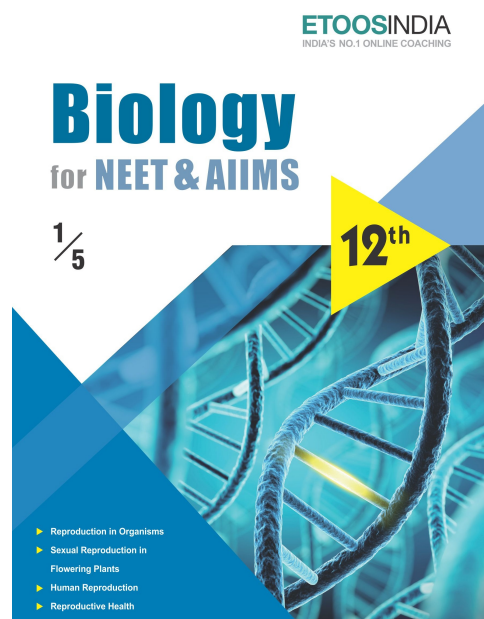
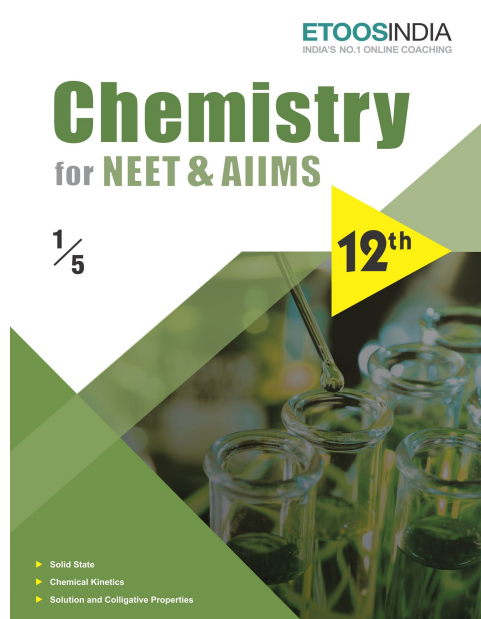
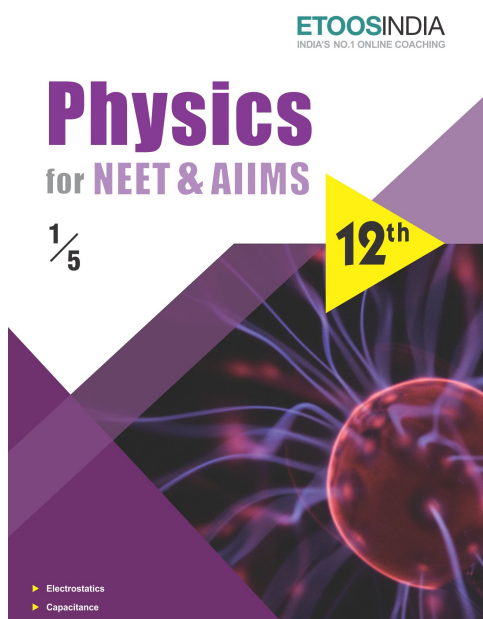
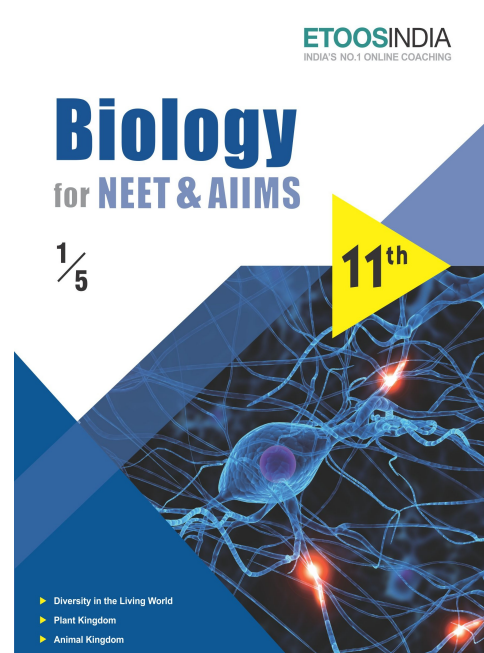
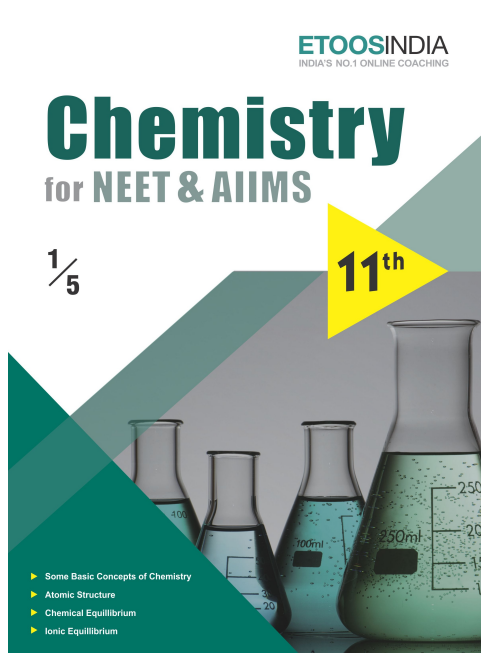
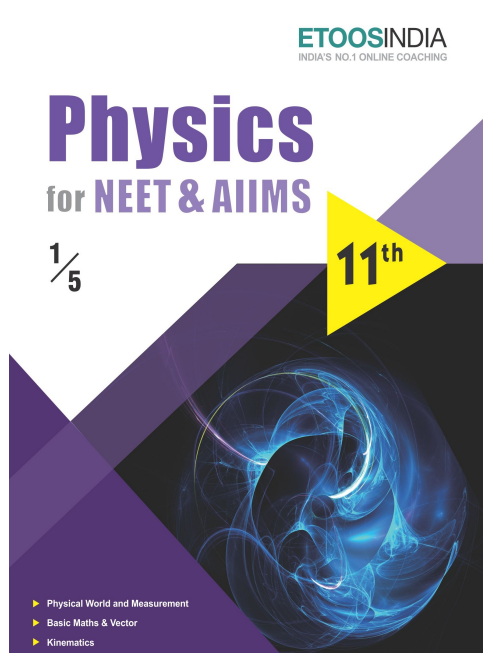


