

9. BIOLOGY (Code No. 044)

The present syllabus reinforces the ideas introduced till the secondary classes. It provides the students with new concepts along with an extended exposure to contemporary areas of the subject. The syllabus also aims at emphasizing on the underlying principles that are common to both animals and plants as well as highlighting the relationship of biology with other areas of knowledge. The format of the syllabus allows a simple, clear, sequential flow of concepts without any jarring jumps. The syllabus also stresses on making better connections among biological concepts. It relates the study of biology to real life through the use of technology. It links the discoveries and innovations in biology to everyday life such as environment, industry, health and agriculture. The updated syllabus also focuses on reducing the curriculum load while ensuring that ample opportunities and scope for learning and appreciating basic concepts of the subject continue to be available within its framework. The prescribed syllabus is expected to :

- Promote understanding of basic principles of Biology
- Encourage learning of emerging knowledge and its relevance to individual and society
- Promote rational/scientific attitude towards issues related to population, environment and development
- Enhance awareness about environment issues, problems and their appropriate solutions.
- Create awareness amongst the learners about diversity in the living organisms and developing respect for other living beings
- Appreciate that the most complex biological phenomena are built on essentially simple processes

It is expected that the students would get an exposure to various branches of Biology in the syllabus in a more contextual and friendly manner as they study its various units.



BIOLOGY (Code No. 044)
Course Structure
Class XI (2016-17)
(Theory)

Time : 3 Hours

Max. Marks : 70

Unit	Title	No. of Periods	Marks
I	Diversity of Living Organisms	23	07
II	Structural Organisation in Plants and Animals	22	11
III	Cell : Structure and Function	35	15
IV	Plant Physiology	40	17
V	* Human Physiology (A) – Section for OTBA Human Physiology (B)	40	*10 + 10
Total		160	70

Note : The question paper of the year end examination to be held in the March 2017 will include a Section on Open Text Based Assessment (OTBA) which will include question of a total of 10 marks. No other questions will be asked from the section of the unit earmarked for OTBA. The open text material will be supplied in advance. This material is designed to assess the analytical and higher order thinking skills of students.

*This section will be assessed through OTBA only.

Unit–I Diversity of Living Organisms

23 Periods

Chapter–1 : The Living World

What is living ? Biodiversity; Need for classification; three domains of life : taxonomy and systematics; concept of species and taxonomical hierarchy; binomial nomenclature; tools for study of taxonomy-museum, zoological parks, herbaria, botanical gardens.

Chapter–2 : Biological Classification

Five kingdom classification; Salient features and classification of Monera, Protista and Fungi into major groups; Lichens, Viruses and Viroids.

Chapter–3 : Plant Kingdom

Salient features and classification of plants into major groups – Algae, Bryophyta, Pteridophyta, Gymnospermae and Angiospermae (three to five salient and distinguishing features and at least two examples of each category); Angiosperms –classification upto class, characteristic features and examples.

Chapter-4 : Animal Kingdom

Salient features and classification of animals non-chordates up to phyla level and chordates up to class level (three to five salient features and at least two examples of each category).

(No live animals or specimen should be displayed.)

Unit-II Structural Organisation in Animals and Plants

22 Periods

Chapter-5 : Morphology of Flowering Plants

Morphology and modifications : Tissues

Chapter-6 : Anatomy of Flowering Plants

Anatomy and functions of different parts of flowering plants : root, stem, leaf, inflorescence, flower, fruit and seed (to be dealt along with the relevant experiment of the Practical Syllabus).

Chapter-7 : Structural Organisation in Animals

Animal tissues : Morphology, anatomy and functions of different systems (digestive, circulatory, respiratory, nervous and reproductive) of an insect (cockroach), (a brief account only)

Unit-III Cell : Structure and Function

35 Periods

Chapter-8 : Cell-The Unit of Life

Cell theory and cell as the basic unit of life : Structure of prokaryotic and eukaryotic cells; Plant cell and animal cell; cell envelope; cell membrane, cell wall; cell organelles—structure and function; endomembrane system, endoplasmic reticulum, Golgi bodies, lysosomes, vacuoles; mitochondria, ribosomes, plastids, microbodies; cytoskeleton, cilia, flagella, centrioles (ultrastructure and function); nucleus, nuclear membrane, chromatin, nucleolus.

Chapter-9 : Biomolecules

Chemical constituents of living cells : biomolecules, structure and function of proteins, carbohydrates, lipids, nucleic acids, enzymes, types, properties, enzymes action.

Chapter-10 : Cell Cycle and Cell Division

Cell cycle, mitosis, meiosis and their significance.



Unit–IV Plant Physiology

40 Periods

Chapter–11 : Transport in Plants

Movement of water, gases and nutrients; cell to cell transport, Diffusion, facilitated diffusion, active transport; plant-water relations, Imbibition, water potential, osmosis, plasmolysis; long distance transport of water–Absorption, apoplast, symplast, transpiration pull, root pressure and guttation; transpiration, opening and closing of stomata; Uptake and translocation of mineral nutrients–Transport of food, phloem transport, massflow hypothesis; diffusion of gases.

Chapter–12 : Mineral Nutrition

Essential minerals, macro-and micronutrients and their role; deficiency symptoms; mineral toxicity; elementary idea of hydroponics as a method to study mineral nutrition; nitrogen metabolism, nitrogen cycle, biological nitrogen fixation.

Chapter–13 : Photosynthesis in Higher Plants

Photosynthesis as a mean of autotrophic nutrition; site of photosynthesis, pigments involved in photosynthesis (elementary idea); photochemical and biosynthetic phases of photo-synthesis, cyclic and non cyclic photophosphorylation; chemiosmotic hypothesis; photorespiration; C3 and C4 pathways; factors affecting photosynthesis.

Chapter–14 : Respiration in Plants

Exchange of gases; cellular respiration–glycolysis, fermentation (anaerobic), TCA cycle and electron transport system (aerobic); energy relations–number of ATP molecules generated; amphibiotic pathways; respiratory quotient.

Chapter–15 : Plant–Growth and Development

Seed germination; phases of plant growth and plant growth rate; conditions of growth; differentiation, dedifferentiation and redifferentiation; sequence of developmental processes in a plant cell; growth regulators–auxin, gibberellin, cytokinin, ethylene, ABA; seed dormancy; vernalisation; photoperiodism.

Unit–V Human Physiology

40 Periods

Part (A) will be assessed through OTBA whereas from the Part (B), there will be usual conceptual question in year end examination.

Part (B) Chapter–16 : Digestion and Absorption

Alimentary canal and digestive glands, role of digestive enzymes and gastrointestinal hormones; Peristalsis, digestion, absorption and assimilation of proteins, carbohydrates and fats; calorific values of proteins, carbohydrates and fats; egestion; nutritional and digestive disorders–PEM, indigestion, constipation, vomiting, jaundice, diarrhoea.

Part (B) Chapter–17 : Breathing and Exchange of Gases

Respiratory organs in animals (recall only); Respiratory system in human; mechanism of breathing and its regulation in humans–exchange of gases, transport of gases and regulation of respiration, respiratory volume; disorders related to respiration–asthma, emphysema, occupational respiratory disorders.

Part (A) Chapter–18 : Body Fluids and Circulation

Composition of blood, blood groups, coagulation of blood; composition of lymph and its function; human circulatory system–structure of human heart and blood vessels; cardiac cycle, cardiac output, ECG; double circulation; regulation of cardiac activity; disorders of circulatory system–hypertension, coronary artery disease, angina pectoris, heart failure.

Part (B) Chapter–19 : Excretory Products and Their Elimination

Modes of excretion–ammonotelism, ureotelism, uricotelism; human excretory system–structure and function; urine formation, osmoregulation of kidney function–renin–angiotensin, atrial natriuretic factor, ADH and diabetes insipidus; role of other organs in excretion; disorders–uraemia, renal failure, calculi, nephritis; dialysis and artificial kidney.

Part (B) Chapter–20 : Locomotion and Movement

Types of movement–Ciliary, flagellar, muscular; skeletal muscle–contractile proteins and muscle contraction; skeletal system and its functions; joints; disorders of muscular and skeletal system–myasthenia gravis, tetany, muscular dystrophy, arthritis, osteoporosis, gout.



Part (B) Chapter–21 : Neural Control and Coordination

Neuron and nerves; Nervous system in humans—central nervous system; peripheral nervous system and visceral nervous system; generation and conduction of nerve impulse; reflex action; sensory perception sense organs; elementary structure and functions of eye and ear.

Part (A) Chapter–22 : Chemical Coordination and Integration

Endocrine glands and hormones; human endocrine system—hypothalamus, pituitary, pineal, thyroid, parathyroid, adrenal, pancreas, gonads; mechanism of hormone action (elementary idea); role of hormones as messengers and regulators, hypo—and hyperactivity and related disorders; dwarfism, acromegaly, cretinism, goiter, exophthalmic goiter, diabetes, Addison's disease.

