CHAPTER

4

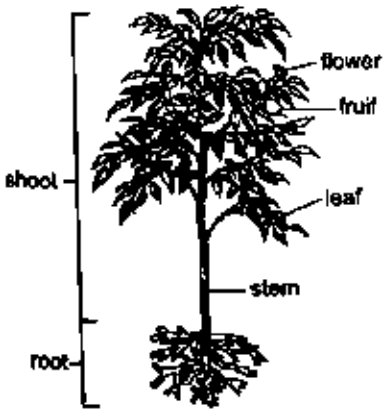
The Plant Life

Morphology of Angiosperms

- **Morphology** (*Morphe* = form; *logos* = study) deals with the study of forms and features of different plant organs like roots, stems, leaves, flowers, seeds, fruits, etc.
- The body of typical angiospermic plant is differentiated into an underground root system and an aerial shoot system.
- **Parasitic plants** Depend on other plants for food and water. They have special roots for absorption of food and water. These roots are called **Sucking roots** or **Haustoria.**
- **Saprophytic plants** Grow on dead organic matter, *e.g.,* fungi. They are also called **humus plant.**
- **Symbiotic plants** Symbiosis or mutual beneficial partnership of two organisms, *e.g.,* Lichens and Rhizobium (N_2 fixing bacteria).

Root System

- Roots develop from radicle of seed.
- Roots are non-green, underground, (+) geotropic, (–) phototropic and hydrotropic.
- They do not bear buds, nodes and internodes.
- Roots have unicellular root hairs.



Morphology of a Plant

- Lateral roots arise endogenously from pericycle.
- Tap roots develop from radicle. The primary root grows and gives rise to secondary and tertiary roots forming tap root system, *e.g.,* Dicots.
- Adventicious roots develop from any part of the plant body other than the radicle.

Functions

(a) Fixation
(b) Absorption of water and minerals.
(c) Storage of food.
(d) Conduction of water.
(e) Photosynthesis (*Tinospora*) and respiration.

Shoot System

Stem

- Stem is ascending part of plant, formed by the prolongation of the plumule of embryo.
- It bears nodes and internodes.
- It has buds and may bear multicellular hair on external surface.

Modifications of Stem

- **Rhizome** It grows parallel or horizontal to soil surface. It bears nodes, internodes, buds and leaves, *e.g.,* Ginger.
- **Tuber** It is terminal portion of underground stem branch which is swollen on account of accumulation of food, *e.g.,* Potato.
- **Corm** It grows vertically to soil surface and is covered by thin sheathing leaf bases of dead leaves called **scales**, *e.g., Colocasia, Gladiolus.*
- **Phylloclade** It is green flattened or rounded succulent stem with leaves either feebly developed or modified into spines *e.g., Opuntia, Euphorbia.*
- **Cladode** Phylloclade with one or two internode is called **cladode**. *e.g., Asparagus.*
- **Thorn** It is modification of axillary bud. Thorns not only reduce transpiration but also check browsing by animals.

Leaves

- A leaf is a flat, lateral outgrowth of the stem or the branch, arising from a node and usually having a bud in its axil.
- The chief functions of the leaf are photosynthesis and transpiration.
- **Bracts** are specialized leaves arises from the axil of leaves, *e.g., Bougainvillea.*

Venation

- The arrangement of veins and the veinlets in the lamina of leaf is called venation.
- **Reticulate venation** The branches or veins forming a network, *e.g.,* dicots.
- **Parallel venation** The veins and veinlets remain parallel to each other, *e.g.,* monocots.
- **Phyllotaxy** is an arrangement of the leaves on the stem or branch.
- Phyllotaxy is adopted so that each leaf is properly exposed to sunlight.

Types of Phyllotaxy

- **Alternate** a single leaf arises at each node.
- **Opposite** single leaf arise at each node of occurs opposite to each other.
- **Whorled** If two or more leaves arise at a node and form a whorl.
- Heterophylly is occurrence of more than one type of leaves on the same plant, *e.g., Ranunculus* sp.

