an arrangement of  
 (a) ovules within the ovary  
 (b) synergids within the ovary  
 (c) carpels in a flower  
 (d) pistils in a flower
- 62** In marginal placentation, the ovules are arranged  
 (a) along the inner wall of carpel in a syncarpous ovary  
 (b) along the margin of single carpel  
 (c) in the middle of the ovary  
 (d) to the base of the ovary
- 63** Axile placentation is found in syncarpous ovaries. In this placentation, the ovules are arranged along the  
 (a) base of the ovary  
 (b) margin of the ovary  
 (c) axis in the centre of the ovary  
 (d) None of the above
- 64** In a multicarpellary syncarpous unilocular ovary, if the ovules are borne on the central axis and septa are absent this is defined as  
 (a) marginal placentation  
 (b) parietal placentation  
 (c) axile placentation  
 (d) free-central placentation

- 65** Free-central placentation is found in **NEET 2016**  
 (a) *Dianthus* (b) *Argemone*  
 (c) *Brassica* (d) *Citrus*
- 66** Basal placentation develops when the ovary has  
 (a) single ovule  
 (b) many ovules  
 (c) many locules  
 (d) single ovules in each locule
- 67** Identify the types of placentation in the given diagrams (A to E).

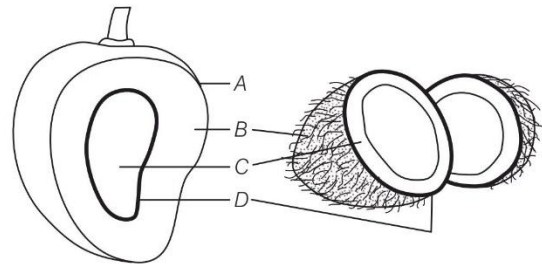


- (a) A–Marginal, B–Axile, C–Parietal, D–Free-central, E–Basal  
 (b) A–Marginal, B–Basal, C–Parietal, D–Free-central, E–Axile  
 (c) A–Parietal, B–Basal, C–Marginal, D–Free-central, E–Axile  
 (d) A–Parietal, B–Axile, C–Marginal, D–Free-central, E–Basal

## TOPIC 5~ Fruit and Seed

- 68** The fruit is a characteristic of ...A... and the formation of fruit from ovary without fertilisation is called ...B...  
 (a) A–Gymnosperms, B–Parthenogenesis  
 (b) A–Dicots, B–Apomixis  
 (c) A–Flowering plants, B–Parthenocarpy  
 (d) A–Angiosperms, B–Amphimixis
- 69** Choose the incorrect match.  
 (a) Parthenocarpic fruit –Seedless fruit  
 (b) Wall of fruit – Epicarp  
 (c) Edible part of apple and pear – Thalamus  
 (d) Dry or fleshy part of fruit – Pericarp
- 70** Thick and fleshy pericarp is differentiated into  
 (a) epicarp and endocarp  
 (b) epicarp, mesocarp and endocarp  
 (c) epicarp and sporocarp  
 (d) sporocarp and cystocarp

- 71** Identify A to D in the given diagram.



- (a) A–Epicarp, B–Mesocarp, C–Seed, D–Endocarp  
 (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
- 72** Coconut fruit is a **NEET 2017**  
 (a) drupe (b) berry (c) nut (d) capsule



- 73** In mango and coconut, the fruit develops from  
**CBSE-AIPMT 2012**
- monocarpellary superior ovaries and are one seeded
  - monocarpellary superior ovaries and are many seeded
  - polycarpellary superior ovaries and are one seeded
  - polycarpellary superior ovaries and are many seeded

- 74** An aggregate fruit is one which develops from  
**CBSE-AIPMT 2014**
- multicarpellary syncarpous gynoecium
  - multicarpellary apocarpous gynoecium
  - complete inflorescence
  - multicarpellary superior ovary

- 75** How many plants in the list given below have composite fruits that develop from an inflorescence ?  
 Walnut, poppy, radish, fig, pineapple, apple, tommato, mulberry  
**CBSE-AIPMT 2012**
- Four
  - Five
  - Two
  - Three

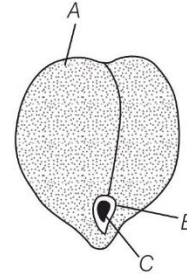
- 76** Choose the incorrect pair.
- Seed – contains an embryo
  - Monocotyledonous seed – wheat
  - Dicotyledonous seed – maize
  - Seed coat – outermost covering
- 77** The seed coat has two layers, i.e. the outer ....A.... and the inner .....B..... . The .....C..... is scar on the seed coat through which the developing seeds are attached to the fruit. Above the .....D..... is a small pore called the .....E..... .

- Choose the correct option.
- A-Testa, B-Tegmen, C-Hilum, D-Hilum, E-Micropyle
  - A-Tegmen, B-Testa, C-Hilum, D-Hilum, E- Micropyle
  - A-Testa, B-Tegmen, C-Micropyle, D-Micropyle, E-Hilum
  - A-Tegmen, B-Testa, C-Micropyle, D-Micropyle, E-Hilum

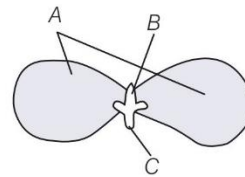
- 78** Which of the following structures is present in a dicot seed at the two ends of the embryonal axis ?
- Endosperm
  - Coleorhiza and cleoptile
  - Radicle and plumule
  - Epicarp
- 79** In the seed of *X* plant, the endosperm formed as a result of double fertilisation whereas seeds of *Y* plant are non-endospermous. Identify *X* and *Y* and select the correct option.

X	Y
(a) Pea	Bean
(b) Bean	Castor
(c) Castor	Gram
(d) Gram	Pea

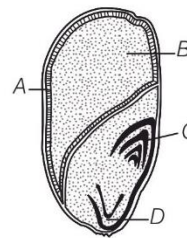
- 80** Identify *A*, *B* and *C* in the given diagram.



- A-Seed coat, B-Micropyle, C-Hilum
  - A-Seed coat, B-Hilum, C-Micropyle
  - A-Hilum, B-Seed coat, C-Micropyle
  - A-Micropyle, B-Seed coat, C-Hilum
- 81** Identify *A*, *B* and *C* in the given diagram.



- A-Plumule, B-Cotyledon, C-Radicle
  - A-Radicle, B-Cotyledon, C-Plumule
  - A-Cotyledon, B-Plumule, C-Radicle
  - A-Cotyledon, B-Radicle, C-Plumule
- 82** Identify *A*, *B*, *C* and *D* in the given diagram.



- A-Aleurone layer, B-Endosperm, C-Coleoptile, D-Coleorhiza
  - A-Aleurone layer, B-Coleoptile, C-Endosperm, D-Coleorhiza
  - A-Coleoptile, B-Aleurone layer, C-Endosperm, D-Coleorhiza
  - A-Coleoptile, B-Aleurone layer, C-Coleorhiza, D-Endosperm
- 83** The wheat grain has an embryo with one large, shield-shaped cotyledon known as

- CBSE-AIPMT 2015**
- epiblast
  - coleorhiza
  - scutellum
  - coleoptile
- 84** Cotyledon of maize grain is called **NEET 2016**
- coleorhiza
  - coleoptile
  - scutellum
  - plumule