Note—Diseases related to all the human physiological systems to be taught in brief.

Practicals

Time Allowed : Three hours

Max.Marks : 30

Evaluation Scheme	
One Major Experiment	5 Marks
One Major Experiment	4 Marks
Slide Preparation	5 Marks
Spotting	7 Marks
Practical Record + Viva Voce	4 Marks
Project Record + Viva Voce	5 Marks
Total	30 Marks

A. List of Experiments

60 Periods

1. Study and description of three locally available common flowering plants, one from each of the families Solanaceae, Fabaceae and Liliaceae including dissection and display of floral whorls, anther and ovary to show number of chambers (floral formulae and floral diagrams). Types of root (Tap and adventitious); stem (herbaceous and woody); leaf (arrangement, shape, venation, simple and compound).
2. Preparation and study of T.S. of dicot and monocot roots and stems (primary).
3. Study of osmosis by potato osmometer.
4. Study of plasmolysis in epidermal peels (e.g. Rhoeo leaves).
5. Study of distribution of stomata in the upper and lower surface of leaves.
6. Comparative study of the rates of transpiration in the upper and lower surface of leaves.
7. Test for the presence of sugar, starch, proteins and fats. Detection in suitable plant and animal materials.
8. Separation of plant pigments through paper chromatography.
9. Study of the rate of respiration in flower buds/leaf tissue and germinating seeds.
10. Test for presence of urea in urine.
11. Test for presence of sugar in urine.
12. Test for presence of albumin in urine.
13. Test for presence of bile salts in urine.

B. Study/observation of the following (spotting)

1. Study of the parts of a compound microscope.
2. Study of the specimens/slides/modles and identification with reasons—Bacteria, Oscillatoria, Spirogyra, Rhizopus, mushroom, yeast, liverwort, moss, fern, pine, one monocotyledonous plant, one dictoyledonous plant and one lichen.
3. Study of virtual specimens/slides/models and identification with reasons—Amoeba, Hydra, liverfluke, Ascaris, leech, earthworm, prawn, sliworm, honeybee, snail, starfish, shark, rohu, frog, lizard, pigeon and rabbit.
4. Study of tissues and diversity in shapes and sizes of plnat and animal cells (palisade cells, guard cells, parenchyma, collenchyma, sclerenchyma, xylem, phloem, suquamous epithelium, muscle fibers and mammalian blood smear) through temporary/permanent slides.
5. Study of mitosis in onion root tip cells and animals cells (grasshopper) from permanent slides.
6. Study of different modifications in roots, stems and leaves.
7. Study and identification of different types of inflorescence (cymose and racemose).
8. Study of imbibition in seeds/raisins.
9. Observation and a comments on the expeirmental set up for showing :
 - (a) Anaerobic respiration
 - (b) Phothotropism
 - (c) Effect of apical bud removal
 - (d) Suction due to transpiration
10. Study of human skeleton and different types of joints with the help of virtual images/models only.
11. Study of external morphology of cockroach through virtual images/models.

Practical Examination for Visually Impaired Students

Class XI

Note : Same Evaluation scheme and general guidelines for visually impaired students as given for Class XII may be followed.

A. Items for Identification/Familiarity with the apparatus/equipments/ animal and plant material/chemicals etc. for assessment in practicals (All experiments)

Plants of—

- Solanaceae—Bringal, Petunia, any other
- Fabaceae—Rice, Wehat, any other
- Liliaceae—Any of the Lilies

A compound microscope, seeds of monocot and dicot—maize and gram or any other Model of Human skeleton to show.

- Ball and socket joints of girdles and limbs
- Rib cage

Test tube, honey comb, Mollusc shell, Models of Pigeon and Star fish, mushroom, petridish, succulents such as *Aloe vera*/kalenchoe, raisins, beaker, potatoes, scalpel, chromatography paper, chromatography chamber, alcohol, specimen/model of cockroach.

B. List of Practicals

1. Study three locally available common flowering plants of the families—Solanaceae, fabaceae, Liliaceae and identify :
 - Types of roots as Tap and Adventitious
 - Types of stems as Herbaceous or Woody
 - Types of leaves as Compound or Simple
2. Study the parts of a compound microscope—eye piece and objective lense, mirror, stage, coarse and fine adjustment knobs.
3. Differentiate between monocot and dicot plants on the basis of venation patterns.
4. Study the following parts of human skeleton (Model);
 - Ball and socket joints of thigh and shoulder
 - Rib cage
5. Study honey bee through comb, snail through shell, Starfish through model, Pigeon through model.
6. Identify the given specimen of a fungus—Mushroom.
7. Study the adaptive features of xerophytic plants.
8. Study the process of osmosis through endosmosis in raisins.
9. Identify and relate the given experimental set up with aim of experiment :
 - Paper Chromatography
 - or
 - Potato Osmometer
10. Study the external features/morphology of cockroach through model

Note : The above practicals may be carried out in an experimental manner rather than recording observations.

Prescribed Books :

1. Biology Class-XI, Published by NCERT
2. Other related books and manuals brought out by NCERT (consider multimedia also)

BIOLOGY (Code No. 044)

Question Paper Design

Class-XI (2016–17)

Time : 3 Hours

Max. Marks : 70

S. No.	Typology of Questions	Very short Answer (VSA) (1 marks)	Short Answer-I (SA-I) (2 marks)	Short Answer-II (SA-II) (3 marks)	Value based question (4 marks)	Long Answer (LA) (5 marks)	Total Marks	% Weightage
1.	Remembering–(Knowledge based) Simple recall questions, to know specific facts, terms, concepts, principles, or theories, Identify, define, or recite, information)	2	1	1	–	–	7	10%
2.	Understanding–(Comprehension) –To be familiar with meaning and to understand conceptually, interpret, compare, contrast, explain, paraphrase information)	–	2	4	–	1	21	30%
3.	Application (Use abstract information in concrete situation, to apply knowledge to new situations, Use given content to interpret a situation, provide an example, or solve a problem)	–	2	4	–	1	21	30%
4.	High Order Thinking Skills (Analysis & Synthesis) –Classify, Compare, Contrast, or differentiate between different pieces of information, Organize and/or integrate unique pieces of information from a variety of sources)	2	–	1	–	1	10	14%
5.	Evaluation –(Appraise, judge, and/or justify the value or worth of a decision or outcome, or to predict outcomes based on values)	1	–	2	1	–	11	16%
TOTAL		5×1=5	5×2=10	12×3=36	1×4=4	3×5=15	70(26)	100%

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Question Wise Break Up

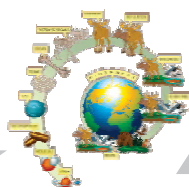
Types of Question	Mark(s) per Question	Total No. of Questions	Total Marks
VSA	1	5	05
SA-I	2	5	10
SA-II	3	12	36
VBQ	4	1	04
LA	5	3	15
Total		26	70

1. Internal Choice : *There is no overall choice in the paper. However, there is an internal choice in one in one question of 2 marks weightage, one question of 3 marks weightage and one question of 5 marks weightage (Content based question).*
2. *The above template is only a sample. Suitable internal variations may be made for generating similar templates keeping the overall weightage to different form of questions and typology of questions same.*

BIOLOGY – XI

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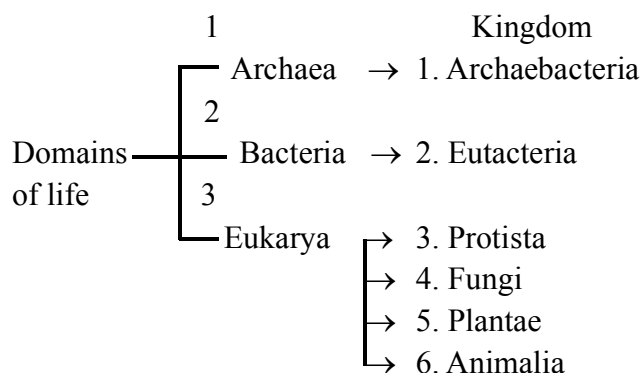


Chapter - 1

The Living World

Points to Remember

1. Organism (Microorganism, plant and animals) who possesses life is living.
2. Life is a complex organisation expressing itself through chemical reactions and exhibit characteristics of living organisms.
3. **Characteristics of Living Organisms** : Growth, reproduction, metabolism, cellular organisation, consciousness (ability to sense environment), self-replicating and self regulation.
 - Reproduction and growth are NOT defining properties.
 - Metabolism, cellular organisation and consciousness are defining properties.
 - Living organisms are self-replicating, evolving and self-regulating interactive and systems capable of responding to external stimuli.
4. **Biodiversity** : Term used to refer to the variety of microorganisms, plant and animals on earth.
5. **Need for classification** : To organise the vast number of microorganisms, plants and animals into categories that could be named, remembered, studied and understood.
6. **Three Domains of Life** : Proposed by Carl Woese in 1990 who also proposed the six kingdom classification for living organisms. The three Domains of life are Archaea, Bacteria and Eukarya.