Flower

- It is the reproductive organ of a **plant**.
- **Complete flower** When calyx, corolla, androecium and gynoecium are present.
- **Bisexual flower** Both gynoecium and androecium present on the same flower.
- **Unisexual flower** Either androecium (Staminate flower) or gynoecium (Pistillate flower) is present in the flower.
- **Actinomorphic flower** When a flower is divided into two equal halves by any vertical section passing through the center, *e.g.,* Cruciferae, Malvaceae.
- **Zygomorphic flower** When a flower is divided into two equal halves by only one vertical section passing through the centre, *e.g.,* Pea.
- **Epicalyx** It is an extra whorl of sepal-like structures called bracteoles which occurs on the outside of calyx, *e.g.,* members of Malvaceae.
- When there is no distinction of sepals and petals, the non-essential floral organs are collectively called **perianth.**
- Types of flowers on the basis of position of ovary.
- **Hypogyny** Ovary is at the top. Flowers are hypogynous and ovary is superior, *e.g., Malva, Brassica.*
- **Epigyny** Calyx and corolla arise from upper side of ovary. It is completely surrounded by thalamus, ovary is inferior and flower is epigynous, *e.g.,* Marigold, *Cucurbita maxima.*
- **Perigyny** Ovary is half superior, half inferior, *e.g.,* Rose, plum.
- **Monoecious plant** When both male and female flowers are present on the same plant, *e.g., Cocos, Ricinus, Zea, Colocasia Acalypha.*
- **Dioecious plant** When male and female flower are present on separate plants, *e.g.,* Mulberry, papaya.
- **Polygamous plant** When unisexual (Male or female) bisexual flowers are present on the same plant, *e.g., Polygonum, Mango.*

Inflorescence

- The arrangement of flowers and mode of distribution of flowers on the shoot system of a plant is called **inflorescence**. *It is of following types*
  - (a) **Racemose** (Indefinite) Main axis of inflorescence does not end in a flower but continues to grow. The development of flowers is acropetal. The opening of flowers is centripetal.
  - (b) **Cymose** (Definite) Main axis ends in a flower. The development of flower is basipetal and opening of flowers is centrifugal.
  - (c) **Special type capitulum** is characteristic type of inflorescence in members of Compositae (Asteraceae).
- Verticillaster inflorescence is character ristic of *Ocimum.*
- Cyathium inflorescence is characteristic feature of *Euphorbia.*

Hypanthodium inflorescence is characteristic feature of family–Moraceae (*e.g., Ficus*)

Some Terms Related to Angiosperms Plant

- The study of structure and development of embryo is called **Embryology.**
- The great embryologist of India is P Maheshwari.
- Anther consisting of four microsporangia (Tetrasporangiate) is called **dithecous.** Anthers are reniform or kidney-shaped and consisting of two microsporangia (bisporangiate) is called as **monothecous.**
- In Cruciferae, stamens are six (2 outer short and 4 inner long). this condition is called **tetradynamous.**
- **Axile placentation** is found in members of Malvaceae and Liliaceae.
- Cereals are rich in carbohydrates and belong to family–Gramineae.
- **Monodelphous stamens** are found in members of Malvaceae.
- In members of Labiatae family, stamens are four of which two are short and two are long. Such conditions called as **didynamous.**
- Ovary is bicarpellary in members of family–Solanaceae.
- Placentation is **axile** in members of Solanaceae and **basal** in members of Asteraceae.
- Flowers are **epigynous** in members of family–Compositae.
- The fertilized ovule forms **seed.**
- The study of seed is called **Spermology.**
- The seeds are of two types
- Non-endospermic or exalbuminous
- Endospermic or albuminous
- **Parthenocarpy** The formation of fruit without fertilization is called **parhenocarpy**. Such fruits are **seedless.**

Parthenogenes is When the unfertilized egg develops into embryo (false embryo), the process is called parthenogenesis,

Parthenogany When the sexual reproduction fails, then gametes directly behave as spores, these are called parthenospores or azygospores. The phenomena is called parthenogamy.

Polyembryony The occurrence of more than one embryo in the seed is called **polyembryony**.

Tissue Culture Tissue culture is the technique to exploit the property of **totipotency** of the plant cells.

The transfer of pollen grains from the anthers of a flower to stigma of the same (self) or different flower of the same species (cross) is called pollination.

Rose, *Bryophyllum* and marigold can be propagated by cutting.

Homogamy Male and female reproductive parts in bisexual flowers, mature at the same time.

Cleistogamy Sometimes bisexual flowers remain closed and never open, such flowers are known as **cleistogamous**.

conomic Botany

Natural rubber is para rubber, obtained from *Hevea brasiliensis*.

- Seeds of groundnut have 23-30% proteins.
- Starch is polymer of glucose.
- Coir is obtained from fibrous mesocarp of coconut.
- Sunflower is cultivated for oil and ornamental flowers.
- Red and black seeds of *Abrus* (Ratti) are used as jeweller's weight.
- Eucalyptus grows very fast and stem be used in paper and pulp industry.
- Cheif source of sugar in India is shoot of sugarcane (*Saccharum officinarum*).
- Coffee is obtained from seeds of *Coffea arabica* (family-Rubiaceae).
- Sunnhemp is the plant used for green manuring in India.
- Botanical name of tea is *Thea sinensis* (family-Theaceae).
- Most important cereals are rice, wheat, maize, etc.
- Banana, mango and citrus are indigenous to India.
- Pungent smell in garlic is due to allicin compound.
- "Black gold of India" is pepper.
- Cutting and peeling of onions brings tears to eyes because onion acids combines with sulphur to form amino acid sulphoxides.