## TOPIC 6 ~ Semi-Technical Description of a Typical Flowering Plant

- 85** What would we interpret if % is given for a flower in its floral formula?  
 (a) Any vertical section passing through its centre divides it into two equal vertical halves  
 (b) Only one vertical section divides it into equal vertical halves  
 (c) Cannot be divided into equal vertical halves by any vertical section  
 (d) Only one vertical section passing through its centre divides it into two equal vertical halves
- 86** When both essential floral organs (stamens and carpels) are present in a flower, we write ..... in its floral formula.  
 (a) ♂ (b) ♂ (c) ♀ (d) ⊕
- 87** Give the symbol of bicarpellary syncarpous, inferior ovary  
 (a)  $\underline{G}_{(2)}$  (b)  $G_0$   
 (c)  $G_2$  (d)  $\overline{G}_{(2)}$
- 88** Give symbol for actinomorphic flower with 6 tepals, gamotepalous.  
 (a)  $\oplus P_{3+3}$  (b)  $\% P_{(6)}$   
 (c)  $\oplus P_{(3)} + P_{(3)}$  (d)  $\% P_6$
- 89** Choose the correct option denoting the symbols used for the presence of tepals and epitepalous stamens in a flower.  
 (a)  $\widehat{K} \widehat{A}$  (b)  $\widehat{P} \widehat{A}$   
 (c)  $\widehat{C} \widehat{A}$  (d)  $\widehat{G} \widehat{A}$
- 90** The partial floral formula of a flower is  $\widehat{K}_{(5)} \widehat{C}_5 \widehat{A}_{(\infty)} \underline{G}_{(5)}$ . Which of the following sets of information is conveyed here?  
 (a) Gamosepalous, polypetalous, syncarpous and superior ovary  
 (b) Polysepalous, polypetalous, syncarpous and inferior ovary  
 (c) Gamosepalous, gamopetalous, polycarpous and superior ovary  
 (d) Gamosepalous, polypetalous, syncarpous and inferior ovary
- 91** From the options given below, find out the correct floral formula for a flower having the following characters namely actinomorphic bisexual, five united sepals, five united petals, stamens five and epipetalous, bicarpellary, syncarpous with superior ovary.  
 (a)  $\oplus \varphi \widehat{K}_{(5)} \widehat{C}_{(5)} \widehat{A}_{(5)} \underline{G}_{(2)}$  (b)  $\oplus \varphi \widehat{K}_{(5)} \widehat{C}_{(5)} \widehat{A}_{(5)} \underline{G}_{(2)}$   
 (c)  $\oplus \varphi \widehat{K}_{(5)} \underline{C}_{(5)} \widehat{A}_{(5)} \underline{G}_{(2)}$  (d)  $\oplus \varphi \widehat{K}_{(5)} \widehat{C}_{(5)} \widehat{A}_{(5)} \underline{G}_{(2)}$

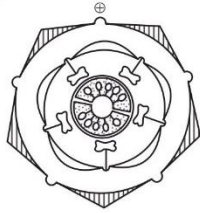
## TOPIC 7 ~ Description of Some Important Families

- 92** vexillary aestivation is characteristic of the family  
**CBSE-AIPMT 2012**  
 (a) Fabaceae (b) Asteraceae  
 (c) Solanaceae (d) Brassicaceae
- 93** Add the missing floral organs in the given floral formula of family-Fabaceae.  
 $\% \varphi \widehat{K}_{(5)} - A_{1+(9)} \underline{G}_1$   
 (a)  $C_{1+2+2}$  (b)  $C_{1+2+(2)}$   
 (c)  $C_{1+2+3}$  (d)  $C_5$
- 94** Which floral family has (9) + 1 arrangement of anthers in the androecium?  
 (a) Malvaceae (b) Rutaceae  
 (c) Fabaceae (d) Caesalpiniaceae
- 95**  $\oplus \varphi \widehat{K}_{(5)} \widehat{C}_{(5)} \widehat{A}_5 \underline{G}_{(2)}$  is the floral formula of  
**CBSE-AIPMT 2015**  
 (a) *Brassica* (b) *Allium*  
 (c) *Sesbania* (d) *Petunia*
- 96**  $\oplus \varphi \widehat{K}_{(5)} \widehat{C}_{(5)} \widehat{A}_5 \underline{G}_{(2)}$  is the floral formula of  
 (a) Poaceae (b) Solanaceae (c) Asteraceae (d) Musaceae
- 97** Tricarpellary, syncarpous gynoecium is found in flowers of  
**NEET 2016**  
 (a) Solanaceae (b) Fabaceae (c) Poaceae (d) Liliaceae
- 98** 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 | Actinomorphic | 5       | Bicarpellary  |
| Liliaceae  | Solitary, cymose or racemose | Actinomorphic | C       | Tricarpellary |
- |              | A             | B     | C               | D |
|--------------|---------------|-------|-----------------|---|
| (a) Racemose | Zygomorphic   | 3 + 3 | Monocarpellary  |   |
| (b) Racemose | Actinomorphic | 5     | Bicarpellary    |   |
| (c) Cymose   | Zygomorphic   | 3 + 3 | Tricarpellary   |   |
| (d) Cymose   | Actinomorphic | 5     | Multicarpellary |   |



**99** Study carefully the given floral diagram and select the option, which correctly represents the related Floral Formula (FF).

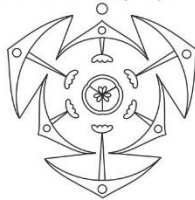
- (a)  $\% \varnothing K_{(5)} C_{1+2+(2)} A_5 \overline{G}_{(2)}$   
 (b)  $\oplus \varnothing K_{(5)} \overline{C}_{(5)} A_5 \underline{G}_{(2)}$   
 (c)  $\oplus \varnothing P_{5+5} A_{(5)} \underline{G}_{(2)}$   
 (d)  $\oplus \varnothing K_{(5)} \overline{C}_{(5)} A_5 \underline{G}_{(2)}$



**100** Which of the following is a correct combination of family and its respective members?

- (a) Fabaceae–Tomato, Chilli  
 (b) Solanaceae–Tobacco, Brinjal  
 (c) Liliaceae–*Petunia*, Potato  
 (d) None of the above

**101** Study carefully the given floral diagram and select the option, which correctly represents the related Floral Formula (FF).



- (a)  $\oplus \varnothing P_{(3+3)} A_{3+3} \underline{G}_{(3)}$  (b)  $\oplus \varnothing P_6 A_6 \underline{G}_{(3)}$   
 (c)  $\oplus \varnothing P_{5+5} A_{(5)} \underline{G}_{(2)}$  (d)  $\oplus \varnothing K_{(5)} \overline{C}_{(5)} A_5 \underline{G}_{(2)}$

**102** Choose the incorrect match about Fabaceae.

- (a) Dye – *Indigofera* (b) Fibres – Sunhemp  
 (c) Medicine – *Muliathi* (d) Edible oil – *Sesbania*, *Trifolium*

**103** Choose the correct option.

- (a) Members of Solanaceae family are used as spices (chilli), medicine (*Belladonna*, ashwagandha)  
 (b) Members of Liliaceae include *Aloe*, *Asparagus*  
 (c) Members of Fabaceae like *Lupin*, sweet pea are used in ornamental purposes  
 (d) All of the above

**104** I. Plants belonging to the family...A... possesses a persistent calyx.  
 II. The family ...B... mainly contains monocotyledonous plants.

Choose the correct option to fill in the blanks 'A' and 'B'.

- | A              | B          |
|----------------|------------|
| (a) Fabaceae   | Poaceae    |
| (b) Solanaceae | Fabaceae   |
| (c) Solanaceae | Liliaceae  |
| (d) Asteraceae | Solanaceae |

# NEET

## SPECIAL TYPES QUESTIONS

### I. Assertion and Reason

■ **Direction** (Q. 105-123) In each of the following questions, a statement of Assertion (A) is given by corresponding statement of Reason (R). Of the statements, mark the correct answers as

- (a) If both A and R are true and R is the correct explanation of A  
 (b) If both A and R are true, but R is not the correct explanation of A  
 (c) If A is true, but R is false  
 (d) If A is false, but R is true

**105 Assertion** (A) Root cap protects the root meristem from the friction of the soil and its outer cells are continuously replaced by newer ones.