7. **Taxonomy** : Study of principles and procedures of identification, nomenclature and classification.
8. **Systematics** : It deals with classification of organisms based on their diversities and relationships among them. Terms was proposed by Carolus Linnaeus who wrote '*Systema Naturae*'.
9. **Concept of Species** : All the members that can interbreed among themselves and can produce fertile offsprings are the members of same species. This is the biological concept of species proposed by Mayr.
10. **Taxa** : Each category (*i.e.*, unit) of classification is called as a taxon.
11. **Taxonomic Hierarchy** : Classification of organisms in a definite sequence of taxon or category or rank in a descending order.
Kingdom → Phylum /Division → Class → Order → Family → Genus → Species.
12. **Binomial Nomenclature** : Given by Carolus Linnaeus. Each scientific name has two components-Generic name + Specific epithet.
13. **ICBN** : International Code for Botanical Nomenclature (for giving scientific name to plants.)
14. **ICZN** : International Code of Zoological Nomenclature (for giving scientific name to animals.)
15. **Rule for Nomenclature** :
 - Latinised names are used.
 - First word is genus, second word is species name.
 - Printed in italics; if handwritten then underlined separately.
 - First word starts with capital letter while species name written in small letter.
16. ● **Scientific names of some organisms** :

Man	—	<i>Homo sapiens</i>
Housefly	—	<i>Musca domestica</i>
Mango	—	<i>Mangifera indica</i>
Wheat	—	<i>Triticum aestivum</i>
17. Taxonomical Aids are the tools for study of taxonomy.
18. Museums in educational institutes (school and colleges) have collection of skeletons of animals, stuffed and preserved specimens of organisms for study and reference.
19. Zoological Parks (Places where wild animals are kept in protected environment under human care) Example : National Zoological Park, Delhi.
20. **Herbarium** Store house of dried, pressed and preserved plant specimen on sheets, kept systematically according to a widely accepted system of classification, for future use.

21. **Botanical Garden** : Collection of living plants for reference.
Example : Royal Botanical garden Kew (England), National Botanical Research Institute (Lucknow), Indian Botanical Garden Howrah.
22. ● Keys (Used for identification of plants and animals on the basis of similarities and dissimilarities.)
23. **Couplet** are the two alternate characteristic statement used in key to identify organisation.
24. Each Statement of the key is called a *lead*.
25. ● Flora (Index to plant species found in a particular area.)
26. ● Manuals (Provide information for identification of name of species in an area.)
27. ● Monographs (Contain information on any one taxon.)

Question

Very Short Answer Question

(1 mark each)

1. Define species.
2. What is systematics ?
3. Give the names of two famous botanical gardens.

Short Answer Question-I

(2 marks each)

4. What is the basis of modern taxonomical studies ?
5. Why growth and reproduction cannot be taken as defining property of all living organisms ?
6. How is a taxon (pl.taxon) defined ?

Short Answer Question-II (3 marks each)

7. What is the difference between Botanical Garden and Herbarium ?
8. Keys are analytical in nature and are helpful in identification and classification of organisms. How ?
9. Define : (a) Genus (b) Family (c) Order

Long Answer Questions

(5 marks each)

10. What are the universal rules of nomenclature ? What does 'Linn.' Refer to in *Mangifera indica* Linn ?

11. Illustrate taxonomical hierarchy with suitable examples from plant and animal species.
12. Define classification. What is the significance of classification ? What is the six kingdom classification ?

Answers

Very Short Answers

(1 marks each)

1. Members that can interbreed to produce fertile offspring.
2. Systematic arrangement which also takes into account evolutionary relationships between organisms.
3. Kew (England) and National Botanical Research Institute (Lucknow), Indian Botanical Garden (Howrah).

Short Answers-I

(2 marks each)

4. External and internal structure, structure of cell, development process and ecological information.
5.
 - Non-living things can also increase in mass by accumulation of material on surface (accretion.)
 - Many organisms do not reproduce (*e.g.*, mules, sterile worker bees.)
6. Each category in a taxonomical hierarchy represents a rank and is called taxon.

Short Answers-II

(3 marks each)

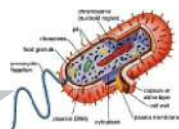
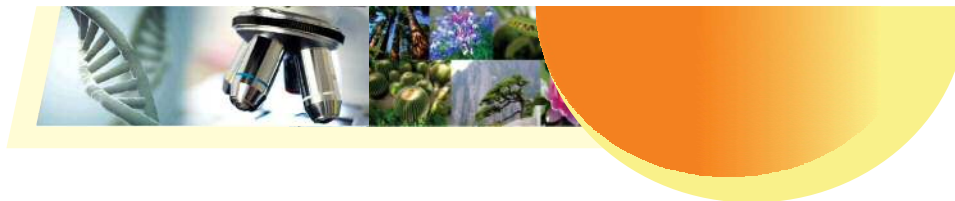
7. Botanical Garden : Collection of living plants.
Herbarium : Collection of dried, pressed and preserved plant specimens on sheets.
8. Key is a list of alternate characters arranged in such a manner that by acceptance and rejection one can easily identify an organism as to its name and position. Keys are generally analytical in nature.
9. (a) Genus : Group of related species;
(b) Family : Group of related genera;
(c) Order : Group of related families.

Long Answers

(5 marks each)

10. Refer page no. 7, NCERT, Text Book of Biology for Class XI.
‘Linn.’ indicates that the species was first described by Linnaeus.
11. Refer table 1.1, page no. 11, NCERT, Text Book of Biology for Class XI.
12. Grouping organisms on the basis of their similarities and differences.
Significance : – Aids in study, better understanding, predicting the features of the group known.
Refer ‘Points to Remember’ for six kingdom classification in three domains of life.





Chapter - 2

Biological

Classification

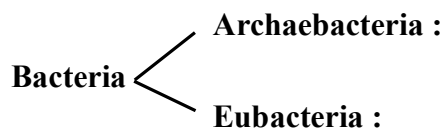
Points to Remember

Systems of Classification :

- Earliest classification was given by Aristotle. Divided plants into herbs, shrubs and trees.
Animals into those with red blood and those who do not have it.
- **Two kingdom classification** : Given by Carolous Linnaeus–Kingdom–plantae and kingdom–Animalia.
- **Five kingdom classification** : By R.H. Whittaker, Monera, Protista, Fungi, Plantae and Animalia are the five kingdoms.
- The main criteria for classification of organisms into five kingdoms include cell structure, thallus organisation, mode of nutrition, reproduction and phylogenetic relationships.

Kingdom Monera :

- Has bacteria as sole members.
- Bacteria can have shapes like : Coccus (spherical), Bacillus (rod-shaped), Vibrium (comma shaped) and spirillum (spiral shaped).
- Bacteria found almost everywhere and can be Photosynthetic autotrophs, Chemosynthetic autotrophs or Heterotrophs.



- Halophiles (salt-loving)
- Thermoacidophiles (in hot springs)
- Methanogens (in marsh and in gut of ruminant animals. Produce methane gas.)
- Photosynthetic autotrophs like Cyanobacteria (Blue-green algae BGA). Some like *Anabaena* and *Nostoc* have specialized cells called heterocysts for nitrogen fixation.

- *Algae bloom* is rich growth of blue green algae over the surface of polluted water bodies.
 - Algae bloom releases neurotoxins, deplete oxygen and water unfit for use.
 - **Chemosynthetic autotrophs** : Oxidise various inorganic substances like nitrates/nitrites, ammonia and use released energy for their ATP production. They help in nutrients recycling of N, P, Fe and S.
 - **Heterotrophic bacteria** : Decomposers, help in making curd, production of antibiotic, N_2 fixation, cause diseases like cholera, typhoid, tetanus and citrus canker.
- Mycoplasmas** : Completely lack cell wall. Smallest living cells. Can survive without oxygen. Pathogenic in animals and plants.

Kingdom PROTISTA

(Comprises of all single celled eukaryotes)

- Forms a link between plants, animals and fungi.
- Chrysophytes** (Has diatoms and golden algae/dinoflagellates)

Fresh water/marine, photosynthetic, microscopic plankton.

 - Cell walls have silica which makes it indestructible and cell walls overlap to fit together like a soap box.
 - Their accumulation forms 'Diatomaceous Earth' (gritty soil)
 - Used in polishing, filtration of oils and syrups.
 - Dinoflagellates** :
 - Marine, photosynthetic cell wall has stiff cellulose plates.
 - Two flagella—one longitudinal and other transverse in a furrow between wall plates.
 - **Example** : *Gonyaulax* multiplies rapidly, make sea appear red (red tides) and produce toxins to kill marine animals.
 - Euglenoids** :
 - Found in stagnant fresh water.
 - Have protein rich layer 'pellicle' which makes body flexible.
 - Photosynthetic in presence of sunlight but become heterotrophs if they do not get sunlight. (Mixotrophic nutrition)
 - **Example** : *Euglena*
 - Slime Moulds** :
 - Saprophytic protists
 - Under suitable conditions form an aggregate called plasmodium, grows on decaying twigs and leaves.