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MORPHOLOGY IN FLOWERING PLANTS

"Time is the most valuable thing a man can spend."

THEOPHRASTUS (371-287 BC)

INTRODUCTION

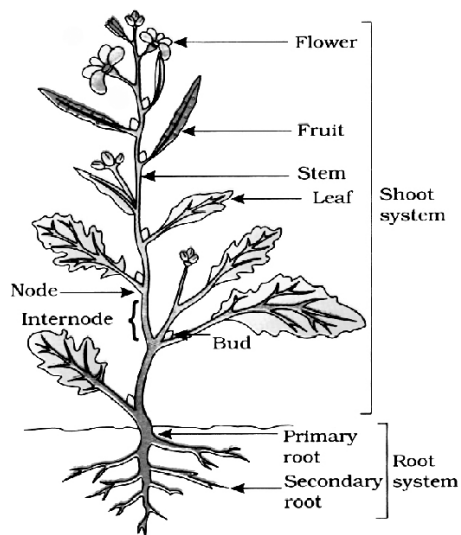
As we all know that all flowering plants are multicellular organism. They grow by cell division, morphological features and trait are genetically determined. Even though the angiosperms show such a large diversity in external structure or morphology, they are all characterised by presence of roots, stems, leaves, flowers and fruits.

We also need to know about the possible variations in different parts, found as adaptations of the plants to their environment, e.g., adaptations to various habitats, for protection, climbing, storage, etc.

In this chapter you will learn how different parts of plants are modified to serve specific needs including defence from their enemies. You will also get an idea to know about plant families.

PLANT MORPHOLOGY

INTRODUCTION:



Parts of a flowering plant

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

The body of a typical angiospermic plant is differentiated into :

- (1) An underground root system
- (2) An aerial shoot system.

The shoot system consists of stem (including branches), leaves, flowers and fruits.

The roots, stems and leaves are **vegetative parts**, while flowers constitute the **reproductive part**.

CLASSIFICATION OF PLANTS :

Depending upon their life span, plants are classified as –

- a. Annuals** – Plants that complete their life cycle in **one year** or **single growing season** or few weeks to a few months. They pass the unfavourable period in the form of **seeds** eg. Mustard, Pea.
- b. Biennials** – Plants that complete their life cycle in two years-**growing, vegetative** and storing food **in the first year, flowering and fruiting in the second year**. They die off after producing flowers and fruits. Radish, turnip, carrot are **biennial** in **colder** areas. They become **annual** in **warmer** places.
- c. Perennials** – Plants that survives for several years. These plants usually bears flowers and fruits every year and do not die after producing flowers. eg. Mango, Banana, Guava.

ROOT

Radicule comes out/arise from the seed coat in the form of soft structure and move toward the soil. It develops and forms primary root.

General Characters :

- 1. Roots are **non green, underground**, (+) geotropic, (-) phototropic and (+) hydrotropic.
- 2. Buds present for vegetative propagation in sweet potato (**Ipomea**) and Indian red wood (**Dalbergia**)
- 3. Roots do not bear buds, nodes and internodes
- 4. Roots have **unicellular** root hairs.

TYPES OF ROOTS:

Roots are of two types :

- 1. Tap root

2. Adventitious root

Tap root : It develops from radicle and made up of one main branch and other sub branches.

Adventitious roots : When root is originated from any other part of plant than radicle. It is known as Adventitious root.