**Reason** (R) Effect of the soil friction damages the outer cells of root cap, which are peeled off and replaced by new cells produced by root meristem.

**106 Assertion** (A) Fibrous root system consists of large number of fine, fibrous roots developing from the base of the stem.

**Reason** (R) Fibrous root system is found in dicots only.

**107 Assertion** (A) Stems of some plants protect them from browsing animals.

**Reason** (R) Axillary buds of stems of these plants are modified into thorns.

**108 Assertion** (A) Stem tubers are the swollen ends of specialised underground stem branches, which help in vegetative propagation of the plant.

**Reason** (R) *Solanum tuberosum* is an example of a stem tuber, which stores inulin as the main reserve food material.

**109 Assertion** (A) In bamboo, modified form of stem called culm is seen.



**Reason (R)** Culm possesses swollen nodes giving a jointed appearance.

- 110 Assertion (A)** In some leguminous plants, the leaf base is swollen.

**Reason (R)** The swollen leaf base is called pulvinus.

- 111 Assertion (A)** Leaves of both monocot and dicot plants generally possess parallel venation.

**Reason (R)** Parallel venation is the characteristic feature of monocot plants.

- 112 Assertion (A)** Alternate type of phyllotaxy is seen in China rose and mustard plant.

**Reason (R)** Alternate type of phyllotaxy is the arrangement of leaves in which a single leaf arises at each node in alternate manner.

- 113 Assertion (A)** Type of inflorescence in *Sphaeranthus* is cyathium.

**Reason (R)** In cyathium type inflorescence, the flowers are achlamydeous.

- 114 Assertion (A)** In racemose type of inflorescence the main axis grows indefinitely.

**Reason (R)** Main axis is not terminated by flower.

- 115 Assertion (A)** Monoadelphous stamens are found in China rose.

**Reason (R)** When the stamens are united into one bunch or bundle the condition is said to be monoadelphous.

- 116 Assertion (R)** Parietal placentation is observed in pea plant.

**Reason (R)** In pea plant, the placenta forms a ridge along the ventral suture of ovary and ovules are borne on this ridge forming two rows.

- 117 Assertion (A)** A dicot seed is always unitegmic.

**Reason (R)** Unitegmic seeds consist of single integuments.

- 118 Assertion (A)** Fruit is the mature or ripened ovary developed after fertilisation.

**Reason (R)** Parthenocarpic fruit is formed without fertilisation of the ovary.

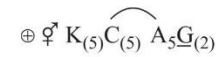
- 119 Assertion (A)** Caryopsis fruits differ from typical achenes with respect to the fusion of pericarp with the seed-coat (testa). **AIIMS 2018**

**Reason (R)** Caryopsis fruits commonly occur in the members of family-Poaceae.

- 120 Assertion (A)**  $\underline{G}_2$  is the symbol for inferior ovary.

**Reason (R)** Fusion is indicated by enclosing the number within bracket.

- 121 Assertion (A)** The floral formula of family-Solanaceae is



**Reason (R)** This floral formula tells that flower is bisexual, sepals five, petals five, stamens five and gynoecium tricarpeal, trilobular with many ovules.

- 122 Assertion (A)** Seeds of most of the members of Solanaceae are endospermic.

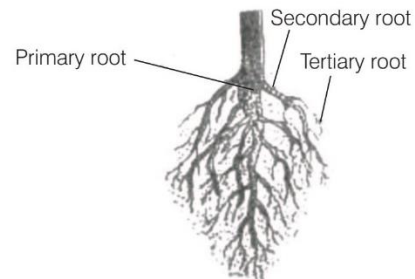
**Reason (R)** Endosperm is found in mature seeds.

- 123 Assertion (A)** Some dicotyledonous plant bears flowers but never produces fruits and seeds.

**Reason (R)** Some dicotyledonous plants are monoecious.

## II. Statement Based Questions

- 124** Refer to 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 hairs for absorption  
 (d) Secondary and tertiary roots are borne in acropetal succession
- 125** Select the incorrect statement with respect to underground stems.
- (a) Both bulb and bulbil are underground stem modification in onion  
 (b) Rhizome of ginger is fleshy horizontal underground stem possessing nodes and internodes  
 (c) Tuber of potato is an underground stem having depressions called eyes  
 (d) The corm bears buds at nodes and adventitious roots at the base
- 126** Which of the following statement is incorrect?
- (a) Underground stems of turmeric, zaminkand and *Colocasia* modifies to store food  
 (b) Stem tendrils develop from the internodes of stem  
 (c) Thorns in *Citrus* and *Bougainvillea* are modified axillary buds  
 (d) Stem tendrils help cucumber and watermelon plants to climb





**127** Which of the following statement(s) is/are true for a leaf ?

- (a) It is a lateral, flattened structure borne on stem
- (b) Stipule is a lateral appendage of leaf base
- (c) Leaves develop from node and bear axillary bud in its axil
- (d) All of the above

**128** Which of the following statement is incorrect?

- (a) Arrangement of veins in leaf lamina is called venation
- (b) In reticulate venation, veinlets form a network
- (c) In parallel venation, veins run parallel to each other within a lamina
- (d) Leaves of dicotyledonous plants possess parallel venation

**129** Find the incorrect statement with respect to flower.

- (a) A flower is modified shoot wherein the shoot apical meristem changes into floral meristem
- (b) Flower is always solitary when shoot bud transforms into flower
- (c) The arrangement of flowers on the floral axis is called inflorescence
- (d) The apex produces different floral appendages horizontally and internodes elongates

**130** Choose the incorrect statement.

- (a) Stamens when attached to petals, they are epipetalous
- (b) Stamens when attached to sepals, they are epiphyllous
- (c) If one margin of the appendage overlaps that of the next one like in China rose, it is called twisted aestivation
- (d) If there are five petals, the largest overlap the two lateral petals, which in turn overlap the two smallest petals it is vexillary aestivation

**131** Which one of the following statement is correct?

**CBSE-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

**132** Which of the following statement is incorrect for floral formula?

- (a) Br stands for bracteate and K stands for calyx
- (b) Superior ovary is represented as  $\overline{G}$
- (c)  $\oplus$  represents actinomorphic and  $\%$  represents zygomorphic nature of flower
- (d) Fusion is indicated by enclosing the figure with bracket

**133** Identify the correct order (roots) from base to root apex.

- I. Mineral absorption zone.
  - II. Soil penetration zone.
  - III. Cell number increasement zone.
  - IV. Area of root apex protection.
- (a) II, I, IV, III                      (b) I, II, III, IV  
 (c) IV, III, II, I                      (d) III, IV, I, II

**134** Read the following statements.

- I. In *Curcuma*, fasciculated roots are found.
- II. Moniliform roots are found in *Momordica*.
- III. Epiphytic roots of *Vanda* possess well-developed root caps and root hairs.

Choose the option with correct statement(s).

- (a) I and II    (b) Only II    (c) II and III    (d) Only III

**135** Read the following statements.

- I. *Bougainvillea* is a scrambler as its weak stems rise up with the help of curved thorns.
- II. In *Opuntia*, function of photosynthesis is carried out by phylloclade.
- III. *Zingiber* is an example of corm.

Choose the option with incorrect statement(s).

- (a) I and II    (b) Only III    (c) II and III    (d) Only I

**136** Study the following statements.

- I. Food is stored in the leaf bases.
- II. Buds develop in the leaf bases.
- III. The presence of tunicated bulb.

Identify the correct combination of statements with reference to *Scilla*.

- (a) I, II and III                      (b) I and II  
 (c) I and III                          (d) II and III

**137** Read the following statements.

- I. The corolla is the outermost whorl of the flowers.
- II. Calyx is composed of sepals.
- III. Corolla may be tubular, bell-shaped, funnel-shaped or wheel-shaped.
- IV. A sterile stamen is called staminode.