- During unfavourable conditions, plasmodium differentiates and forms fruiting bodies bearing spores at their tips.
 - Spores have true walls which are extremely resistant and survive for many years and dispersed by air currents.
- (v) **Protozoans** : Are heterotrophs and live as predators or parasites. Have four major groups.
- Amoeboid** : Catch prey using pseudopodia, *e.g.*, *Amoeba*. *Entamoeba* are parasite.
- Flagellated** : Have one or more flagella. Cause disease like Sleeping Sickness *e.g.*, *trypanosoma*.
- Ciliated** : Have cilia to move food into gullet and help in locomotion. *e.g.*, *Paramecium*.
- Sporozoans** : Have infective spore like stage in life cycle, *e.g.*, Plasmodium which causes malaria.

Kingdom Fungi

1. Heterotrophic organisms
2. Non chlorophyllous hyphae
3. Network of hyphae called mycelium
4. Hyphae which have multinucleate cytoplasm are called coenocytic hyphae
5. Cell wall of chitin and polysaccharides
6. Cosmopolitan. Grow in warm and humid places.
7. Saprophytic, parasitic, symbiotic (Lichen and Mycorrhiza) *e.g.*, ***Puccinia***, (wheat rust disease), ***Penicillium***, Yeast is a unicellular fungus.
8. Reproduction can take place by vegetative means fragmentation, fission and budding. Asexual reproduction by spores—conidia, sporangiospores or zoospores. Sexual reproduction by Oospores, ascospores and basidiospores—produced in fruiting bodies.
9. **Sexual cycle involves 3 steps :**
 - (i) Plasmogamy (fusion of Protoplasms.)
 - (ii) Karyogamy (fusion of two nuclei.)
 - (iii) Meiosis in zygote resulting in haploid spores.
10. Dikaryophase is a condition of having dikaryon in an intervening dikaryotic stage ($n + n$ i.e., two nuclei per cell) between plasmogamy and karyogamy in fungi like ascomycetes and basidiomycetes.

Classes of Fungi

(i) Phycomycetes :

- grow on decaying wood or as obligate parasites on plants
- Mycelium aseptate and coenocytic
- Spores produced endogenously in sporangium.
- Asexual reproduction by Zoospores or Aplanospores
- Zygosporangia are formed by the fusion of gametes.

e.g., Rhizopus, Albugo, Mucor

(ii) Ascomycetes :

- also known as 'sac fungi'
- Are saprophytic, decomposers, parasitic or coprophilous (growing on dung).
- Mycelium branched and septate
- Asexual spores are called conidia produced exogenously on the conidiophores.

Sexual spores are called ascospores produced endogenously in ascus, produced inside fruiting body called Ascocarp.

e.g., Aspergillus, Neurospora, Saccharomyces (Unicellular fungi), Claviceps, morels, truffles

(iii) Basidiomycetes :

- Mycelium septate and branched.
- Generally asexual spores are not found.
- Vegetative reproduction by fragmentation.
- Sexual reproduction by fusion of vegetative or somatic cells to form basidium produced in basidiocarp.
- Basidium produces four basidiospores exogenously after meiosis.

e.g., Agaricus, Ustilago, Puccinia

(iv) Deuteromycetes :

- Called as 'Fungi Imperfecti' as sexual form (perfect stage) is not known for them.
- Once sexual form is discovered the member is moved to Ascomycetes or Basidiomycetes.
- Mycelium is septate and branched.
- Are saprophytic parasitic or decomposers.

e.g., Alternaria, Colletotrichum, Trichoderma.

Viruses :

- They did not find a place in classification.
- Not truly living.
- non-cellular organisms which take over the machinery of host cell on entering it and become living but as such they have inert crystalline structure appear non-living. So, difficult to call them living or non-living.
- Virus means venom of poisonous fluid. Pastuer gave the term virus.
- D.J. Ivanowsky found out that certain microbes caused Tobacco Mosaic Disease in tobacco plant.
- M.W. Beijerinck called fluid as 'Contagium vivum fluidum' as extracts of infected plants of tobacco could cause infection in healthy plants.
- W.M. Stanley showed viruses could be crystallized to form crystals of protein which are inert outside their specific host.
- Viruses are obligate parasites.

Structure of Virus :

- It is a nucleoprotein made up of protein coat called Capsid. Capsid is made up of capsomeres arranged in helical or polyhedral-geometric forms. Have either DNA or RNA as genetic material which may be single or double stranded.
- Usually plant viruses have single stranded RNA; bacteriophages have double stranded DNA and animal viruses have single or double stranded RNA or double stranded DNA.

Diseases caused in humans :

Mumps, Small pox, herpes, influenza and AIDS etc. In plants, symptoms can be mosaic formation, leaf rolling and curling, yellowing and vein clearing, dwarfing and stunted growth.

Viroids :

- Infectious agent, free RNA (lack protein coat)
- RNA has low molecular weight.
- Causes potato spindle tuber disease.
- Discovered by T.O. Diener.

Lichens :

- Symbiotic association between algal component (Phycobiont) and fungal component (mycobiont). Algae provides food. Fungi provides shelter and absorb nutrients and water for alga.
- Good pollution indicators as they do not grow in polluted areas.

Questions

Very Short Answer Question (1 mark each)

1. *Nostoc* and *Anabaena* have specialized cells called heterocysts. What is the function of these cells ?
2. Which group comprises of single celled eukaryotes only ?
3. Which organisms are the chief producers in oceans ?
4. Name the fungus which causes disease in wheat (i) rust (ii) smut.
5. Which Ascomycetes has been used extensively in biochemical and genetic work ?
6. What is the principle underlying the use of cyanobacteria in agriculture ?

Short Answer Question-I (2 marks each)

7. How are bacteria classified on the basis of their shapes ?
8. What is the mode reproduction in bacteria ?
9. Why are red tides caused and why are they harmful ?
10. Viruses and viroids differ in structure and the diseases they cause. How ?
11. Which class of kingdom fungi has both unicellular as well as multicellular member ? When is a fungus called coprophilous ?

Short Answer Question-II (3 marks each)

12. Who gave five kingdom classification ? What was the criteria used for such classification ?
13. What are the modes of nutrition in fungi ?
14. Some symbiotic organisms are very good pollution indicators and composed of a chlorophyllous and a non-chlorophyllous member. Describe them.

VBQ (4 marks)

15. Vineeta went to the market along with Roshan, her younger brother bought a packet of mushroom. Roshan thinks that mushrooms is a product of plants.
 - (a) What does Vineeta explain ?
 - (b) Name any two edible products from this group (scientific name.)
 - (c) What values are displayed by Vineeta.

Long Answer Questions (5 mark each)

16. Some primitive relatives of animals live as predators or parasites and are divided into four major groups. Elaborate.

17. differentiate between various classes of kingdom Fungi on the basis of their (i) Mycelium, (ii) Types of spores and (iii) Types of fruiting body. Also give two examples for each class.
18. Describe sexual reproduction in fungi.

Answers

Very Short Answers

(1 mark each)

1. Help in nitrogen fixation.
2. Kingdom Protista.
3. Diatoms
4. (i) *Puccinia*, (ii) *Ustilago*
5. *Neurospora*
6. Capability of nitrogen fixation

Short Answers-I

(2 marks each)

7. Bacillus (rod-shaped), Coccus (spherical), Vibrio (comma shaped) and Spirillum (spiral shaped).
8. Mainly by fission; Production of spores in unfavourable conditions. Sexual reproduction by DNA transfer.
9. Rapid multiplication of dinoflagellates like *Gonyaulax*. Harmful as they release toxins which kill marine animals.
10. Refer 'Points to Remember'.
11. Ascomycetes : Yeast (Unicellular), *Penicillium* (Multicellular), Coprophilous, means fungi which grow on dung.

Short Answers-II

(3 marks each)

12. R.H. Whittaker, Criteria for classification : Cell structure, thallus organisation, mode of nutrition, reproduction and phylogenetic relationships.
13. Saprophytes, Parasites, Symbionts-Lichens and Mycorrhiza.
14. Lichens, Refer 'Points to Remember'

VBQ

(4 marks each)

15. (a) Mushrooms belong to Kingdom Fungi. They are saprotrophic, with cell wall made of chitin-heterotrophs.
(b) Agaricus, Morchella
(c) Scientific attitude, observant, will to disseminate knowledge to younger people.