Root System :

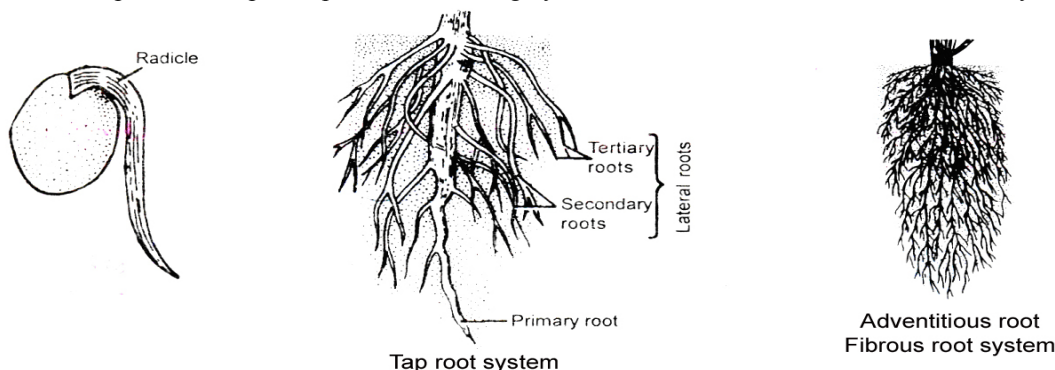
Root systems are of two type :

(i) Tap Root System,

(ii) Fibrous Root System

(i) **Tap root system** - Primary root and its branches constitute tap root system. e.g., Dicot

(ii) **Fibrous root system** – In some plant mainly in monocots, after sometime growth of tap root stop and than roots develop from other part of plant which are highly branched and fibrous and form fibrous root system.



REGIONS OF ROOTS :

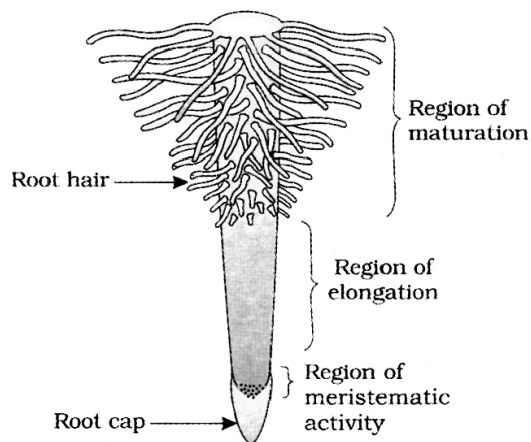
Morphologically four distinct regions are present in roots.

Root cap : It is terminal structure. It protects tender apex of root.

Meristematic zone : Cells of this regions are very small and thin walled. They divide repeatedly and increase cell number

Elongation region : The cells proximal to meristematic zone undergo rapid elongation and enlargement and are responsible for rapid growth of roots.

Maturation region : Cells proximal to region of elongation gradually differentiate and mature. Root hairs are present in maturation zone.



The regions of the root-tip

MODIFICATION OF ROOTS :

1. Modified tap root for storage :

Conical roots : These roots are thicker at their upper side and tapering at basal end. eg. Carrot.

FAMILY OF ANGIOSPERM

FAMILIES OF ANGIOSPERMS :

The symbols used in Floral Formula -

Bracteate	=	Br
Ebracteate	=	Ebr
Actinomorphic	=	⊕
Zygomorphic	=	% or ⊖
Bisexual	=	♂ ♀ +
Unisexual male (staminate)	=	♂ ○
Unisexual female (Pistillate)	=	♀ ○
Epicalyx	=	Epi
Calyx	=	K or if joined = K ₀
Corolla	=	C or if joined = C ₀
Perianth	=	P or if joined = P ₀
Androecium	=	A or if joined = A ₀
Gynoecium	=	G or if joined = G ₀
Superior ovary / Hypogynous flower	=	<u>G</u>
Inferior ovary / Epigynous flower	=	\overline{G}
Ovary half inferior or half superior / Perigynous flower	=	G-
Adhesion		
Epiphyllous	=	$\overbrace{P \ A}$
Epipetalous	=	$\overbrace{C \ A}$

CRUCIFERAE (BRASSICACEAE) (Mustard family)

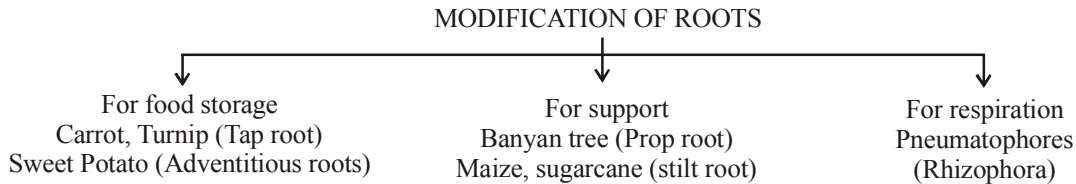
Distinguishing Features of Cruciferae -

The plant organs usually have pungent odour. This odour is due to presence of sulphur containing glucosides compound. Myrosin enzyme (present in secondary cells) hydrolyse then into glucose & different isothiocyanates (Various oils).

Inflorescence – Typical raceme.

Etoos Tips & Formulas

- 1. Direct elongation of the radicle leads to the formation of primary root and lateral roots are called secondary and tertiary roots, (are collectively called tap root system). eg most of the dicot plants (Mustard).
- 2. In monocots primary root is replaced by the large numbers of roots which is originated from the base of stem called fibrous roots. eg - wheat
- 3. Roots arise from parts of the plant other than radicle are called adventitious roots. eg. Grass, Monstera, Banyan.