Choose the correct option.

- (a) Statements I and II are correct  
 (b) Statements III and IV are correct  
 (c) Statements II and III are incorrect  
 (d) Statements I and IV are incorrect

**138** Consider the following statements.

- I. Petals are usually brightly coloured and can be united or free in a flower.
  - II. Petals protect the flower in the bud stage.
- (a) I is true, but II is false    (b) I is false, but II is true  
 (c) Both I and II are true    (d) Both I and II are false

**139** Read the following statements for floral formula of flower.

- I. The position of the mother axis with regard to flower is represented by a dot on the top of floral diagram.
- II. Outermost whorl represents the calyx.
- III. Floral formula shows cohesion and adhesion within parts of whorls.

Choose the option with correct statements.

- (a) I, II and III    (b) I and II    (c) II and III    (d) I and III



### III. Matching Type Questions

**140** Match the following columns.

Column I (Regions of root tip)	Column II (Features)
A. Root cap	1. Lengthwise growth
B. Meristematic zone	2. Root hairs
C. Elongation zone	3. Fast cell division
D. Maturation zone	4. Thimble-like structure

**Codes**

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

**141** Match the following columns.

Column I (Type of fleshy taproot)	Column II (Examples)
A. Conical	1. <i>Brassica rapa</i>
B. Fusiform	2. <i>Daucus carota</i>
C. Napiform	3. <i>Raphanus sativus</i>
D. Tuberous	4. <i>Mirabilis jalapa</i>

**Codes**

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

**142** Match the following columns.

Column I (Stem modification)	Column II (Found in)
A. Underground stem	1. <i>Euphorbia</i>
B. Stem tendrils	2. <i>Opuntia</i>
C. Stem thorn	3. Potato
D. Flattened stem	4. <i>Citrus</i>
E. Fleshy cylindrical stem	5. Cucumber

**Codes**

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

**143** Match the following columns and choose the correct option from the codes given below. **AIIMS 2019**

Column I (Modifications in plants)	Column II (Examples)
A. Tap root	1. Sweet potato
B. Adventitious root	2. Turnip
C. Stem	3. Wheat
D. Fibrous root	4. Potato

**Codes**

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

**144** Match the Column I with Column II and select the correct option.

Column I (Types of buds)	Column II (Features)
A. Vegetative buds	1. Buds develop in axils of leaves
B. Floral buds	2. Buds produce leafy shoots
C. Axillary buds	3. Reproductive buds that produce flowers
D. Accessory buds	4. Additional buds borne at leaf bases

**Codes**

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

**145** Match the following columns.

Column I (Modification in leaves)	Column II (Examples)
A. Leaf tip tendrils	1. Pitcher plant and Venus flytrap
B. Bud is absent in the axil of leaflets	2. <i>Cacti</i>
C. Spines (modified leaves)	3. Compound leaf
D. Leaves modified to catch insects	4. <i>Gloriosa</i>
E. Fleshy leaves with stored food	5. Garlic and onion

**Codes**

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

**146** Match the following columns.

Column I (Leaf modifications)	Column II (Examples)
A. Pinnately compound leaf	1. Silk cotton
B. Stem thorns	2. Rose
C. Palmately compound leaves	3. <i>Duranta</i>
D. Prickles	4. <i>Bombax</i>

**Codes**

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

**147** Match the following columns.

Column I (Characteristics)	Column II (Types of phyllotaxy)
A. Single leaf arises at each node in alternate manner	1. Whorled phyllotaxy
B. Pair of leaf arises at each node and arranged opposite to each other	2. Opposite phyllotaxy
C. More than two leaves arise at each node	3. Alternate phyllotaxy



**Codes**

A	B	C	A	B	C
(a) 3	2	1	(b) 3	1	2
(c) 1	2	3	(d) 1	3	2

**148** Match the following columns.

Column I (Inflorescence types)	Column II (Examples)
A. Racemose	1. <i>Euphorbia</i>
B. Cyathium	2. Jasmine
C. Cymose	3. Peepal
D. Hypanthodium	4. <i>Calotropis</i>

**Codes**

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

**149** Match the following columns. **NEET (Odisha) 2019**

Column I (Placentation)	Column II (Examples)
A. Basal	1. Mustard
B. Axile	2. China rose
C. Parietal	3. <i>Dianthus</i>
D. Free-central	4. Sunflower

**Codes**

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

**150** Match the following columns.

Column I (Parts of flower)	Column II (Description)
A. Calyx	1. Female reproductive part
B. Corolla	2. Male reproductive part
C. Androecium	3. Outermost whorl of flower
D. Gynoecium	4. Composed of petals

**Codes**

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

**151** Match the following columns.

Column I (Terms)	Column II (Used for)
A. Pedicel	1. Reduced leaf
B. Peduncle	2. Stalk of the flower
C. Bract	3. Stalk of the leaf
D. Petiole	4. Inflorescence axis

**Codes**

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

**152** 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-seeded fruit developing from monocarpellary superior ovary	4. Radicle
E. Membranous seed coat	5. Endosperm

**Codes**

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

**153** 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	B	C	D	E	F
(a) 1	2	3	4	5	6
(b) 6	5	4	3	2	1
(c) 2	4	1	3	6	5
(d) 5	6	3	1	4	2

**154** Match the following columns.

Column I (Symbols of floral formula)	Column II (Description)
A. $\oplus$	1. Zygomorphic
B. %	2. Actinomorphic
C. K	3. Calyx
D. C	4. Corolla

**Codes**

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

**155** Match the following columns.

Column I (Members of Fabaceae)	Column II (Economic importance)
A. <i>Dalbergia sisso</i>	1. Fibres
B. Moong	2. Fodder
C. <i>Sesbania</i>	3. Timber
D. Sunhemp	4. Pulses

**Codes**

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



# NCERT & NCERT Exemplar

## MULTIPLE CHOICE QUESTIONS

### NCERT

- 156** In swampy areas like the sunderbans in West Bengal plants bear special kind of roots called .....
- (a) prop roots (b) stilt roots  
(c) nodular roots (d) pneumatophores
- 157** In aquatic plants like *Pistia* and *Eichhornia*, leaves and roots are found near .....
- (a) the deep region of a water surface  
(b) the surface of water  
(c) the base of water body  
(d) None of the above
- 158** Which parts in ginger and onion are edible?
- (a) Leaves, roots (b) Roots, stem  
(c) Stem, leaves (d) Roots, leaves
- 159** Name the body part modified for food storage in the following.
- I. *Gladiolus* II. *Portulaca*  
III. *Asparagus*
- Choose the correct option.
- (a) I. Stem; II. Root; III. Root  
(b) I. Root; II. Stem; III. Leaf  
(c) I. Leaf; II. Stem; III. Root  
(d) I. Root; II. Leaf; III. Stem
- 160** In epigynous flower, position of ovary is .....
- (a) higher than other floral whorls  
(b) lower than other floral whorls  
(c) same as the other floral whorls  
(d) None of the above

### NCERT Exemplar

- 161** Roots developed from part of the plant other than radicle are called
- (a) tap roots (b) fibrous roots  
(c) adventitious roots (d) nodular roots
- 162** Rearrange the following zones from the base to apex as seen in the root in vertical section and choose the correct option.
- I. Root hair zone  
II. Zone of meristems  
III. Root cap zone  
IV. Zone of maturation  
V. Zone of elongation
- Codes**
- (a) III, II, V, I, IV (b) I, IV, V, II, III  
(c) IV, V, I, III, II (d) V, IV, III, II, I