Long Answers

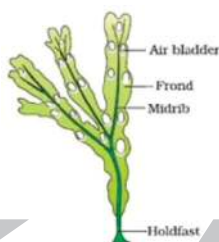
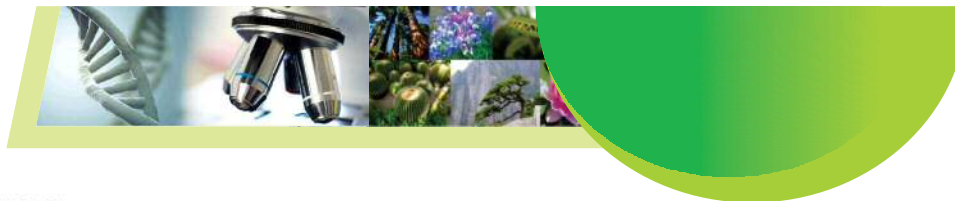
(5 marks each)

16. Protozoans. Refer page no 21-22, NCERT Text Book of Biology for Class XI.
17. Refer NCERT Text Book of Biology for Class XI, Page no. 23-24.
18. Refer NCERT text book of Biology for Class XI Page 23. (Plasmogamy, Karyogamy, Meiosis in zygote, Dikaryophase)

The steps are :

- (i) Plasmogamy : fusion of protoplasm of two motile or non-motile gametes.
- (ii) Karyogamy : fusion of two nuclei.
- (iii) Zygotic Meiosis to form haploid spores.
- (iv) Dikaryophase in ascomycetes and basidiomycetes where before karyogamy two nuclei per cell (dikaryon) are found.





Chapter - 3

Plant Kingdom

Points to Remember

Classification :

- **Artificial System of Classification**
 - By Carolus Linnaeus, based on androecium structure and vegetative characters.
- **Natural System of Classification**
 - Based on natural affinities among organisms
 - Included external as well as *internal features*
 - By Geroge Bentham and J.D. Hooker
- **Phylogenetic System of Classification**
 - Based on evolutionary relationships between the various organisms By Hutchinson

Numerical Taxonomy :

- Carried out using computers
 - Based on all observable characteristics
 - Data processed after assigning number and codes to all the characters.
- Advantages :** Each character gets equal importance and a number of characters can be considered.

Cytotaxonomy :

- Based on *cytological informations*.
- Gives importance to chromosome number, structure and behaviour.

Chemataxonomy :

- Based on Chemical constituents of the plants.

Algae :

- Chlorophyll bearing, simple, thalloid, autotrophic and largely aquatic organisms.

Importance of Algae :

- Help in carbon dioxide fixation by carrying out photosynthesis and have immense economic importance.
- At least half of the total carbon dioxide fixation on earth carried out by them.
- Increases dissolved oxygen level in their environment.
- Many species like *Laminaria*, *Sargassum*, *Porphyra* etc. are used as food.
- *Agar* obtained from *Gelidium* and *Gracilaria* which is used in ice-creams and jellies and to grow microbes.
- *Algin* obtained from brown algae and *carrageen* from red algae used commercially as *hydrocolloids*.
- *Chlorella* and *Spirulina* are unicellular algae, rich in protein and used even by space travellers.
- Algae are unicellular like *Chlamydomonas*, colonial like *Volvox* or or filamentous like *spirogyra* and *Ulothrix*. Occur in water, soil, wood moist stones etc.

Algae are divided into 3 classes.

(i) Chlorophyceae

- Green algae, Main pigment is chlorophyll 'a' and 'b'.
- Cell wall has inner layer of cellulose and outer layer of pectose.
- Has pyrenoids made up of starch and proteins.
- Pigment and pyrenoids are located in *Chloroplast*.
e.g., Chlamydomonas, Volvox, Spirogyra, Ulothrix, Chara.

(ii) Phaeophyceae

- Brown algae are brown coloured due to main pigments chlorophyll 'a', 'c' and fucoxanthin (xanthophyll)
- Cell wall has cellulose with gelatinous coating of algin.
- Has mannitol and laminarin (complex carbohydrate) as reserve food material.
- Body divisible into holdfast, stipe and frond.
- *e.g., Ectocarpus, Fucus, Laminaria, Dictyota, Sargassum*

(iii) Rhodophyceae

- Red algae are red coloured due to pigments chlorophyll 'a', 'd' and r-phycoerythrin.
- Found on surface as well great depths in oceans.
- Cell wall has cellulose.
- Reserve food material is floridean starch.
e.g., Polysiphonia, Porphyra, Gelidium, Gracilaria.

Reproduction in Algae

Vegetative reproduction : by fragmentation

Asexual Reproduction : Flagellated zoospores in Chlorophyceae, Biflagellated zoospores in Phaeophyceae, By non-motile spores in Rhodophyceae.

Sexual Reproduction : Isogamous, anisogamous or oogamous in chlorophyceae and Phaeophyceae.

By non-motile gametes and oogamous in Rhodophyceae.

Bryophytes :

- ‘Amphibians of plant kingdom’.
- Occur in damp, humid and shaded places.
- Lack true roots, stem or leaves.
- Main plant body is haploid and thallus like (prostrate or erect)
- **Economic Importance :** Food for herbaceous animals.

Sphagnum in form of peat is used as fuel and also used as packing material for trans-shipment of living material, as it has water holding capacity.

Prevents soil erosion, alongwith lichens are first colonizers on barren rock.

- Is divided into two classes **Liverworts** (thalloid body, dorsiventral, e.g., *Marchantia*) and **Mosses** (have two stages in gametophyte—creeping, green, branched, filamentous **protonema stage** and the **leafy stage** having spirally arranged leaves e.g., *Funaria*, *Polytrichum* and *Sphagnum*).

Reproduction in Bryophytes

- Vegetative reproduction by fragmentation.
- Asexual reproduction by gemmae formed in gemma cups.
- Sexual reproduction : Main plant body is haploid, produces gametes and so called **Gametophyte**. By fusion of antherozoids produced in antheridium and egg cell produced in archegonium, results in formation of zygote which develops into sporophytic structure differentiated into foot, seta and capsule. **Spores** produced in a capsule germinate to form free-living gametophyte (Protonema). **Sporophyte** is not free living but attached to photosynthetic gametophyte from which derives nutrition.

Pteridophytes :

- First terrestrial plants.
- Prefer cool, damp and shady places to grow.
- Grown as ornamentals.
- Used for medicinal purpose, as soil binder.

- Main plant body is sporophyte which is differentiated into true root, stem and leaves.
- Leaves may be small (microsporophyll) as in *Selaginella* or large (macrophyll) as in ferns.
- Sporangia having spores are subtended by leaf-like appendages called sporophylls. (Sporophylls may be arranged to form strobili or cones.)
- In Sporangia, the spore mother cells give to spores after meiosis.
- Spores germinate to form haploid gametophytic structure called **prothallus** which is free living, small, multicellular and photosynthetic.
- Prothallus bears antheridia and archegonia which bear antherozoids and egg cell respectively which on fertilisation form zygote. Zygote produces multicellular, well differentiated sporophyte.
- The four classes are : Psilopsida (*Psilotum*), Lycopsidea (*Selaginella*), Sphenopsida (*Equisetum*) and Pteropsida (*Pteris*).

Heterospory : Two kinds of spores *i.e.*, large (macro) and small (micro) spores are produced. *e.g.*, *Selaginella* and *Salvinia*.

Seed Habit : The development of zygote into young embryos takes place within the female gametophyte which is retained on parent sporophyte. This event is precursor to seed habit and this is an important step in evolution and is found *Selaginella* and *Salvinia* among the pteridophytes.

Gymnosperms :

- Have naked seeds as the ovules are not enclosed by any ovary wall and remain exposed.
- Includes shrubs and trees (medium and tall sized).
- Have generally tap roots, stem may be unbranched (*Cycas*) or branched (*Pinus*, *Cedrus*), leaves—needle like (*Pinus*) and pinnate (*Cycas*).
- Roots of *Pinus* have fungal association in the form of mycorrhiza.
- *Cycas* have small specialized roots called **coralloid root** which are associated with N_2 fixing cyanobacteria.
- Heterosporous—Produce haploid microspores and megaspores.
- Male cone has microsporophylls which bear microsporangia having microspores which develop into reduced gametophyte called pollengrain.
- Female cone has megasporophylls which bear megasporangia having megaspores which are enclosed within the megasporangium (Nucellus). One megaspore develops into female gametophyte bearing two or more archegonia.

- Pollen grains carried in air currents reach ovules, form pollen tube which reach archegonia and release male gametes which fertilise egg cell and form zygote which produce embryos. Ovules develop into seeds which are not covered.

Angiosperms :

- Called flowering plants and have seeds enclosed in fruits.
- Divided into two classes—Dicotyledons (have two cotyledons) and Monocotyledons (have one cotyledon).
- **Smallest angiosperm** : *Wolffia*
- **Large tree** : *Eucalyptus* (Over 100 meters)
- Stamen has filament and anther. Anthers bear pollen grains. Pollen grains have two male gametes.
- Pistil has stigma, style and ovary. Ovary has ovule in which female gametophyte (embryo sac) develops.
- Embryo sac has 7 cells and 8 nuclei. One egg cell 2 synergids, 3 antipodals and two polar nuclei which fuse to form secondary nucleus.
- Pollen grain is carried by wind, water, insects and other agents reaches to stigma and produces pollen tube which enters embryo sac.
- **Double fertilisation** : One male gamete fuses with egg cell (Syngamy) to form zygote which develops into embryo.