Types and Edible Parts of Some Common Fruits

Common Name	Botanical Name	Type	Edible Parts
Simple Fruits			
Mango	*Mangifera indica*	Drupe	Fleshy mesocarp
Coconut	*Cocos nucifera*	Drupe	Endosperm
Almond	*Prunus amygdalus*	Drupe	Seeds
Walnut	*Juglans regia*	Drupe	Cotyledons
Apple	*Pyrus malus*	Pome	Fleshy thalamus
Pear	*Pyrus communis*	Pome	Fleshy thalamus
Betel nut	*Areca catechu*	Berry	Seeds
Pea	*Pisum sativum*	Legume	Seeds
Cashew nut	*Anacardium occidentale*	Nut	Cotyledons and fleshy thalamus
Litchi	*Litchi chinensis*	Nut	Aril
Water chestnut	*Trapa bispinosa*	Nut	Seeds
Pomegranate	*Punica granorum*	Balausta	Succulent testa
Bengal quince (Bael)	*Aegle marmelos*	Amphisarca	Inner fleshy layer of pericarp and placentae
Grape	*Vitis*	Berry	Pericarp and placenta
Papaya	*Carica papaya*	Berry	Mesocarp
Tomato	*Solanum lycopersicum*	Berry	Pericarp and placenta
Banana	*Musa*	Bery	Mesocarp and endocarp
Watermelon	*Citrullus lanatus*	Pepo	Mesocarp and endocarp
Lemon	*Citrus limon*	Hespeaidium	Juicy placenta and juicy hairs developed from endocarp
Wheat	*Triticum sativum*	Caryopsis	Starchy endosperm

Aggregate Fruits			
Lotus	*Nelumbo nucifera*	Etaerio of achenes	Fleshy thalamus and seeds
Strawberry	*Fragaria vesca*	Etaerio of achenes	Fleshy thalamus and seeds
Custard apple	*Annona squamosa*	Etaerio of berries	Inner layer of pericarp and thalamus
Multiple or Composite Fruits			
Mulberry	*Morus alba* and *M. nigra*	Sorosis	Succulent perianth and fleshy axis
Pineapple	*Ananas comosus*	Sorosis	Fleshy axis, bracts, fused peria and pericarp
Jack fruit	*Artocarpus heterophyllus*	Sorosis	Fleshy axis, bracts, perianth and seeds
Fig	*Ficus carica*	Syconus	Fleshy receptacle or thalamus

Plant Anatomy

- The branch of Botany dealing with the internal organization of plants is called **Anatomy.**
- A group of similar or dissimilar cells that perform a common function and have a common origin is called **tissue**. The tissues have been classified into two groups :
  (a) Meristematic (immature)
  (b) Permanent (mature)

Common Medicinal Plants

Common Name	Botanical Name	Part Used
Aconite	*Aconitum napellus*	Tuberous roots
Belladona	*Atropa belladona*	Leaves
Sarpgandha	*Rauwolfia serpentina*	Roots
Quinine	*Cinchona officinale*	Bark
Opium	*Papaver somniferum*	Fruits
Ashwagandha	*Withani somnifera*	Roots
Isubgol	*Plantago ovata*	Fruits and seeds
Ephedrine	*Ephedra*	Bark

- **N Grew** (1682), 'Father of Plant Anatomy', gave the terms tissue and parenchyma.
- **Nageli** (1850) coined the terms meristem, xylem and phloem.
- Some organisms are made up of just one (single) cell, such as *Amoeba*.
- Similar cells packed together form a tissue.
- Different tissues arranged together form an organ.
- Related organs together constitute an organ system.
- Permanent tissues include protective tissue (*e.g.*, Epidermis), supporting tissue (*e.g.*, Parenchyma, collenchyma, sclerenchyma) and conducting tissue (*e.g.*, Xylem, phloem).
- In phloem, three types of cells are sieve element, companion cells and phloem parenchyma.
- Xylem consists of trachieds, vessels, xylem parenchyma and xylem fibres.
- **Dendrology** is the study of trees.
- Number of annual rings decrease as we proceed from base to the top of tree.
- Procambium is meristematic tissue which forms primary xylem, phloem and vascular cambium.
- In monocot leaf, mesophyll is undifferentiated and made up of only spongy parenchyma. In bicollateral vascular bundles, xylem is sandwiched between external and internal phloem.
- The parenchyma cells which have large intercellular spaces are called aerenchyma, *e.g., hydrophytes*.
- **Myrmecophily** is the symbiotic relationship between ants and some higher plants. The ants obtain food and shelter from the plant and protect the plant from other animals, *e.g., Acacia*.