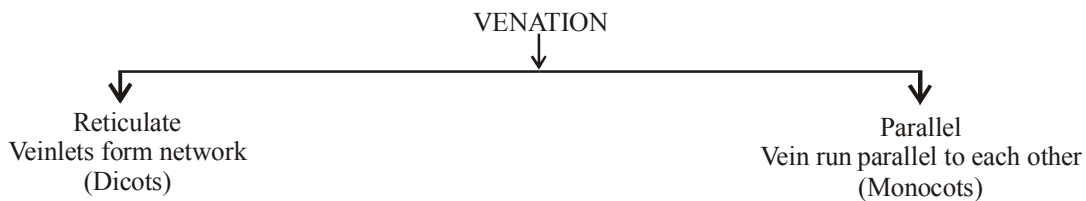


- 4. **STEM**
It develops from the plumule. The main function of the stem is spreading out branches bearing leaves, flowers and fruits.

MODIFICATIONS OF STEM

- For food storage - underground stem (Potato, ginger, turmeric, zaminkand, Colocasia)
- Stem tendrils - Help plants to climb
e.g. - Gourds (Cucumber, Pumpkins, Watermelon) and grapevines
- Thorns - Protect plants from browsing animals
e.g. - Citrus, Bougainvillea.
- Phylloclade - Perform photosynthesis
e.g. - Opuntia (Flat), Euphorbia (Cylindrical)
- Offset - Pistia, Eichhornia
- Sucker - Banana, Pineapple, Chrysanthemum

- 5. **LEAF**
Leaves originate from shoot apical meristem and are arranged in an acropetal manner.
The leaf is attached to the stem by leaf base and may bear two lateral small leaf like structures called stipules.
Swollen leaf bases are called pulvinus. e.g. Some leguminous plants.
Venation - Arrangement of veins and veinlets in the lamina of leaf is termed as venation



SOLVED EXAMPLE

- Ex.1** If a primary root continues to grow, the type of root system will be known as
 (A) Secondary (B) Fibrous
 (C) Tap (D) Stilt
Sol. (C)
- Ex.2** Roots developing from plant parts other than radical are
 (A) Epiphyllous (B) Epicaulous
 (C) Adventitious (D) Fibrous
Sol. (C) : In monocotyledonous plants the radicle dies immediately after germination of seeds and later these roots arise from any germination of seeds and later these roots arise from any other portion (stem, leaves etc.) of the plant.
- Ex.3** In which the pneumatophores are found
 (A) Tinospora (B) Pinus
 (C) Rhizophora (D) None of these
Sol. (C) : Pneumatophores develop from horizontal roots. They bear a number of lenticels or pneumathodes. Exchange of gases occurs through these pores. e.g., Rhizophora.
- Ex.4** Stilt roots which grow obliquely from basal nodes of culm stem and acting as brace are found in
 (A) Sorghum (B) Maize
 (C) Sugarcane (D) All of these
Sol. (D)
- Ex.5** Find out correct order of vegetative propagules of plants like potato, ginger Agave, Bryophyllum and water hyacinth
 (A) Offset, bulbil, leaf bud, rhizome and eyes
 (B) Leaf bud, bulbil, offset, rhizome and eyes
 (C) Rhizome, bulbil, leaf bud, eyes and offset
 (D) Offset, bulbil, leaf bud, rhizome and eyes
Sol. (C)
- Ex.6** Thorn is a stem structure because it
 (A) Develops from trunk
 (B) Develops from axillary bud
 (C) Grows from external surface
 (D) Is pointed
Sol. (B) : Thorns are actually modified axillary buds or terminal buds, and they possess vascular supply.
- Ex.7** An example of edible underground stem is
 (A) Sweet potato (B) Potato
 (C) Carrot (D) Groundnut
Sol. (B) : Sweet potato, Carrot – Edible root. Potato – Edible underground stem.
- Ex.8** Which one of the following is correctly matched
 (A) Onion - Bulb
 (B) Ginger - Sucker
 (C) Chlamydomonas - Conidia
 (D) Yeast - Zoospores
Sol. (A) : Onion – Bulb – underground stem, Ginger – Rhizome - Chlamydomonas – Zoospore.
- Ex.9** Succulent stem is found in
 (A) Pisum (B) Casuarina
 (C) Oxalis (D) Euphorbia
Sol. (D)
- Ex.10** Presence of sheathing leaf base and ligule are characteristic of
 (A) Cycas leaf (B) Fern leaf
 (C) Banana leaf (D) Grass leaf
Sol. (D) : In grasses and many monocots, the leaf base is broad and surrounds the stem as an envelope, such a leaf base is called sheathing leaf base. An additional outgrowth is present between leaf base and lamina. It is called ligule, e.g., Grasses.
- Ex.11** Identify the correct types of phyllotaxy which shown in the following figures
 (A) A - Whorled, B - Alternate, C - Opposite
 (B) A - Alternate, B - Whorled, C - Opposite
 (C) A - Whorled, B - Opposite, C - Alternate
 (D) A - Alternate, B - Opposite, C - Whorled
Sol. (D)
- Ex.12** Study the following statements and select the correct option
 (A) Buds are present in the axil of leaflets of the compound leaf
 (B) Pulvinus leaf-base is present in some leguminous plants
 (C) In Alstonia, the petioles expand, become green and synthesize food
 (D) Opposite phyllotaxy is seen in guava
 (A) (B) and (D) are correct but (A) and (C) are wrong
 (B) (A) and (C) are correct but (B) and (D) are wrong
 (C) (B), (C) and (D) are correct but (A) are wrong
 (D) (A) and (B) are correct but (C) and (D) are wrong
Sol. (A)