- 163** 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
- 164** Endosperm, a product of double fertilisation in angiosperms is absent in the seeds of
- (a) coconut (b) orchids  
(c) maize (d) castor
- 165** The mature seed of plants such as gram and peas possess no endosperm, because
- (a) these plants are not angiosperms  
(b) there is no double fertilisation in them  
(c) endosperm is not formed in them  
(d) endosperm gets used up by the developing embryo during seed development
- 166** Which of the following plants is used to extract the blue dye?
- (a) *Trifolium* (b) *Indigofera*  
(c) *Lupin* (d) *Cassia*
- 167** Match the following columns.
- | Column I                | Column II                |
|-------------------------|--------------------------|
| A. Aleurone layer       | 1. Nutrition             |
| B. Parthenocarpic fruit | 2. Without fertilisation |
| C. Ovule                | 3. Seed                  |
| D. Endosperm            | 4. Double fertilisation  |
- Codes**
- | A     | B | C | D | A     | B | C | D |
|-------|---|---|---|-------|---|---|---|
| (a) 3 | 2 | 4 | 1 | (b) 2 | 1 | 4 | 3 |
| (c) 4 | 2 | 1 | 3 | (d) 2 | 4 | 1 | 3 |

- 168** Many pulses of daily use belongs to one of the families below.
- (a) Solanaceae (b) Fabaceae  
(c) Liliaceae (d) Poaceae
- 169** Venation is a term used to describe the pattern of arrangement of
- (a) floral organs  
(b) flower in inflorescence  
(c) veins and veinlets in a lamina  
(d) All of the above
- 170** The placenta is attached to the developing seed near the
- (a) testa (b) hilum  
(c) micropyle (d) chalaza



# Answers

## > Mastering NCERT with MCQs

1 (a)	2 (b)	3 (d)	4 (b)	5 (c)	6 (d)	7 (c)	8 (a)	9 (c)	10 (c)
11 (a)	12 (c)	13 (a)	14 (c)	15 (b)	16 (d)	17 (c)	18 (d)	19 (b)	20 (b)
21 (d)	22 (a)	23 (b)	24 (d)	25 (b)	26 (b)	27 (c)	28 (d)	29 (a)	30 (b)
31 (c)	32 (b)	33 (a)	34 (b)	35 (b)	36 (c)	37 (b)	38 (b)	39 (d)	40 (d)
41 (b)	42 (b)	43 (a)	44 (b)	45 (a)	46 (c)	47 (c)	48 (a)	49 (a)	50 (d)
51 (a)	52 (b)	53 (c)	54 (d)	55 (a)	56 (b)	57 (b)	58 (b)	59 (b)	60 (b)
61 (a)	62 (b)	63 (c)	64 (d)	65 (a)	66 (a)	67 (a)	68 (d)	69 (b)	70 (b)
71 (a)	72 (a)	73 (a)	74 (b)	75 (d)	76 (c)	77 (a)	78 (c)	79 (c)	80 (b)
81 (c)	82 (a)	83 (c)	84 (c)	85 (d)	86 (a)	87 (d)	88 (c)	89 (b)	90 (a)
91 (b)	92 (a)	93 (b)	94 (c)	95 (d)	96 (b)	97 (d)	98 (a)	99 (d)	100 (b)
101 (a)	102 (d)	103 (d)	104 (c)						

## > NEET Special Types Questions

105 (a)	106 (c)	107 (a)	108 (c)	109 (b)	110 (b)	111 (d)	112 (a)	113 (d)	114 (a)
115 (a)	116 (d)	117 (d)	118 (b)	119 (b)	120 (d)	121 (c)	122 (a)	123 (c)	124 (b)
125 (a)	126 (b)	127 (d)	128 (d)	129 (d)	130 (b)	131 (c)	132 (b)	133 (c)	134 (b)
135 (b)	136 (a)	137 (b)	138 (a)	139 (a)	140 (b)	141 (a)	142 (d)	143 (c)	144 (a)
145 (c)	146 (b)	147 (a)	148 (a)	149 (c)	150 (c)	151 (a)	152 (b)	153 (c)	154 (b)
155 (d)									

## > NCERT & NCERT Exemplar Questions

156 (d)	157 (b)	158 (c)	159 (a)	160 (b)	161 (c)	162 (b)	163 (b)	164 (b)	165 (d)
166 (b)	167 (a)	168 (b)	169 (c)	170 (b)					

## Answers & Explanations

- 4 (b)** Fibrous roots are large number of roots that originates from the base of stem after replacing the short-lived primary root. These can be seen in monocotyledonous plants like wheat plant.
- 5 (c)** Option (c) contains the mismatched pair and can be corrected as  
 Roots arising from the radicle do not form stilt roots, which are a modification of adventitious root system. Roots arising from any part of the plant other than the radicle are called adventitious roots. These roots can be seen in plants like grass, *Monstera* and the banyan tree.
- 6 (d)** Option (d) is incorrect and can be corrected as  
 A few millimetres above the root cap is the region of meristematic activity possessing very small, repeatedly dividing thin-walled cells with dense protoplasm. This region shows that meristematic activity is present in roots.
- 7 (c)** Smallest region of root is meristematic or growing point as the cells in this region are very small, actively dividing and having a dense cytoplasm.
- 9 (c)** Part A is the root hair zone which represents the zone of differentiation or maturation. This is the most suitable part for anatomical studies of root, because different types of primary tissues differentiate or mature

in this region. Xylem, phloem, pericycle, endodermis, cortex and epiblema are clearly visible in this region.

- 10 (c)** The tap roots of carrot and (*Daucus carota*), turnip (*Brassica rapa*) get swollen and store food.  
 In case of *Ipomoea batatas* (sweet potato), the adventitious roots get modified to store food.
- 11 (a)** Stilt roots are the supporting roots coming out of the lower nodes of the stem. They can be seen in *Zea mays* (maize), *Saccharum officinarum* (sugarcane), etc.
- 12 (c)** Option (c) contains the mismatched pair that can be corrected as  
 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 help to get oxygen for respiration, i.e. respiratory roots.
- 15 (b)** The region of the stem where leaves are borne are called nodes, while internodes are the portions, between two nodes. Axillary buds develop in the axil of leaf.
- 17 (c)** In *Bougainvillea* and *Citrus*, thorns are found which are the modifications of stem. These are the stiff, sharp structures, that have lost their growing capability and become hard.





In other words, axillary buds of stems in some plants get modified into woody, straight and pointed thorns. They protect the plants from browsing animals.

- 19 (b)** Plants like mint, jasmine, wild strawberry (*Fragaria*), etc., contain elongated horizontal or arched runners, which arise from the base of the main axis, which are called stolon. These grow aerially for some time and after that arch downwards, touching the ground.
- 20 (b)** Aquatic plants like *Pistia* (water lettuce), *Eichhornia* (water hyacinth) contain offsets. These are one internode long small runners common in aquatic plants, each node bear, a rosette of leaves and tuft of roots.
- 21 (d)** Plants like banana, pineapple and *Chrysanthemum* contain sucker. It is a special non-green slender subaerial stem, which arises from the underground base of an erect shoot or crown. It grows obliquely upward in the soil and ultimately comes out to form a new aerial shoot or crown.
- 22 (a)** Some plants of arid regions modify their stems into flattened (*Opuntia*) or fleshy cylindrical (*Euphorbia*) structures called phylloclades. They contain chlorophyll and carry out photosynthesis.
- 23 (b)** In *Passiflora*, axillary bud is modified into tendril and in *Duranta* into stem thorn.
- 25 (b)** 'A' represents **lamina** which is the green expanded part of the leaf with veins and veinlets.  
 'B' represents the **stipule** which is the lateral small leaf-like structure of the leaf.  
 'C' represents the **axillary bud** of the leaf.  
 'D' represents the **leaf base** by which a leaf gets attached to the stem.
- 27 (c)** In some leguminous plants, the leaf base may become swollen and is called the pulvinus.
- 29 (a)** A—represents reticulate venation that is generally seen in dicot plants (exception *Calophyllum*), B—represents parallel venation that is generally seen in monocot plants (exception : *Smilax*).
- 33 (a)** 'A' represents a pinnately compound leaf in which a number of leaflets occur around a common axis, e.g. neem.  
 'B' represents a palmately compound leaf in which leaflets are attached to a common point, e.g. silk cotton.
- 34 (b)** Phylloclades are the flattened (e.g. *Opuntia*) or cylindrical (e.g. *Casuarina*) green, fleshy structures, which help in performing photosynthetic functions. It is an aerial modification of stem.
- 35 (b)** Figure A represents **alternate phyllotaxy**—In this, one leaf is borne on the node and the leaves of the adjacent nodes roughly lie towards the opposite side. Figure B represents **opposite decussate phyllotaxy**—In this, two leaves are borne on the opposite sides of a single node at right angles so that four rows of leaves are formed on the stem.