Plant Physiology

Plant Nutrients

Plants need mineral for growth, these are called nutrients. There are two types of nutrients :

(a) **Macronutrients** Minerals needed in large amount, *e.g.*, C, H, Ca, P, Mg, O_2 and S.

(b) **Micronutrients** Minerals needed by plants in traces, *e.g.*, Fe, Zn, Cl, Cu, Mo, B and M_n.

Imbibition

- It is the phenomenon of adsorption of water of liquid by the solid particles of a substance.
- The solid particles which adsorb water are called **Imbibants**. The liquid which is imbibed is called **imbibate**.
- **Imbibition Pressure** The pressure that an imbibant develops after being imbibed is called imbibition pressure/matric potential (ψ_m).

Diffusion

- It is the net movement of particles from a region of its higher concentration to a region of its lower concentration due to their own kinetic energy.
- Rate of diffusion α temperature α $\frac{1}{\text{Size or mass of particle}}$.
- Diffusion pressure deficits (DPD) the difference between diffusion pressure of the solution and its solvent at a particular temperature and atmospheric conditions is called **DPD**.

Permeability

It can be defined as a degree to which a membrane permits the movement of molecules across it.

Types of membranes on the basis of permeability

(a) **Permeable Membrane** Allows the diffusion of both the solvent and solute molecules across it.

(b) **Impermeable Membrane** Neither the solute or solvent molecules can diffuse across membrane.

(c) **Semipermeable Membrane** Allows movement of solvent molecules across it molecules but not the solute

(d) **Differentially Permeable Membrane** Membrane allowing diffusion of only selected molecules across it.

Osmosis

It is the movement of solvent molecules from the region of lower concentration to the region of higher concentration across a semipermeable membrane.

- Discovered by **Nollet** in 1748.

Types of Osmosis

- **Endoosmosis** The entry of water into the cell when placed in hypotonic (less concentrated) solution is called endoosmosis.
- **Exoosmosis** Removal of water from a cell when placed in hypertonic (concentrated) solution is called exoosmosis.
- Isotonic solutions are the solutions of same concentration no net movement of molecules occur between isotonic solution.
- **Osmotic pressure** The actual pressure that develops in a solution when it is separated from pure water by means of a semipermeable membrane.
- Osmotic pressure of a plant cell can vary from 4-5 atm.
- Osmotic pressure = – osmotic potential (ψ_s).

Turgor Pressure

Due to osmosis, water enters into the cell sap and in turn this forces the water into the cell sap, the pressure is thus developed, due to the cell wall being pressed by protoplasm and thus cell becomes turgid. This pressure is called turgor pressure/hydrostatic pressure/ pressure potential (ψ_p).

$$\psi_p = \psi_s$$

Plasmolysis

The phenomenon of shrinkage of protoplasm from the cell wall under the influence of some hypertonic solution is called plasmolysis.

Deplasmolysis

Water enter into the cell sap, the cell becomes turgid and the protoplasm again assumes its normal shape, this is called deplasmolysis.

Transpiration

The loss of water vapour from the living tissues of aerial part of plant.

Types of Transpiration

(a) **Stomatal Transpiration** Transpiration though stomata. It accounts for 80-90% of total water loss from the plant.

(b) **Cuticular Transpiration** Cuticle is the relatively impermeable covering of plant. If it is thin and green up to 20% of transpiration can take place through it.

(c) **Lenticular Transpiration** transpiration through lenticels, *i.e.*, an airy aggregation of cells within the structural surfaces of stem, roots other parts of vascular plants. Very little transpiration occurs through lenticels.

Photosynthesis

Photosynthesis (GK *photon* = light; *synthesis* = putting together) is the anabolic process by which green plants synthesize complex carbohydrates from simple substances like carbon dioxide and water with the help of light energy.

$$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Light}} C_6H_{12}O_6 + 6H_2O + 6O_2$$

Site of Photosynthesis

- Chloroplasts are the green plastids which occur in green parts of plants are the site of photosynthesis.
- Maximum number of chloroplasts are present in leaves.
- Chloroplast is a double membranous organelle enclosing a liquid matrix called stroma. The lamellar system within the stroma forms flattened sac-like lamellae called thylakoids. Thylakoids are stacked to form grana. Stroma is the site of dark reaction and thylakoids for light reaction.