Other male gamete fuses with secondary nucleus (triple fusion) which forms triploid primary endosperm nucleus (PEN). PEN develops into endosperm which nourishes the developing embryo.

- Ovules develop into seeds and ovaries into fruits.

Life Cycle and Alternation of Generations

- Plants complete their *life cycle* in two phase—a diploid *sporophyte phase* and the haploid *gametophyte phase*. These two phase follow each other rigidly. This phenomenon is called *alternation of generations*.
- Life cycle of different plant group/individuals can be of following patterns.
 1. **Haplontic Life Cycle**—Gametophyte phase — longer and dominant (haploid).
Sporophyte phase—Zygote (diploid) stage.
Example—Mostly in Algae (*Volvox*, *Spirogyra*, *Chlamydomonas*)

2. **Diplontic Life Cycle—**

Gametophyte Phase — Short, represented by single to few celled haploid gametophyte (pollen/embryosac)

Sporophyte phase — Longer and dominant (diploid).

Example—All seed bearing plants (gymnosperms & angiosperms) *Fucus*.

3. **Haplo-diplontic life cycle—**(With intermediate condition)

(a) Gametophyte phase — dominant, independent, haploid, thalloid/erect phase.

Sporophyte phase — Totally or partially dependent on gametophyte for anchorage and nutrition (short lived)

Example—Bryophytes

(b) Gametophyte phase — Independent short lived, multicellular haploid, saprophytic/autotrophic.

Sporophyte phase — dominant, diploid, independent vascular plant body.

Example—Pteridophytes

(c) Other examples are *Ectocarpus*, *Polysiphonia*, Kelps.

Questions

Very Short Answer Question

(1 mark each)

1. What is a pyrenoid body ?
2. Define gemma.
3. Which group of plants is regarded as first terrestrial plants ? Why ?
4. Which organism is regarded as one of the tallest tree species ?
5. The gametes and spores of phaeophyceae have a distinct morphology. Give its name.
6. Which substance has structural similarity to floridean starch ?
7. Name the organisms which exhibit heterospory and seed habit.

Short Answer Question-I

(2 marks each)

8. *Sphagnum* has a lot of economic importance. Justify.
9. Gymnosperms can show polyembryony. Why do you think so ?

10. How is leafy stage formed in mosses ? How is it different from protonema ?

Short Answer Question-II

(3 marks each)

11. The leaves in gymnosperms are adapted to withstand xerophytic conditions. Justify.
12. The gametophytes of bryophytes and pteridophytes are different from that of gymnosperms. How ?
13. Roots in some gymnosperms have fungal or algal association. Give examples, their names and role in the plants.
14. Why is presence of water a must for fertilisation in pteridophytes ?

Long Answer Questions

(5 marks each)

15. Draw the life cycle of an angiosperm alongwith a brief note on double fertilisation.
16. Explain alternation of generation in plants.

Answers

Very Short Answers

(1 mark each)

1. Proteinaceous body usually surrounded by starch found in algae.
2. Gemma are green, multicellular, asexual buds which develop in receptacles called as gemma cups.
3. Pteridophytes. As they possess vascular tissues—xylem and phloem.
4. *Sequoia*
5. Pyriform (pear-shaped), bear two laterally attached flagella.
6. Amylopectin and glycogen.
7. *Selaginella* and *Salvinia*.

Short Answers-I

(2 marks each)

8. Provide peat used as fuel : used as packing material for trans-shipment of living material.
9. Have two or more archegonia, so polyembryony can occur.
10. Leafy stage develops from secondary protonema as a lateral bud. Protonema is creeping, green, branched frequently filamentous stage whereas leafy stage is upright with spirally arranged leaves.

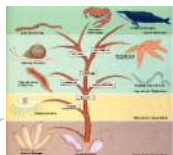
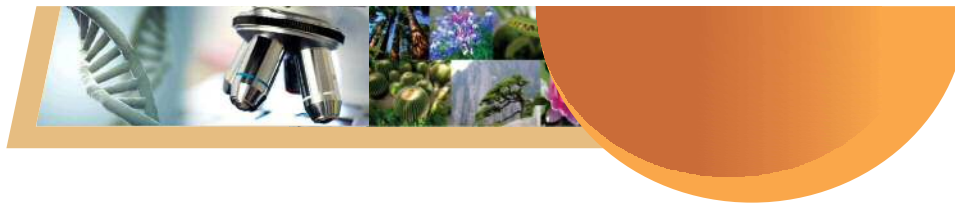
Short Answers-II (3 marks each)

11. Gymnosperms like conifers have : needle shaped leaves to reduce surface area, thick cuticle and sunken stomata to reduce water loss.
12. Male and female gametophyte have free existence in bryophytes and pteridophytes but not in Gymnosperms. They remain within sporangia retained on sporophytes.
13. *Pinus* has fungal association to form mycorrhiza which helps in absorption of water and minerals. *Cycas* has algal association in coralloid roots which are associated with N_2 fixing cyanobacteria.
14. The antheridia produces male gametes, antherozoids which swim in water to reach archegonia, bearing non-motile egg. Thus fertilisation can occur only when water is present in the surrounding medium.

Long Answers (5 mark each)

15. Refer Figure 3.6, page no. 41, NCERT, Text Book of Biology for Class XI.
16. Refer 'Points to Remember' and Page No. 42, NCERT, Text book of Biology for class XI.





Chapter - 4

Animal Kingdom

Point to Remember

Basis of Classification :

Animals are classified on the basis of following few fundamental features—

1. Levels of Organisation :

- (1) Cellular level : Cells are arranged as loose cell aggregates, *e.g.*, sponges.
- (2) Tissue level : The cells performing the same function are arranged into tissues, *e.g.*, Coelenterates.
- (3) Organ level : Tissues are grouped together to form organs, each specialised for a particular function. *e.g.*, platyhelminthes.
- (4) Organ system level : organs are associated to form functional systems *e.g.*, Annelids, Arthropods, Molluscs, Echinoderms and Chordates.

Example : Circulatory System.

Open type : Blood pumped out through heart. Not confined to blood vessels. Cells and tissues are directly bathed in it.

Closed types : Blood is circulated through blood vessels (arteries, veins and capillaries)

2. Symmetry :

- **Asymmetrical :** Cannot be divided into equal halves through median plane *e.g.*, Sponges.
- **Radial symmetry :** Any plane passing through central axis can divide organism into identical halves. *e.g.*, coelenterates, Ctenophores and echinoderms.
- **Bilateral symmetry :** Only one plane can divide the organism into two identical left and right halves *e.g.*, Annelids and Arthropods.

3. Germinal Layers :

Diploblastic : Cells arranged in two embryonic layers *i.e.*, external ectoderm and internal endoderm. (Mesoglea may be present in between ectoderm and endoderm) *e.g.*, porifers and Coelenterates. (Cnidarians)

Triploblastic : Three layers present in developing embryo *i.e.*, ectoderm, mesoderm and endoderm. *e.g.*, Platyhelminthes to Chordates.

4. Coelom (Body cavity which is lined by mesoderm)

Coelomates : Have coelom *e.g.*, Annelids, Arthropods, molluscs, Echinoderms, Chordates etc.

Pseudocoelomates : No true coelom as mesoderm is present in scattered pouches between ectoderm and endoderm. *e.g.*, Aschelminthes.

Acoelomates : Body cavity is absent *e.g.*, Platyhelminthes.

5. Segmentation (A) True Metamerism : Found Annelida, Arthropoda, Chordata :

- Segmentation is external as well as a internal in Annelids.
- Segmentation is external in Arthropods.
- Segmentation is internal in chordates.
- **Metamerism** : If body is externally and internally divided into segments (metameres) with serial repetition of atleast some organs, then phenomenon is called metamerism *e.g.*, Earthworm. (B) Pseudometamerism : Found in tapeworm. The proglottids (segments of tapeworm) budded off from neck not emryonic in origin.

6. Notochord :

- Rod-like structure formed during embryonic development on the dorsal side. It is mesodermally derived *e.g.*, Chordates.
- Non-chordates do not have notochord *e.g.*, porifera to echinoderms.