Figure C represents **opposite superposed phyllotaxy**—In this, opposite leaves of two successive nodes lie in the same plane in superposed position.

- 36 (c)** *Alstonia* shows whorled phyllotaxy. In whorled phyllotaxy, more than two leaves arise at a node and form a whorl. Other options are
- Mustard and China rose show alternate phyllotaxy.
  - *Calotropis* shows opposite phyllotaxy.
- 37 (b)** Option (b) contains the incorrect pair. It can be corrected as  
 In some plants, such as Australian *Acacia*, the leaves are short-lived and small. The petiole expands to form phyllode (not phylloclade) and becomes green to synthesise food.
- 38 (b)** Figure A represents **leaf tendrils**, which provides support to the plant in climbing around other plant.  
 Figure B represents **leaves modified into spines**, which protect the plant.  
 Figure C represents **fleshy leaves** which store the food.
- 41 (b)** Figure A represents **racemose inflorescence** in which the main axis continues to grow and the flowers are borne laterally in an acropetal succession.  
 Figure B represents **cymose inflorescence** in which the main axis terminates in a flower, limiting the growth and the flowers are arranged in a basipetal order.
- 42 (b)** Verticillaster inflorescence is the characteristic feature of tulsi (*Ocimum*) belonging to family-Lamiaceae or Labiatae. Here, flowers are arranged in two opposite cymose groups on each node.  
 Other options are
- In mustard, raceme and in sunflower, capitulum or head type of racemose inflorescence are found, respectively.
  - China rose has solitary axillary flower.
- 43 (a)** Stamen is the odd one out among the given options. Stamen represents the male reproductive part of a flower, whereas stigma, style and ovary are the parts of a carpel or pistil which represents the female reproductive part of flower.
- 44 (b)** Papilionaceous refers to a butterfly-like flower. It consists of a large upper petal, called the standard or vexillum.
- 45 (a)** In some flowers like lily, the calyx and corolla are not distinct and hence, termed as perianth.
- 46 (c)** Keel is the characteristic feature of the flower of *Indigofera*. It is the term used for the petals (enclosing stamens and pistil) of *Indigofera* in which their petals resemble keel of the boat.
- 47 (c)** Pea, bean, *Cassia*, gulmohar flowers show zygomorphic symmetry.  
 In this, the flower is bilaterally symmetrical, i.e. divisible into only two equal halves by a single vertical plane.





Other options are

*Datura*, mustard, chilli, *Canna* show actinomorphic symmetry in which the flower can be divided into two equal radial halves in any radial plane passing through the centre, which show regular of radial symmetry.

- 49 (a) Figure A represents a hypogynous flower. In this, the sepals, petals and stamens are successively and separately inserted below the ovary in the flowers and the ovary is said to be superior.  
Figure B and C shows a perigynous flower. In this, the sepals, petals and stamens are inserted at the same plane as the ovary and the ovary in such condition is half superior, subinferior or partially inferior ovary.  
Figure D shows an epigynous flower. In this, the sepals, petals and stamens are successively and separately inserted above the ovary in the flower, the ovary in this situation is said to be inferior.
- 50 (d) Options (a) and (b) are the correct match, while option (c) is incorrect match. It can be corrected as Hypogynous ovary is found in mustard and China rose (not in rose).
- 51 (a) A represents **androecium**, which is the male reproductive part of a flower.  
B represents **gynoecium**, which is the female reproductive part of a flower.  
C represents **corolla**, the part composed of brightly coloured petals.  
D represents **calyx** which is the outermost whorl of the flower consisting of green coloured sepals.  
E represents the **pedicel** of a flower which is the stalk that bears individual flowers.
- 53 (c) Option (c) contains the incorrect pair. It can be corrected as  
When the margins of sepals or petals overlap one another, but not in any particular direction as in *Cassia* and gulmohar, that type aestivation is called imbricate.
- 54 (d) Figure A shows **valvate aestivation** in which the sepals or petals lie very close to each other with out overlapping.  
Figure B shows **twisted aestivation** in which one margin of the sepal or petal overlaps the next one which then overlaps the third one and so on.  
Figure C shows **imbricate aestivation** in which the margins of sepals or petals overlap one another but not in a particular direction.  
Figure D represents **quincuncial aestivation** in which the two petals are inner, two are outer and one is partly outer and partly inner.  
Figure E represents **vexillary aestivation** in which the largest petal (out of five) overlaps the two smallest anterior petals.
- 56 (b) Option (b) is incorrect and can be corrected as Diadelphous kind of arrangement, i.e. (9) + 1 or (5) + (5), in which fusion of filaments produces two groups is seen in members of family-Fabaceae.

In cucurbits, synandrous condition of stamens is present in which stamens are fused by both their filaments as well as anthers.

- 57 (b) The term 'polyadelphous' is related to androecium. In this condition, stamens are present in more than two groups, which are separated from each other.
- 58 (b) The incorrect match is present in option (b). It can be corrected as  
The condition in which stamens are attached to perianth is called epiphyllous.
- 60 (b) Only four plants that are *Salvia*, mustard, radish and turnip out of the given list have stamens of different length in their flowers.
- 65 (a) The plant *Dianthus* has free-central placentation. In this type of placentation, the ovules are attached on the main axis of the placenta.
- 66 (a) Basal placentation develops when the ovary has single ovule. In this, the placenta develops at the base of ovary with a single ovary attached to it as in sunflower, marigold, etc.
- 69 (b) The incorrect match is present in option (b). It can be corrected as  
The wall of fruit is pericarp.
- 72 (a) Coconut fruit is a drupe. It has a membranous epicarp, fibrous mesocarp and a stony endocarp.  
Other options are  
Tomato is a berry, litchi is a nut and capsular fruits are found in cotton.
- 74 (b) Aggregate or etario fruits develop from a multicarpellary apocarpous gynoecium (ovary). Aggregate fruit may also be called accessory fruit in which part of the flower other than the ovary becomes fleshy and forms part of the fruit, e.g. raspberry, etc.
- 75 (d) Fig, pineapple and mulberry are composite fruits.

Plants	Botanical name	Fruits	Inflorescence
Fig	<i>Ficus carica</i>	Syconus	Hypanthodium
Pineapple	<i>Annanas sativus</i>	Sorosis	Spike
Mulberry	<i>Morus sp.</i>	Sorosis	Catkin

- 76 (c) Option (c) contains the incorrect pair. It can be corrected as  
Dicotyledonous seeds have two cotyledons such as seeds of pea plant, castor plant, etc. Maize plant has monocotyledonous seed (not dicot).
- 79 (c) In seeds of some plant such as castor, the endosperm formed as a result of double fertilisation, is a food storing tissue such seeds are hence called endospermic. In plants, such as bean, gram and pea, the endosperm is not present in mature seeds and such seeds are called non-endospermic.
- 82 (a) A represents **aleurone layer** which is a proteinaceous layer that separates the embryo from the outer seed coat.