Photosynthetic Pigments

- Pigments are the organic molecules that absorb the light of specific wavelength in the visible region.
- *Different types of pigments are :*
  (a) Chlorophyll (b) Carotenoids and phycobilins

Chlorophylls

- Chlorophylls (Gk *Chlor* = green, *phyll* = leaf) are the green photosynthetic pigments present in all photosynthetic autotrophic organisms.
- There are about ten types of chlorophylls–chl-*a*, *b*, *c*, *d* and *e*, bacterio chlorophyll-*a*, *b*, *c* and d and bacterio viridin.
- Chl-*a* is found in all the oxygen evolving organisms.
- Chlorophyll is the **primary photosynthetic pigment.**

Structure of Chlorophyll

- It consists of porphyrin head and phytol tail.
- The porphyrin head is made up of four pyrolle rings linked together by methane groups, forming a ring system. The centre of tetrapyrolle is occupied by a divalent Mg^{2+} which is complexed with the nitrogen atoms of four pyrolle rings.

- The phytol tail is made up of 20 carbon alcohol and Gound in ester linkage to the 4th pyrolle ring.

Mechanism of Photosynthesis

- Photosynthesis is a two step process.
- The first step is dependent on light and responsible for accumulation of assimilatory power. It is called light reaction.
- The second step is called dark reaction as light is not required for the purpose. It is responsible for CO_2 fixation into carbohydrate.

Plant Growth

- All living organisms show various changes in their weight, shape, size and volume during their entire life cycle (birth to death). It is collectively known as **growth.**
- The growth of plants are regulated by certain chemical substances which are synchesized by them and these are called **growth hormones** or **growth regulators.**
- Plant growth regulators are also called phytohomones.
- These are :

Auxins

- Auxins promote cell elongation. IAA is natural while IBA, NAA and 2, 4-D are synthetic auxins.

Gibberellins

- Gibberellins cause cell elongation and increase length.
- Gibberellins are produced in embryos, roots and young leaves near the shoot tip.
- It is helpful in flowering, enzyme synthesis and fruit growth.

Cytokinins

- Cytokinins promote cytokinesis (cell division).
- Kinetin was first isolated from degraded sample of DNA.
- Zeatin was isolated from maize endosperm.
- It is responsible for cell division, cell enlargement, prevention of senescence and enzyme synthesis.

Ethylene

- It is gaseous hormone which is produced from the ripening fruits and mainly acts as growth inhibitor.
- Ethylene hastens ripening of fruits and promote ageing of plant organs.

Abscissic Acid (ABA)

- It is a growth inhibitor by counteracting other hormones.
- It is responsible for dormancy in buds and seeds, ageing in leaves, inhibits mitosis, abscission of leaves, flowers and fruits.

Exercise

1. Match list I (Plants) with list II (Seed dispersal mechanism) and select the correct answer using the codes given below the lists.

List I (Plants)	List II (Seed Dispersal Mechanism)
A. Coconut	1. By animals
B. Drumstick	2. Explosive mechanism
C. Coklebur (xanthium)	3. By water
D. Castor	4. By wind

Codes

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

2. Which reference to human nutrition consider the following statements?

I. Banana is richer source of carbohydrates than apples.
II. Banana contain some amount to protein also.
III. Spinach has no protein at all.
IV. Patatoes are richer sources of protein than peas.

Which of the above statements are correct?
(a) 1 and 2 (b) 2, 3 and 4
(c) 3 and 4 (d) 1, 2, 3 and 4

3. Wood is the common name for
(a) vascular bundle (b) cambium
(c) secondary xylem (d) secondary phloem

4. Consider the following statements.

I. Vapour pressure of a solution is always less than the vapour pressure of the pure solvent
II. Osmotic pressure of a solution increases if the number of solute molecules is increased
III. The temperature at which the liquid and solid states of a substance have the same vapour pressure is the freezing point
IV. Osmotic pressure of a solution is inversely proportional to the elevation of boiling point

Which of the above statements is/are correct?
(a) I, II and III (b) II and IV
(c) III and IV (d) I only

5. Eyes of potato are useful for
(a) nutrition (b) respiration
(c) reproduction (d) vegetative propagation

6. Which of the following is correctly matched?
(a) Tomato–Pome (b) Banana–Berry
(c) Mango–Berry (d) Apple–Drupe

7. Bamboo is a
(a) grass (b) herbs (c) shrub (d) tree

8. *Belladona* plant is the source of alkaloid
(a) auxin (b) atropine
(c) cocaine (d) nicotine

9. The largest flower in the world is that of
(a) lotus (b) *Rafflesia*
(c) giant cactus (d) None of these

10. The adjoining figure of ovule represents.
(a) Anatropous ovule
(b) Amphitropous ovule
(c) Hemitropous ovule
(d) Circinotropous ovule