Exercise # 1

SINGLE OBJECTIVE

NEET LEVEL

1. Roots developing from plant parts other than radicle are -
 (A) Tap root (B) Adventitious root
 (C) Both (A) & (B) (D) None of the above
2. A plant with parallel venation is -
 (A) Castor (B) Grass
 (C) Colocasia (D) Mustard
3. An edible inflorescence is -
 (A) *Brassica rapa* (B) *Mustard*
 (C) *Raphanus sativus* (D) *Brassica oleracea*
4. Main function of leaf is -
 (A) Manufacture of food (B) Exchange of gases
 (C) Both (A) and (B) (D) None of the above
5. Cruciform corolla is found in -
 (A) Pea (B) China rose
 (C) Radish (D) Sunflower
6. Siliqua is the fruit of -
 (A) Cruciferae (B) Malvaceae
 (C) Liliaceae (D) Solanaceae
7. Chlorophyll containing fleshy cylindrical structures found in *Euphorbia* are modified
 (A) Roots (B) Fruit
 (C) Leaves (D) Stem
8. In *Pistia* and *Eichhornia*, stems are modified to form
 (A) Offsets (B) Tendrils
 (C) Stolons (D) Suckers
9. Leaves originate from _____ and modified to form
 (A) Root apical meristem, acropetal
 (B) Floral meristem, basipetal
 (C) Shoot apical meristem, acropetal
 (D) Internodes, basipetal
10. Leaf base may bear two lateral small leaf like structures called
 (A) Lamina (B) Pulvinus
 (C) Stipules (D) Sepals
11. Mark the incorrect statement
 (A) Flower is a modified shoot
 (B) In cymose inflorescence, the main axis terminates in a flower
 (C) Flower are borne on successive internodes on the stems and roots
 (D) When a shoot tip transforms into a flower, the flower is always solitary
12. The four whorls of a flower are arranged on the
 (A) Thalamus (B) Petiole
 (C) Corolla (D) Stamens
13. Radial symmetry is found in flowers of
 (A) Cassia (B) Chilli
 (C) Gulmohur (D) Canna
14. The flower of which of the following plants is zygomorphic ?
 (A) Bean (B) *Datura*
 (C) Mustard (D) Canna
15. Which of the following plant has epigynous flower ?
 (A) Cucumber (B) Brinjal
 (C) Mustard (D) Peach
16. Parallel venation is a characteristic of monocots. Which of the following is an exception to this generalization?
 (A) *Smilax* (B) *Colocasia*
 (C) *Alocasia* (D) All of these
17. Carpels are fused in the flowers of
 (A) Lotus (B) Tomato
 (C) Rose (D) Both (A) & (C)
18. The stony hard part of the mango represents
 (A) Mesocarp (B) Epicarp
 (C) Endocarp (D) Marginal

Exercise # 2**SINGLE OBJECTIVE****AIIMS LEVEL**

1. Occurrence of different types of leaves on the same plant is -
(A) Heterophylly (B) Heteotrophy
(C) Heteronasty (D) All
2. Which one of the following is of related type -
(A) Catkin and Hypanthodium
(B) Raceme and Cyathium
(C) Corymb and Umbel
(D) Verticillaster and spike
3. Didynamous condition is related to -
(A) Androecium (B) Inflorescence
(C) Gynoecium (D) All
4. The floral organs arise from -
(A) Mother axis (B) Thalamus
(C) Root (D) Pedicel
5. A typical flower with superior ovary and other floral parts inferior is -
(A) Polygamous (B) Hypogynous
(C) Perigynous (D) Epigynous
6. A characteristic of angiosperm is -
(A) Flowers (B) Roots
(C) Seed (D) All
7. A berry fruit is -
(A) Fleshy and single seeded
(B) Fleshy and multiseeded
(C) Dry and multiseeded
(D) Dehiscent & single seeded
8. Water melon is -
(A) Pome (B) Sorosis
(C) Pepo (D) Drupe
9. Fruit of *Halianthus annuus* is -
(A) Legume (B) Follicle
(C) Cypsella (D) Capsule
10. Monadelphous stamens are formed by the fusion of -
(A) Anther lobes of all stamens
(B) Anther lobes of two stamens
(C) Filaments of all stamens
(D) None of these
11. In a 'phylloclade' the function of photosynthesis is taken up by -
(A) Leaves (B) Stipules
(C) Stem (D) Buds
12. Plants disperse their seeds and fruits because -
(A) They produce them
(B) They are good and edible
(C) They want to eliminate struggle for existence
(D) None of the above
13. Rolling mechanism of dispersal is found in -
(A) *Amaranthus* (B) *Acer*
(C) *Shorea* (D) *Moringa*
14. Clove is -
(A) Bud (B) Fruit
(C) Seed (D) Mature flower
15. A perennial plant which flower once in its life time is known as
(A) Annual (B) Perennial
(C) Monocarpic (D) Polycarpic
16. Imparipinnate leaf is characterized by -
(A) Large leaflet
(B) Rachis terminating in by unpaired odd leaflet
(C) Strong Rachis
(D) Leaflets are in pair
17. Presence of monocarpellary, unilocular ovary with marginal placentation are characteristic of -
(A) Solanaceae (B) Cruciferae
(C) Leguminosae (D) Compositae
18. Thorns and spines are -
(A) Defensive organs
(B) Respiratory organs
(C) Both (A) & (B)
(D) Storage organs