Phylum Porifera :

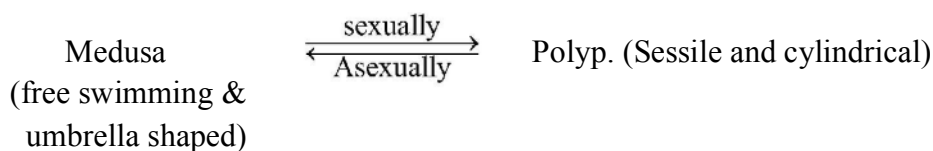
- Also called sponges.
- Are usually marine and asymmetrical.
- Have cellular level of organisation and diploblastic animals.
- Food gathering, respiratory exchange and removal of wastes occurs through water canal system. Digestion intracellular.
- Ostia (minute pores on body), spongocoel (body cavity) and osculum help in water transport. They are lined by choanocytes (collar cells).
- *Body wall* has skeleton of spicules or spongin fibres.
- Animals are hermaphrodite. Fertilisation internal. Development is indirect (*i.e.*, has a larval stage distinct from adult stage) *e.g.*, ***Sycon*, *Euspongia*, *Spongilla*** (Fresh water sponge)

Phylum Coelenterata :

- Also called Cnidarians.
- Are usually marine and radially symmetrical.
- Sessile or free swimming.



- Have tissue level of organisation.
- Are diploblastic (with mesogloea)
- Capture of prey, anchorage and defence occurs through cnidoblasts/cnidocytes (have stinging capsules nematocytes) present on tentacles.
- Digestion extracellular and intracellular.
- Have a central gastro-vascular cavity and an opening, hypostome.
- Body wall of some composed of calcium carbonate. e.g. corals.
- exhibit two body forms : polyp and medusa e.g., *Hydra, Aurelia*.
- Alternation of generation between body forms called **metagenesis** occurs in *Obelia* where :



- e.g., *Physalia, Adamsia, Pennatula, Gorgonia, Meandrina*.

Phylum Ctenophora :

- Also called as sea walnuts or comb jellies.
- Are exclusively marine, radially symmetrical.
- Have tissue level organisation, are diploblastic.
- Digestion both extra and intracellular.
- Body has eight external rows of ciliated comb plates for locomotion.
- Show Bioluminescence (Property of living organisms to emit light).
- Hermaphrodite (sexes are not separate).
- Only sexual reproduction occurs. External fertilization. Indirect development.
e.g., *Ctenoplana, Pleurobrachia*.

Phylum Platyhelminthes :

- Also called as 'flat worms'.
- Have dorsoventrally flattened body. Are mostly endoparasites in animals.
- Are bilaterally symmetrical, triploblastic, acoelomate, with organ level of organisation.
- Absorb nutrients through body surface.
- Parasitic forms have hooks and suckers.
- 'Flame cells' help in osmoregulation and excretion.

- Sexes not separate.
- Fertilisation internal. Many larval stages present. *Planaria* has high regeneration capacity. e.g., *Taenia*, *Fasciola*.

Phylum Aschelminthes :

- Also called 'round worms'.
- May be free living, parasitic, aquatic or terrestrial.
- Are bilaterally symmetrical, triploblastic, pseudocoelomate.
- Alimentary canal complete (has muscular pharynx), wastes removed through excretory pore.
- Sexes separate. (dioecious)
- Females longer than males.
- Fertilisation internal. Development direct or indirect. e.g., *Ascaris*, *Wuchereria*, *Ancylostoma*.

Phylum Annelida :

- Are aquatic or terrestrial, free-living or parasitic.
- Are bilaterally symmetrical, triploblastic, organ-system level of organisation and metamerically segmented body.
- Are coelomate animals.
- Have longitudinal and circular muscles for locomotion.
- Have closed circulatory system.
- *Nereis* (dioecious and aquatic annelid) has lateral appendages called parapodia for swimming.
- Have nephridia for osmoregulation and excretion.
- Neural system consists of paired ganglia connected by lateral nerves to a double ventral nerve cord.
- Reproduction is sexual.
- e.g., Earthworm (*Pheretima*) and Leech (*Hirudinaria*) which are hermaphrodites (*i.e.*, **monoecious**).

Phylum Arthropoda :

- Largest phylum of Animalia.
- Are bilaterally symmetrical, triploblastic, segmented externally and organ system level of organisation, coelomate.
- Body divisible into head, thorax, abdomen and has a chitinous exoskeleton. Jointed appendages are present.



- Respiration by gills, book gills, book lungs or tracheal system. Excretion through **malpighian tubules**.
- Sensory organs : Antennae, eyes; Organs of balance : **Statocysts**.
- Fertilisation usually internal. Development is indirect or direct. Are mostly oviparous.
e.g., Apis, Bombyx, Laccifer, Anopheles, Culex, Aedes, Locusta, Limulus.

Phylum Mollusca :

- Second largest phylum of Animalia.
- Terrestrial or aquatic
- Are bilaterally symmetrical, triploblastic and organ system level of organisation, coelomate.
- Body visible into **head, muscular foot and visceral hump** and is covered by calcareous shell and is unsegmented.
- **Mantle** : Soft and spongy layer of skin; **Mantle cavity** : Space between visceral hump and mantle.
- Respiration and excretion by feather like gills in mantle cavity.
- Head has sensory tentacles. Radula-file like rasping organ for feeding in mouth.
- Are oviparous, dioecious, have indirect development.
e.g., Pila, Pinctada, Octopus, Sepia, Loligo, Aplysia, Dentalium, Chaetopleura.

Phylum Echinodermata :

- Are spiny bodied organisms with endoskeleton of calcareous ossicles.
- Are exclusively marine, **radially symmetrical** in **adult** but **bilaterally symmetrical** in **larval stage**. Organ system level of organisation.
- Triploblastic and coelomate.
- Digestive system complete. Mouth ventral, Anus on dorsal side.
- Food gathering, respiration, locomotion carried out by **water vascular system**.
- Excretory system is absent.
- Reproduction—sexual, sexes are separate.
- Fertilisation external. Development indirect (free swimming larva)
- *e.g., Asterias, Cucumaria, Antedon, Echinus, ophiura.*

Phylum Hemichordata :

- Represents small group of worm-like organisms.
- Was earlier placed as sub-phylum of Phylum Chordata.

- Bilaterally symmetrical, triploblastic and coelomate with organ system level of organisation.
- Body cylindrical, has proboscis, collar and trunk.
- Circulatory System—open.
- Respiration by gills, excretion by proboscis gland.
- Sexes separate, external fertilisation, indirect development.
e.g., Balanoglossus, saccoglossus.

Phylum Chordata :

- Presence of *Notochord*.
- Have *dorsal hollow nerve chord*.
- Have *paired pharyngeal gill slits*.
- Bilaterally symmetrical, triploblastic, coelomate, organ system level of organisation.
- Heart is ventral.
- Post anal tail present, closed circulatory system.

(i) Sub-Phyla Urochordata /Tunicata

- Notochord present only in larval tail.
e.g., Ascidia, Salpa, Doliolum

(ii) Sub-phyla Cephalochordata

- Notochord extends from head to tail (Persistent)
e.g., Amphioxus.

(iii) Sub-Phyla Vertebrata

- Have notochord only during embryonic period.
- Notochord gets replaced by bony or cartilaginous vertebral column.
- Have ventral muscular heart, kidneys for excretion and osmoregulation, paired appendages (fins or limbs)

Vertebrata have two Division :

(a) Agnatha (Lacks Jaw) : Class : Cyclostomata

- Live as ectoparasites on some fishes.
- Have sucking and circular mouth without jaws.
- Have 6-15 pairs of gill slits for respiration.
- No scales, no paired fins.
- Cranium and vertebral column is cartilaginous.



- Marine, Migrate to fresh water for spawning and die after spawning.
- Larva returns to ocean after metamorphosis.

e.g., Petromyzon, Myxine

(b) Gnathostomata (Bear Jaws)—divides into two super classes :

Super-class : Pisces

1. Class : Chondrichthyes :

- Have cartilaginous endoskeleton, are marine with streamlined body.
- Mouth ventral.
- Gill slits without operculum (gill cover).
- Skin has placoid scales; jaws—very powerful.
- No air bladder, so swim constantly to avoid sinking.
- Teeth are backwardly directed, modified placoid scales.
- Notochord is persistent throughout life.
- Two chambered heart; poikilotherms (cold-blooded)
- Sexes separate; males have *claspers* on pelvic fins.
- Internal fertilisation; viviparous.

e.g., Tarpedo, Trygon, Scoliodon, Pristis, Carcharodon

2. Class : Osteichthyes

- Have bony endoskeleton, Aquatic
- Mouth is usually terminal. Body-Streamlined
- Four pairs of gill slits covered by operculum, heart two chambered, cold blooded.
- Skin has cycloid/ctenoid scales.
- Have air bladder which regulates buoyancy.
- Sexes separate.
- Usually oviparous, fertilisation external.
- Development direct.
- *e.g., Hippocampus, Labeo, Catia, Betla, Clarias, Exocoetus*

Sub-Phylum Vertebrata : Gnathostomata

Super Class : Tetrapoda

1. Class : Amphibia

- Can live in aquatic as well as terrestrial habitats.
- Body divisible into head and trunk, paired limbs.
- Skin moist. No scales.