11. Calcium content is maximum in
(a) wheat (b) maize (c) bajra (d) sorghum

12. Palak leaves are rich in
(a) vitamin-A (b) vitamin-D
(c) iron (d) carotene

13. Pulse crops can fix atmospheric nitrogen because of
(a) root nodules (b) deep roots
(c) aerial roots (d) root hair

14. Stem cuttings are commonly used for regrowing
(a) cotton (b) banana
(c) mango (d) sugarcane

15. Which of the following is a living fossil?
(a) Blue-green algae (b) Fungus
(c) Green algae (d) *Ginkgo*

16. Osmosis takes place across
(a) semipermeable membrane
(b) impermeable membrane
(c) Both (a) and (b)
(d) None of the above

17. Scientist associated with the success of green revolution is
(a) Norman Borlaug (b) JC Bose
(c) SS Bhatnagar (d) VR Rao

18. The sharp and pointed outgrowth present on the stem of rose are called
(a) prickles (b) thorns
(c) spines (d) hooks

19. Roots are
(a) exogenous (b) endogenous
(c) superficial (d) None of these

20. Cork cambium is
(a) primary meristem (b) ground meristem
(c) lateral meristem (d) intercalary meristem

21. In groundnut, the root is
(a) nodulated (b) napiform
(c) epiphytic (d) photosynthetic

22. Stem develops from
(a) plumule (b) radicle
(c) pericarp (d) procambium

23. A leaf without petiole is known as
(a) sub-petiolate (b) sessile
(c) zygomorphic (d) heteromerous

24. When soil is wet and atmosphere is humid plants lose water by
(a) photosynthesis (b) osmosis
(c) guttation (d) diffusion

25. Cohesion theory of ascent of sap was proposed by
(a) Dixon (b) Bore (c) Pristly (d) Atkins

26. Transpiration is very low during storms due to
(a) presence of moisture in wind
(b) low temperature during storms
(c) high velocity of winds
(d) None of the above

27. Cause of turgity in plant cell is
(a) air (b) water
(c) hormones (d) All of these

28. If there is no movement of water into a cell from outside medium the medium is known as
(a) hypertonic (b) hypotonic
(c) isotonic (d) transpiration

29. The diffusion through a semipermeable membrane is known as
(a) osmosis (b) imbibition
(c) guttation (d) transpiration

30. A membrane which permits selective movement of molecules through it is called
(a) permeable membrane (b) unit membrane
(c) semipermeable (d) impermeable membrane

31. In the case of C_4 pathway primary acceptor of CO_2 is
(a) RuBP (b) PGA
(c) RuDP (d) PEP

32. Adsorption of light in photosynthesis is done by
(a) water (b) air
(c) chlorophyll (d) carbon dioxide

33. Root hairs are the extension of
(a) epiblema cells (b) cortex cells
(c) pericycle cells (d) xylem tracheids

34. Roots can absorb minerals from the soil when they are in
(a) solid state (b) liquid state
(c) ionic state (d) gaseous state

35. The plant parasite is
(a) *Cuscuta* (b) *Utricularia*
(c) *Rhizopus* (d) green plants

36. Out of the following elements which is required in largest quantity?
(a) Phosphorus (b) Nitrogen
(c) Calcium (d) Sulphur

37. Which one of the following is a macronutrient?
(a) Potassium (b) Manganese
(c) Copper (d) Boron

38. Interveinal necrosis in lemon leaf is caused by deficiency of
(a) boron (b) molybdenum
(c) copper (d) zinc

39. Absorption of water increased by
(a) magnesium (b) zinc
(c) calcium (d) manganese

40. Fruit is a ripened
(a) ovary (b) stamen
(c) anther (d) ovule

41. Fusion product of protoplast from different plants is called
(a) zygote (b) homokaryon
(c) heterokaryon (d) oospore

42. The fruit of coconut is
(a) drupe (b) hespridium
(c) composite fruits (d) berry

43. Tomato is
(a) berry (b) drupe
(c) pome (d) legume

44. In primary endosperm nucleus is
(a) haploid (b) diploid (c) triploid (d) tetraploid

45. Which one of the following is dicot endospermic seed?
(a) Maize (b) Bean
(c) Castor (d) Wheat

46. Seeds are dispersed by
(a) wind (b) water
(c) animals (d) All of these

47. Vivipary is found in
(a) mango (b) *Brassica*
(c) mangrove plants (d) *Cycas*

48. The hormone suppreses the growth of a plant.
(a) Auxins (b) Cytokinins
(c) Gibberellins (d) ABA

49. The pigment which plays a major role in seed germination
(a) chloroplast (b) chlorophyll
(c) xanthophyll (d) phytochrome

50. Which of the following are carnivorous plants?
I. Water lily II. Pitcher plant
III. Sundew IV. *Begonia*
(a) I and IV (b) I and II
(c) II and III (d) I, II and III

51. Match the following lists.

List I (Cell Organelles)	List II (Physiological Phenomena)
A. Mitochondria	1. Photosynthesis
B. Chloroplast	2. Transpiration
C. Stomata	3. Respiration
D. Cell wall	4. Osmosis