Exercise # 3

PART - 1

MATRIX MATCH COLUMN

1. Match the items in Column - I with column - II and choose the correct alternative

Column - I

- A. Tubercular storage roots
- B. Pneumatophores
- C. Haustoria
- D. Prop-roots
- E. Assimilatory roots
- (A) A - ii, B - iii, C - iv, D - v, E - i
- (C) A - iii, B - i, C - ii, D - v, E - iv
- (E) A - iii, B - ii, C - iv, D - v, E - i

Column - II

- i. Tinospora
- ii. Heritiera
- iii. Asparagus
- iv. Viscum
- v. Screwpine
- (B) A - iii, B - iv, C - v, D - i, E - ii
- (D) A - v, B - iv, C - v, D - ii, E - i

2. Match the following and select the correct combination from the options given below

Column - I

- (Stem Modifications)
- A. Underground stem
- B. Stem tendril
- C. Stem thorns
- D. Flattened stem
- E. Fleshy cylindrical stem
- (A) A - ii, B - iii, C - iv, D - v, E - i
- (C) A - iii, B - i, C - ii, D - v, E - iv
- (E) A - iii, B - ii, C - iv, D - v, E - i

Column - II

- (Found in)
- i. Euphorbia
- ii. Opuntia
- iii. Potato
- iv. Citrus
- v. Cucumber
- (B) A - iii, B - iv, C - v, D - i, E - ii
- (D) A - v, B - iv, C - v, D - ii, E - i

3. Study the following lists

Column-I

- A. Entire leaf modified into a spine
- B. Leaf except stipules modified into a tendril
- C. Stipules modified into a tendril
- D. First leaf of axillary bud modified into a spine

Column-II

- i. Clematis
- ii. Citrus
- iii. Euphorbia
- iv. Lathyrus
- v. Smilax

The correct match is

A	B	C	D
(A) iii	iv	i	ii
(B) iii	i	iv	ii
(C) ii	iii	i	v
(D) v	ii	i	iii

4. Match list I with list II and select the correct option

Column-I

- A. Gemmules
- B. Leaf-buds
- C. Bulbil
- D. Offset
- E. Conidia
- (A) A - 4, B - 5, C - 1, D - 3, E - 2
- (C) A - 3, B - 5, C - 4, D - 2, E - 1
- (E) A - 3, B - 5, C - 4, D - 1, E - 2

Column-II

- i. Agave
- ii. Penicillium
- iii. Water hyacinth
- iv. Sponges
- v. Bryophyllum
- (B) A - 4, B - 3, C - 2, D - 1, E - 5
- (D) A - 4, B - 1, C - 5, D - 3, E - 2