B represents the **endosperm**.

C represents **coleoptile**, a sheath which encloses the plumule.

D represents **coleorhiza**, a sheath which encloses the radicle.

**83 (c)** The embryo of the seeds of plants such as wheat maize or rice consist of an upper large, shield-shaped cotyledon known as scutellum. The scutellum is closely pressed against the endosperm and helps in the translocation of nutrients from endosperm to the growing embryo at the time of germination and seedling growth.

**85 (d)** The symbol (%) indicates that the flower is zygomorphic, i.e. it is a term used for a bilaterally symmetrical flower. Such a flower can be divided into two equal halves only in a single vertical plane through its centre, e.g. pea, etc.

**86 (a)** Bisexual or Hermaphrodite are the terms used for flowers when both male and female reproductive (floral) organs are present in the same flower. Thus, the symbol ♂, denotes a bisexual flower.

**89 (b)** P denotes tepals and A is stamens.

When the symbol given is  $\overline{P} \overline{A}$ , it represents epitepalous condition of stamens in a flower.

**90 (a)** The partial floral formula  $K_{(5)}C_5A_{(\infty)}\underline{G}_{(5)}$  of a flower denotes the following information  
 $K_{(5)}$  – 5 sepals, gamosepalous (sepal fused)  
 $C_5$  – 5 petals, polypetalous (petals free)  
 $A_{(\infty)}$  – stamens indefinite fused  
 $\underline{G}_{(5)}$  – 5 carpels, syncarpous, superior ovary

**92 (a)** Vexillary aestivation of corolla is a characteristic feature of the family–Fabaceae. In corolla, the posterior petal called vexillum is the largest, two lateral, curved petals are called wings and the two anterior, boat-shaped petals are called keels.

**93 (b)**  $\% \overline{\sigma} K_{(5)}C_{1+2+(2)}A_{1+(9)}\underline{G}_1$

The missing floral organ would be represented as  $C_{1+2+(2)}$

This floral formula is of family – Fabaceae (Papilionaceae). The corolla of this flower has five petals in polypetalous condition consisting of one standard, two lateral wings and two anterior ones forming keel.

**94 (c)** The members of family – Fabaceae are diadelphous, i.e. (9) + 1, in which out of total 10 stamens, nine are united by the lower half of their filaments to form an incomplete tube around the pistil. Tenth posterior stamen is free.

**95 (d)** *Petunia* is an ornamental plant of family– Solanaceae. Standard floral formula of this family is

$\oplus \overline{\sigma} K_{(5)}C_{(5)}A_5\underline{G}_{(2)}$ .

Other plants, i.e. *Brassica* belongs to family–Brassicaceae, *Allium* belongs to family–Amaryllidaceae and *Sesbania* belongs to family– Fabaceae.

**97 (d)** Tricarpellary syncarpous gynoecium is found in family–Liliaceae. Bicarpellary syncarpous gynoecium is found in family–Solanaceae. Monocarpellary gynoecium is found in family–Fabaceae and family–Poaceae.

**100 (b)** Option (b) is correct combination. Other options can be corrected as

Tomato, chilli, potato and *Petunia* all belong to family–Solanaceae.

**101 (a)** The floral formula given in option (a) is correct for the floral diagram that is of family–Liliaceae. Flowers of the family are bracteate or ebracteate, actinomorphic bisexual, trimerous, hypogynous and pentacyclic. 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, ovary trilocular with axile placentation. The option (a) denotes the correct floral formula.

**102 (d)** Option (d) is incorrect and can be corrected as Soybean and groundnut are the members of family–Fabaceae from which edible oil being is extracted. Fodder is obtained from *Sesbania*, *Trifolium*.

**105 (a)** Both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

Outer layer of root cap is cast away from the tip by the process called sloughing. The cap protects the meristem from the damage due to friction as the root passes through the soil.

**106 (c)** Assertion is true, but Reason is false and can be corrected as

In fibrous root system, a number of thin, thread-like branched roots develops from the base of the stem. The roots are nearly equal in size. They form a bunch, which helps in holding the soil firmly. It gives good anchorage to the plant, helps in proper absorption of water and minerals. This root system is found in many monocots. Examples of plants having fibrous root system are wheat and barley.

**107 (a)** Both Assertion and Reason are true and Reason is the correct explanation for Assertion.

Stems are modified to perform different functions like storage, protection, mechanical support and photosynthesis, etc.

Axillary buds of stems may also get modified into woody, straight and pointed thorns. Thorns are found in many plants such as *Citrus*, *Bougainvillea*, etc. They protect plants from browsing animals and also reduce transpiration.

**108 (c)** Assertion is true, but Reason is false and can be corrected as

Stem tuber is an oval or spherical underground swollen stem structure, which does not bear adventitious roots, e.g. potato (*Solanum tuberosum*), Jerusalem artichoke (*Helianthus tuberosus*). Food reserve is starch in potato and inulin in artichoke.







**109** (b) Both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

In bamboo, erect, unbranched stems with distinct nodes and internodes are called culms. Usually, bamboos have hollow culms but some species have solid culms also. Each culm segment begins and ends with nodes. Internodes are also present between nodes. Due to the presence of nodes and internodes in the culm, it is said to be the stem of a bamboo plant. The nodes of culm are swollen giving a jointed appearance to bamboo.

**110** (b) Both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

Leaf base is the lowermost part of the leaf by which the leaf is joined to the node of the stem. It protects the young axillary bud.

The leaf base becomes swollen due to the deposition of sugar. In many legumes, leaf base is swollen. The swollen leaf base is known as pulvinus. It is responsible for sleep and shock movements of certain leaves, e.g. *Mimosa pudica* and *Cassia*.

**111** (d) Assertion is false, but Reason is true. Assertion can be corrected as

The arrangement of veins and the veinlets in the lamina of leaf is termed as venation. Leaves of dicotyledonous plants generally possess reticulate venation, while parallel venation is the characteristic feature of most monocotyledons.

**112** (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

In alternate type of phyllotaxy, a single leaf arises at each node in alternate manner. Only one leaf is borne on a node and the leaves of the adjacent nodes roughly lie towards the opposite sides, e.g. China rose.

**113** (d) Assertion is false, but Reason is true. Assertion can be corrected as

*Sphaeranthus* belongs to family–Asteraceae, in which head capitulum inflorescence is found. Cyathium inflorescence represents the neuter or sterile flower, which are pedicellate achlamydeous.

**114** (a) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

In racemose inflorescence, the peduncle never ends in a flower, but continues to grow indefinitely and bears flower laterally.

**115** (a) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

Androecium is composed of stamens. The adelphous stamens are fused by their filaments only. The anthers are free. When fusion of filaments produces one bunch or bundle it is called monadelphous, e.g. China rose.

**116** (d) Assertion is false, but Reason is true. Assertion can be corrected as

In marginal placentation, one or two alternate rows of the 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).

**117** (d) Assertion is false, but Reason is true and Assertion can be corrected as

A dicot seed is either unitegmic (single integument) or bitegmic (two integuments).

Unitegmic seeds are those which are covered by a single integument. Bitegmic seeds are those are covered by two integuments an outer testa and an inner tegmen.

**118** (b) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.

True fruit or eucarp is a ripened ovary, which develops under the influence of ripening ovules and is meant for protecting the seeds. It consists of a pericarp formed from the wall of ovary and seeds developed from ovules.

A fruit, in which other floral parts like thalamus, base of sepals, petals, etc., fuse with the pericarp is called false fruit or accessory fruit or pseudocarp, e.g. apple, mulberry and strawberry, etc. A fruit formed without fertilisation, i.e. seedless fruit is called parthenocarpic fruit, e.g. banana.