Codes

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

52. In which of the following cell organelles do photo and thermochemical reactions occur in different sites?
(a) Mitochondria (b) Chloroplasts
(c) Ribosomes (d) Lysosomes

53. A cell neither shrinks nor swells when kept in a fluid, then the fluid in the cell in relation to ambient fluid is called
(a) hypertonic (b) hypotonic
(c) isotonic (d) hyalotonic

54. Which of the following is not a seed-borne disease?
(a) Brown leaf spot of rice
(b) Black arm of cotton
(c) Red rot of sugarcane
(d) Potato mosaic

55. Plants that are derived from the vegetative organs of a single plant are known as
(a) clones (b) hybrids
(c) polyploids (d) haploids

56. Match list I (Plant type) with list II (Habitat) and select the correct code as answer.

List I (Plant type)	List II (Habitat)
A. Hydrophytes	1. Plants growing in saline conditions
B. Xerophytes	2. Plants adopted to grow in water
C. Halophytes	3. Plants adopted to grow in deserts
D. Epiphytes	4. Plants grow non-parasitic on other plants

Codes

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

57. Match the following lists.

List I	List II
A. Primary root	1. It is formed due to repeated division of primary root
B. Tap root	2. It is primary root and its branches
C. Fibrous root	3. Root arise any place other than the root system
D. Adventitious root	4. It is direct prolongation of the radicle is noticed nearly in all dicotyledonous plants

Codes

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

58. Match the following lists.

List I (Mode of reproduction)	List I (Plants)
A. Vegetative propagation by leaves	1. Rubber, Mango and Guava
B. Stem cuttings	2. *Bryophyllium* and *Begonia*
C. Grafting	3. Potato
D. Tissue culture	4. Sugarcane rose, *Bougainvillea*

Codes

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

59. Match of following lists.

List I (Plants)	List II (Edible parts)
A. Pea	1. Mesocarp
B. Date palm	2. Cotyledons
C. Papaya	3. Bracts, Perianth and receptacle
D. Pineapple	4. Fleshy pericarp

Codes

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

The leaves used as wrappers for bidis are obtained from which one of the following?
(a) Shikakai (b) Rudraksha
(c) Tendu (d) Lemon grass

Assertion (A) Growth of cereals like rice and wheat is declining the world over as a result of negative out come of green revolution.
Reason (R) Monoculture of cereal crops for prolonged periods remove genetic ceiling strengthening resistance of plants to pests.
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are ture but R is not correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

Assertion (A) In plants, food materials are manufactured mainly in the leaves and are translocated to other regions of the plant through the phloem.
Reason (R) The water and the minerals absorbed by the roots mone up-wards through the xylem.
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are ture but R is not correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

Assertion (A) Some plants flower only during spring season.
Reason (R) Day length affects flowering in plants.
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are ture but R is not correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

Cutting and peeling of onions brings tears to the eyes because of the presence of **(CDS 2011 II)**
(a) sulphur in the cell (b) carbon in the cell
(c) fat in the cell (d) amino acid in the cell

The anti-malarial drug quinine is made from a plant. The plant is **(CDS 2011 II)**
(a) neem (b) eucalyptus
(c) cinnamon (d) cinchona

Why do you feel cool under a tree but not so under a tin shed on a sunny day? **(CDS 2011 I)**
(a) The greenness of the tree gives the cool feeling
(b) Photosynthesis absorbs heat
(c) The leaves convert water vapours into water which is a heat-absorbing process
(d) The leaves give out water which vapourizes absorbing some heat as latent heat

In dry regions, the leaf size of a tree becomes smaller. It is so to **(CDS 2011 I)**
(a) reduce metabolism
(b) reduce transpiration
(c) maintain natural growth
(d) protect plant from animals

Dead organs are generally stored in formalin. Formalin is **(CDS 2011 I)**
(a) aqueous ferrous sulphate
(b) aqueous formaldehyde
(c) aqueous formic acid
(d) aqueous ferric alum

Which one among the following plants cannot be multiplied by cuttings? **(CDS 2010 II)**
(a) Rose (b) *Bryophyllum*
(c) Banana (d) Marigold

Which one among the following is a major source of sugar? **(CDS 2010 I)**
(a) Watermelon (b) Beetroot
(c) Sugarcane (d) Date

Tips of leaves in grasses and common garden plants show water drops in early morning hours. This water accumulation is obtained from **(CDS 2010 I)**
(a) atmosphere (b) stomata
(c) vascular bundles (d) hydathodes

Which one of the following is not biodegradable? **(CDS 2010 I)**
(a) Woollen mat (b) Silver foil
(c) Leather bag (d) Jute basket