Exercise # 4**PART - 1****PREVIOUS YEAR (NEET/AIPMT)**

1. Edible part in lichi is [CBSE AIPMT-1999, 05, 06]
(A) mesocarp (B) fleshy aril
(C) endosperm (D) pericarp
2. Match the following and indicate which is correct ? [CBSE AIPMT-2000]
(A) Cucurbitaceae - Orange
(B) Malvaceae - Cotton
(C) Brassicaceae - Wheat
(D) Leguminosae - Sunflower
3. Edible part of banana is [CBSE AIPMT-2001]
(A) epicarp
(B) mesocarp and less developed endocarp
(C) endocarp and less developed mesocarp
(D) epicarp and mesocarp
4. Which is correct pair for edible part ? [CBSE AIPMT-2001]
(A) Tomato - Thalamus
(B) Maize - Cotyledons
(C) Guava - Mesocarp
(D) Date plum - Pericarp
5. Roots of which plant contains an oxidising agent ? [CBSE AIPMT-2001]
(A) Carrot (B) Soyabean
(C) Mustard (D) Radish
6. Bicarpellary gynoecium and oblique ovary occurs in [CBSE AIPMT-2001]
(A) mustard (B) banana
(C) *Pisum* (D) brinjal
7. Geocarpic fruit is [CBSE AIPMT-2002]
(A) potato (B) groundnut
(C) onion (D) garlic
8. Edible part in mango is [CBSE AIPMT-2002,04]
(A) mesocarp (B) epicarp
(C) endocarp (D) epidermis
9. Which of the following is a correct pair ? [CBSE AIPMT-2002]
(A) *Cuscuta* - Parasite
(B) *Dischidia* - Insectivorous
(C) *Opuntia* - Predator
(D) *Capsella* - Hydrophyte
10. Juicy hair-like structures observed in the fevon fruit develop from [CBSE AIPMT-2003]
(A) mesocarp and endocarp
(B) exocarp
(C) mesocarp
(D) endocarp
11. Long filamentous threads protruding at the end of the young cob of maize are [CBSE AIPMT-2006]
(A) styles (B) ovaries
(C) hairs (D) anthers
12. In a cereal grain the single cotyledon of embryo is represented by [CBSE AIPMT-2006]
(A) scutellum (B) prophyll
(C) coleoptile (D) coleorhiza
13. Pineapple (ananas) fruit develops from [CBSE AIPMT-2006]
(A) a multipistillate syncarpous flower
(B) a cluster of compactly borne flowers on a common axis
(C) a multilocular monocarpellary flower
(D) a unilocular polycarpellary flower
14. What type of placentation is seen sweet pea ? [CBSE AIPMT-2006]
(A) Axile (B) Free central
(C) Marginal (D) Basal
15. Dry indehiscent single- seeded fruit formed from bicarpellary syncarpous inferior ovary is [CBSE AIPMT-2008]
(A) caryopsis (B) cypsela
(C) berry (D) cremocarp

MOCK TEST

- Assertion :** Presence of pneumatophores is a special adaptation of hydrophytes.
Reason : Pneumatophores are positively geotropic shoots that have lenticels and help in gaseous exchange.

(A) If both assertion and reason are true and reason is the correct explanation of assertion.
 (B) If both assertion and reason are true but reason is not the correct explanation of assertion.
 (C) If assertion is true but reason is false.
 (D) If both assertion and reason are false.
- The modified supporting roots called prop roots and stilt roots are seen respectively in

(i) banyan and maize	(ii) banyan and sugarcane
(iii) maize and banyan	(iv) sugarcane and maize.

(A) (i) only
 (B) (ii) only
 (C) (iii) only
 (D) (i) and (ii) only
 (E) (i) and (iv) only
- Which of the following is correctly matched.

(A) <i>Monstera</i> – Fibrous root	(B) <i>Dahlia</i> – Fasciculated root
(C) <i>Azadirachta</i> – Adventitious root	(D) <i>Basil</i> – Prop roots
- Select the correct statements.

(A) From the region of elongation, some of the epidermal cells form root hairs.
 (B) Pneumatophores are seen in *Rhizophora*.
 (C) Adventitious roots are seen in the banyan tree.
 (D) Maize and sugarcane have prop roots.

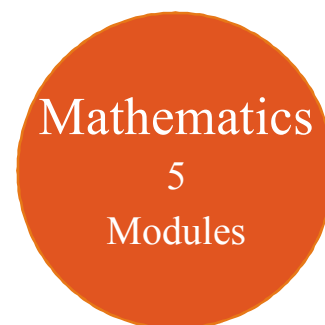
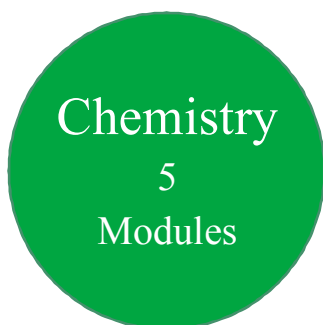
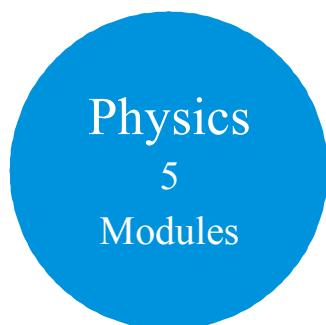
(A) (A) and (D)	(B) (A), (C) and (D)
(C) (C) and (D)	(D) (B) and (C)
(E) (A), (B) and (D)	
- Which of the following is not a stem modification?

(A) Tendrils of cucumber	(B) Flattened structures of <i>Opuntia</i>
(C) Pitcher of <i>Nepenthes</i>	(D) Thorns of citrus
- Match the vegetative propagules listed under column I with the plants given under column II choose the appropriate option from the given choices.