**119** (b) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.

Caryopsis and achenes develop from monocarpellary unilocular, one-seeded and superior ovaries. The only difference in them is that in caryopsis pericarp and seed coat are fused. Caryopsis is common in the members of family–Poaceae.

**120** (d) Assertion is false, but Reason is true and Assertion can be corrected as

A flower is represented by a floral diagram and floral formula. The floral formula is represented by various symbols.  $\overline{G}_{(2)}$  is the symbol for superior ovary. Fusion is indicated by enclosing the number within bracket.

**121** (c) Assertion is true, but Reason is false and can be corrected as

The floral formula of family–Solanaceae is

$$\otimes \overline{\varphi} K_{(5)} \overline{C}_{(5)} A_5 \overline{G}_{(2)}$$

Family–Solanaceae is commonly called potato family.

This floral formula tells that flower is bisexual, actinomorphic, sepals are five and united, petals are five and united, stamens are five, epipetalous and gynoecium is bicarpellary and syncarpous, ovary is superior, bilocular and placenta is swollen with many ovules.

**122** (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Seeds of Solanaceae, e.g. tomato, brinjal, etc. are mostly endospermous. This is because their endosperm remains in the mature seed even after embryo development.

**123** (c) Assertion is true, but Reason is false. Reason can be corrected as

Some dicot plant bears flowers but never produces fruits and seeds because these plants are dioecious (unisexual) and bears only staminate flowers.





- 124** (b) Statement in option (b) is incorrect for the given figure of tap root system. This can be corrected as Lateral branches of the roots develop from interior (usually pericycle) of the parent root. Such an origin is called endogenous.
- 125** (a) The statement in option (a) is incorrect and can be corrected as  
 Bulb is underground stem modification, while bulbil is an aerial stem modifications, both present in onion.
- 126** (b) Statement in option (b) is incorrect and can be corrected as  
 Stem tendrils develop from axillary buds of stem. They are slender and spirally coiled and help the plant to climb such as in gourds (cucumber, pumpkins, watermelon) and grapevines.
- 128** (d) Statement in option (d) is incorrect and can be corrected as  
 Leaves of dicotyledonous plants, generally possess reticulate venation, while parallel venation is the characteristic of most monocotyledons.
- 129** (d) Statement in option (d) is incorrect and can be corrected as  
 A flower is a modified shoot where in the shoot apical meristem changes to floral meristem. Internodes do not elongate and the axis gets condensed. The apex produces different kinds of floral appendages laterally at successive nodes instead of leaves.
- 130** (b) Statement in option (b) is incorrect and can be corrected as  
 Epiphyllous condition is when stamens are attached to the perianth as in the flowers of lily. Epipetalous condition occurs when stamens are attached to petals.
- 131** (c) Statement in option (c) is correct.  
 Rest statements are incorrect and can be corrected as
- Seed in grasses is endospermic.
  - Banana is a parthenocarpic fruit, but mango is not a parthenocarpic fruit.
  - Sterile pistil is called pistillode.
- 132** (b) Statement in option (b) is incorrect and can be corrected as  
 Superior ovary is represented as G and inferior ovary is shown as Ḡ.
- 133** (c) Option (c) represents the correct sequence. The root cap (area of root apex protection) is present at the base of the root above which there is present an area of new cell formation is called meristematic zone. Thus, cell number increases in this zone.  
 Below this zone is soil penetration zone followed by the absorption of water and then mineral takes place. This water and mineral absorption comes under the zone of maturation.
- 134** (b) Only statement II is correct about moniliform roots, that these are swollen roots at regular intervals imparting bead-like appearance of necklace, e.g. *Momordica*.

Rest all statements are incorrect and can be corrected as

- 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.
  - Aerial or Epiphytic roots hang down in air, they do not possess root caps and root hairs instead they possess a covering of dead spongy tissue called velamen.
- 135** (b) Statement III is incorrect and can be corrected as *Zingiber officinale* (ginger) is a straggling sympodial rhizome, which is a perennial, fleshy, dorsiventral, horizontal, usually branched, underground stem growing beneath the surface of soil. It possesses nodes and internodes scaly leaves, axillary buds and roots at their nodes.
- 137** (b) Statements III and IV are correct. Other statements are incorrect and can be corrected as
- Calyx is the outermost whorl of the flower and the members are called sepals.
  - Corolla is composed of petals.
- 138** (a) Statement I is true, but statement II is false. It can be corrected as  
 Petals are brightly coloured in order to attract pollinators (i.e. insects) for pollination. Sepals protect the flower in the bud stage.
- 156** (d) Option (d) is correct as  
 In swampy areas (like Sunderbans), soil does not have air, so no O<sub>2</sub> is available to them.  
 In such cases, roots come out of the soil shows negative geotropism and breathe after coming in contact with air, e.g. *Rhizophora*. Such roots are called pneumatophores respiratory roots.
- 157** (b) *Pistia* and *Eichhornia* are floating plants, where the stem is like a runner, which branches to form leaves at the apex and roots below. The roots are found near the surface of water as both the plants are hydrophytes.
- 158** (c) The edible part of ginger is the modified stem rhizome, which stores food material whereas in onion the edible part constitutes of fleshy leaves. In this case, the internode becomes shortened, leaves get condensed to form a tunic and store food material.
- 159** (a) Option (a) is correct and can be explained as, *Gladiolus* is an underground stem modification forming corm.  
*Portulaca* is a modification of adventitious root forming moniliform roots (i.e. swollen root) having bead-like appearance). *Asparagus* is also an adventitious root modification forming fasciculated roots (i.e. roots forming a tuft or cluster) at the base of the stem.





**160** (b) In epigynous flower, position of ovary is inferior (lower) while the other whorl of flower like sepals, petals and androecium grow above the ovary (superior), e.g. carrot, guava, *Cucurbita*, sunflower, etc.

**161** (c) Roots developed from parts of the plant other than radicle are called adventitious roots.

These branch like tap roots and may be underground or aerial and may develop from nodes, internodes or leaves, etc.

**162** (b) The correct sequence of the zones seen in the vertical section in a root would be as follows

**Root hairs zone** (I) is present at the base of a root to absorb water and minerals. Above this region there is **zone of maturation** (IV), where the cells differentiate and mature gradually.

After this the region or **zone of elongation** (V) occurs, where the cells undergo rapid elongation and enlargement.

Then, the region or **zone of meristematic activity** (II) is present where the cells are very small, thin-walled and with dense protoplasm, dividing repeatedly. At the apex, a thimble structure **root cap** (III) covers the root.

**163** (b) In racemose inflorescence, younger flowers are borne at the apex or distal end, while older flowers are at the base, this type of succession is acropetal

succession. Thus, the position of youngest flower would be distal.

**164** (b) Orchid seed is non-endospermic seed, i.e. endosperm is absent in it.

Endosperm is a nourishing tissue present in the seed, which nourishes the developing embryo. In orchid seed, endosperm is absent because, it is used up during the time of seed development.

Nourishment for germinating seed is provided by the food material present in cotyledons.

**166** (b) *Indigofera tinctoria* and *Tidestromia suffruticosa* are the two plants belonging to the family-Fabaceae that produce blue indigo dye.

Other options are

- *Trifolium* is used as fodder.
- *Lupin* is an ornamental plant.
- *Cassia* is a shrub usually grown on the roadside as an ornamental plant.

**168** (b) Fabaceae is a subfamily of Leguminosae, which was earlier called Papilionoideae. Plants of this family are the source of pulses and edible oils. Pulses are rich in protein contents.

**170** (b) The placenta is attached to the developing seed near the hilum.

It is the scar located near the edge, where seed breaks from stalk of funiculus, i.e. connecting the seed with fruit wall and placenta.