Which one of the following is commonly used as a flavouring agent during the preparation of noodles? **(CDS 2010 I)**
(a) Saffron (b) Cinnamon
(c) Olive oil (d) Ajinomoto

Golden fibre refers to **(CDS 2009 II)**
(a) hemp (b) cotton
(c) jute (d) nylon

Which one of the following statement regarding potato is correct? **(CDS 2009 II)**
(a) It is a root (b) It is a normal stem
(c) It is a modified stem (d) It is a modified root

Match list I with list II and select the correct answer using the codes given below the lists. **(CDS 2009 II)**

List I (Mineral)	List II (Major Source)
A. Iron	1. Banana, date
B. Potassium	2. Palak
C. Iodine	3. Iodized common salt
D. Calcium	4. Milk, egg

Codes

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

Which among the following oils has the maximum protein content? **(CDS 2009 II)**
(a) Castor oil (b) Sunflower oil
(c) Soyabean oil (d) Safflower oil

Quinine is a drug used in the treatment of malaria. From which part of the plant is it obtained? **(CDS 2009 II)**
(a) Roots (b) Stem
(c) Bark (d) Leaves

79. The branches of this tree root themselves like new trees over a large area. The roots then give rise to more trunks and branches. Because of this characteristic and its longevity, this tree is considered immortal and is an integral part of the myths and legends of India. Which tree is this? **(CDS 2009 II)**
(a) Banyan (b) Neem
(c) Tamarind (Imli) (d) Peepal

80. Which one of the following is responsible for the stimulating effect of tea? **(CDS 2009 II)**
(a) Tannin (b) Steroid
(c) Alkaloid (d) Flavonoid

81. Which one of the following is present in chlorophyll which gives a green colour to plant leaves?
(a) Calcium (b) Magnesium **(CDS 2009 II)**
(c) Iron (d) Manganese

82. Bryophytes are photosynthetic but do not have vascular tissue and true roots. This feature enables them to resemble with which of the following?
(a) Fungi (b) Algae **(CDS 2009 II)**
(c) Pteridophytes (d) Angiosperms

83. The genetically engineered 'Golden Rice' is rich in which of the following? **(CDS 2009 I)**
(a) Vitamin-A and nicotinic acid
(b) β-carotene and folic acid
(c) β-carotene and iron
(d) Vitamin-A and niacin

84. The plant dye *Henna* imparts orange-red colour to skin and hairs due to its reaction with which of the following? **(CDS 2009 I)**
(a) Proteins and amino acids (b) Lipids
(c) Carbohydrates (d) Nucleic acids

85. Which one of the following plants is preferred for mixed cropping in order to enhance the bioavailability of nitrogen? **(CDS 2009 I)**
(a) Wheat (b) Gram
(c) Maize (d) Barley

86. Wavelengths of which of the following colour of the visible spectrum of light are maximally absorbed by green plants? **(CDS 2009 I)**
(a) Green and yellow (b) Red and blue
(c) Green and red (d) Blue and yellow

87. Which one of the following is a protein fibre?
(a) Nylon (b) Polyester
(c) Silk (d) Cotton

88. Which one of the following is considered as the drug of last resort for human beings? **(CDS 2009 I)**
(a) Penicillin (b) Tetracycline
(c) Chloramphenicol (d) Streptomycin

89. Which of the following plants is not capable of manufacturing its own food? **(CDS 2008 II)**
(a) Algae (b) Mushroom
(c) Carrot (d) Cabbage

90. The characteristic odour of garlic is due to which one of the following? **(CDS 2008 II)**
(a) Chlorine-containing compounds
(b) Fluorine-containing compounds
(c) Nitrogen-containing compounds
(d) Sulphur-containing compounds

91. Which of the following nutrients is not a structural component of the plant? **(CDS 2008 II)**
(a) Nitrogen (b) Calcium
(c) Phosphorus (d) Potassium

92. Which one among the following kinds of organisms resides in the roots of pulse plants to do nitrogen fixation? **(CDS 2008 I)**
(a) Bacteria (b) Fungi
(c) Protozoa (d) Virus

93. Cloves, used as a spice, are derived from which of the following plant parts? **(CDS 2008 I)**
(a) Seeds (b) Fruits
(c) Flower buds (d) Young leaves

94. Which of the following gases is released from rice fields in the most prominent quantities? **(CDS 2008 I)**
(a) Carbon dioxide
(b) Methane
(c) Carbon monoxide
(d) Sulphur dioxide

95. In dry regions, the leaf size of a tree becomes smaller. It is so to **(CDS 2011 I)**
(a) reduce metabolism
(b) reduce transpiration
(c) maintain natural growth
(d) protect plant from animals

Answers

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