Column I	Column II
A. Rhizome	i. <i>Agave</i>
B. Offset	ii. <i>Bryophyllum</i>
C. Sucker	iii. <i>Ginger</i>
D. Leaf buds	iv. <i>Chrysanthemum</i>
	v. <i>Eichhornia</i>

(A) A-iii, B-v, C-iv, D-ii	(B) A - iii, B - iv, C -i, D - ii
(C) A - ii, B - i, C - v, D - iv	(D) A - iv, B - v, C - ii, D -iii

11th Class Modules Chapter Details



PHYSICS	CHEMISTRY	BIOLOGY
<p>Module-1</p> <ol style="list-style-type: none"> 1. Physical World & Measurements 2. Basic Maths & Vector 3. Kinematics <p>Module-2</p> <ol style="list-style-type: none"> 1. Law of Motion & Friction 2. Work, Energy & Power <p>Module-3</p> <ol style="list-style-type: none"> 1. Motion of system of particles & Rigid Body 2. Gravitation <p>Module-4</p> <ol style="list-style-type: none"> 1. Mechanical Properties of Matter 2. Thermal Properties of Matter <p>Module-5</p> <ol style="list-style-type: none"> 1. Oscillations 2. Waves 	<p>Module-1(PC)</p> <ol style="list-style-type: none"> 1. Some Basic Concepts of Chemistry 2. Atomic Structure 3. Chemical Equilibrium 4. Ionic Equilibrium <p>Module-2(PC)</p> <ol style="list-style-type: none"> 1. Thermodynamics & Thermochemistry 2. Redox Reaction 3. States Of Matter (Gaseous & Liquid) <p>Module-3(IC)</p> <ol style="list-style-type: none"> 1. Periodic Table 2. Chemical Bonding 3. Hydrogen & Its Compounds 4. S-Block <p>Module-4(OC)</p> <ol style="list-style-type: none"> 1. Nomenclature of Organic Compounds 2. Isomerism 3. General Organic Chemistry <p>Module-5(OC)</p> <ol style="list-style-type: none"> 1. Reaction Mechanism 2. Hydrocarbon 3. Aromatic Hydrocarbon 4. Environmental Chemistry & Analysis Of Organic Compounds 	<p>Module-1</p> <ol style="list-style-type: none"> 1. Diversity in the Living World 2. Plant Kingdom 3. Animal Kingdom <p>Module-2</p> <ol style="list-style-type: none"> 1. Morphology in Flowering Plants 2. Anatomy of Flowering Plants 3. Structural Organization in Animals <p>Module-3</p> <ol style="list-style-type: none"> 1. Cell: The Unit of Life 2. Biomolecules 3. Cell Cycle & Cell Division 4. Transport in Plants 5. Mineral Nutrition <p>Module-4</p> <ol style="list-style-type: none"> 1. Photosynthesis in Higher Plants 2. Respiration in Plants 3. Plant Growth and Development 4. Digestion & Absorption 5. Breathing & Exchange of Gases <p>Module-5</p> <ol style="list-style-type: none"> 1. Body Fluids & Its Circulation 2. Excretory Products & Their Elimination 3. Locomotion & Its Movement 4. Neural Control & Coordination 5. Chemical Coordination and Integration

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12th Class Modules Chapter Details

Physics
5
Modules

Chemistry
5
Modules

Mathematics
5
Modules

PHYSICS	CHEMISTRY	BIOLOGY
<p>Module-1</p> <ol style="list-style-type: none"> 1. Electrostatics 2. Capacitance <p>Module-2</p> <ol style="list-style-type: none"> 1. Current Electricity 2. Magnetic Effect of Current and Magnetism <p>Module-3</p> <ol style="list-style-type: none"> 1. Electromagnetic Induction 2. Alternating Current <p>Module-4</p> <ol style="list-style-type: none"> 1. Geometrical Optics 2. Wave Optics <p>Module-5</p> <ol style="list-style-type: none"> 1. Modern Physics 2. Nuclear Physics 3. Solids & Semiconductor Devices 4. Electromagnetic Waves 	<p>Module-1(PC)</p> <ol style="list-style-type: none"> 1. Solid State 2. Chemical Kinetics 3. Solutions and Colligative Properties <p>Module-2(PC)</p> <ol style="list-style-type: none"> 1. Electrochemistry 2. Surface Chemistry <p>Module-3(IC)</p> <ol style="list-style-type: none"> 1. P-Block Elements 2. Transition Elements (d & f block) 3. Co-ordination Compound 4. Metallurgy <p>Module-4(OC)</p> <ol style="list-style-type: none"> 1. HaloAlkanes & HaloArenes 2. Alcohol, Phenol & Ether 3. Aldehyde, Ketone & Carboxylic Acid <p>Module-5(OC)</p> <ol style="list-style-type: none"> 1. Nitrogen & Its Derivatives 2. Biomolecules & Polymers 3. Chemistry in Everyday Life 	<p>Module-1</p> <ol style="list-style-type: none"> 1. Reproduction in Organisms 2. Sexual Reproduction in Flowering Plants 3. Human Reproduction 4. Reproductive Health <p>Module-2</p> <ol style="list-style-type: none"> 1. Principles of Inheritance and Variation 2. Molecular Basis of Inheritance 3. Evolution <p>Module-3</p> <ol style="list-style-type: none"> 1. Human Health and Disease 2. Strategies for Enhancement in Food Production 3. Microbes in Human Welfare <p>Module-4</p> <ol style="list-style-type: none"> 1. Biotechnology: Principles and Processes 2. Biotechnology and Its Applications 3. Organisms and Populations <p>Module-5</p> <ol style="list-style-type: none"> 1. Ecosystem 2. Biodiversity and Conservation 3. Environmental Issues

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