- Tympanum represents ear. Eyes have eyelids.
- Cloaca is the common chamber where alimentary canal, urinary and reproductive tracts open.
- Respiration by gills, lungs or skin.
- Heart is 3-chambered; cold-blooded; Sexes separate; fertilisation external.
- Oviparous. Indirect development.
- *e.g., Bufo, Rana, Hyla, Salamandra, Ichthyophis*

2. Class : Reptilia

- Creep or crawl to locomote. Mostly terrestrial.
- Body has dry and cornified skin and epidermal *scales or scutes*.
- Tympanum represents ear.
- Limbs, when present, are two pairs
- Snakes and lizards shed, scales as *skin cast*.
- Heart 3-chambered but 4-chambered in crocodiles.
- Sexes Separate; fertilisation internal.
- Oviparous. Direct development.
- *e.g., Testudo, Naja, Vipera, Calotes, Crocodilus, Hemidactylus*

3. Class : Aves

- Presence of feathers except flightless birds and beak (modified jaws) without teeth.
- Forelimbs are modified into wings.
- Hind limbs have scales, modified for walking, swimming or clasping.
- Skin is dry as no glands on skin except oil gland (preen gland) at base of tail.
- Endoskeleton bony with air cavities (pneumatic) and hollow bones to assist in flight.
- Crop and Gizzard—Additional chamber in digestive tract.
- Air sacs are connected to lungs to supplement respiration.
- Warm blooded (homeothermous), Heart—Four chambered.
- Oviparous. Direct development.
- *e.g., Columba, Struthio, Pavo, Corvus, Neophron, Psittacula Aptenodytes*.

4. Class : Mammalia

- Have mammary glands to nourish young ones.
- Have two pairs of limbs, adapted to perform special work.
- Skin has hairs.



- External ears or, pinna present.
- Different types of teeth in jaw.
- Homoiothermous; Heart–Four chambered, Lungs for respiration.
- Sexes are separate, fertilisation internal.
- Viviparous. Direct development.
- e.g., *Rattus*, *Canis*, *Elephas*, *Equus*. Oviparous mammal is *Ornithorhynchus*.

Questions

Very Short Answer Questions (1 mark each)

1. What is mesogloea ? Where is it found.
2. When is the development of an organism called as Indirect ?
3. Why are corals important ?
4. What is the difference between class Amphibia and class Reptilia in respect of their skin ?
5. Which phylum consists of organisms with cellular level of organisation ?
6. Name the arthropod which is a (i) Living fossil, (ii) Gregarious pest.
7. Which organ helps in excretion in (i) Arthropods, (ii) Hemichordates ?

Short Answer Questions-I (2 marks each)

8. Distinguish between poikilothermous and homoiothermous organisms.
9. Define metagenesis with a suitable example.
10. List the characteristic features of class Mammalia.

Short Answer Questions-II (3 marks each)

11. What is the difference between organisms on the basis of the coelom ? Give examples for each.
12. Compare the water transport (vascular) system of poriferans and the echinoderms.
13. What are the features of class Aves which help them in flying ?

Long Answer Questions (5 marks each)

14. Distinguish between the chordates and non-chordates.
15. Differentiate between class Chondrichthyes and class Osteichthyes.

Answers

Very Short Answers

(1 mark each)

1. Undifferentiated layer present between ectoderm and endoderm. It is found in Coelenterates.
2. Have a larval stage morphologically distinct from adult.
3. Have skeleton composed of calcium carbonate which gets deposited and can lead to formation of land forms, e.g., Lakshadweep (a coral island).
4. **Class Amphibia** : Have moist skin without scales.
Class Reptilia : Have dry cornified skin with scales.
5. Phylum Porifera.
6. (i) *Limulus* (King crab), (ii) *Locusta* (Locust)
7. (i) Malpighian tubules, (ii) Proboscis gland.

Short Answers-I

(2 marks each)

8. **Poikilothermous** (cold blooded); Lack ability to regulate their body temperature.
Homoiothermous (Warm) : Can regulate body temperature.
9. Refer 'Points to Remember'.
10. Refer 'Points to Remember'.

Short Answers-II

(3 marks each)

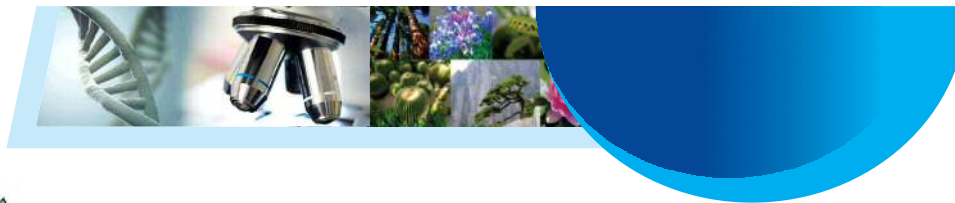
11. Refer 'Points to Remember'.
12. Refer 'Points to Remember, NCERT, Text Book of Biology for Class XI.
13. Wings, bones long and hollow with air cavities, air sacs connected to lungs to supplement respiration.

Long Answers

(5 marks each)

14. Refer Table 4.1, page 55, NCERT, Text Book of Biology for Class XI.
15. Refer 'Points to Remember'.





Chapter - 5

Morphology of Flowering Plants

Points to Remember

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

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

Internal Morphology : Further divided into anatomy and histology.

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

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

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

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

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

Main functions of root system :

1. Absorption of water and minerals from the soil.
2. Provides anchorage to plant parts.
3. Stores reserve food material and synthesises plant growth regulators (cytokinins)

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

Regions of Roots

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

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

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

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

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

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

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

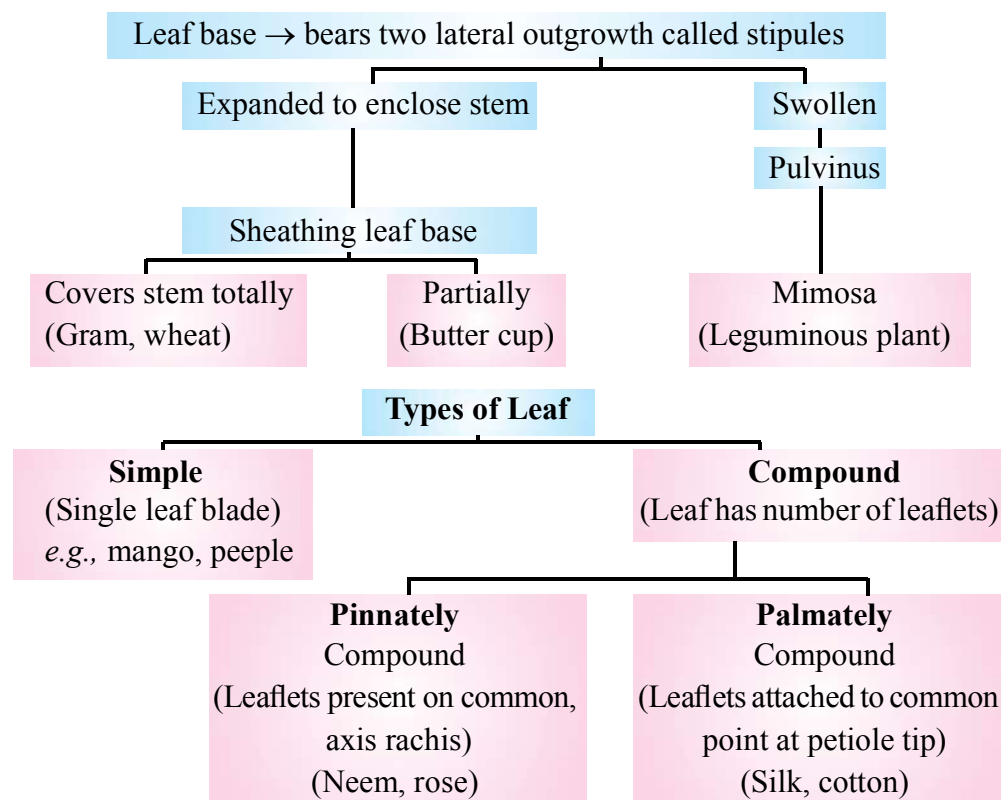
Functions of stem : Exposure of leaves, conduction of water and minerals, translocation of food, exposure of flowers and fruits.

Modifications of Stem :

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

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

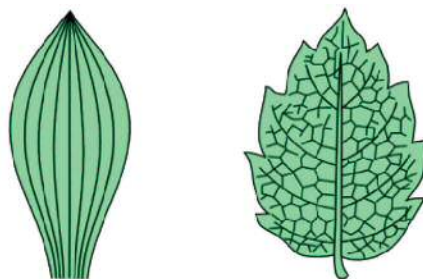
The Leaf : Develops from shoot apical meristem, flattened, green structure acropetally arranged manufacture the food by photosynthesis. It has bud in axil. A typical leaf has *leaf base*, *petiole* and *lamina* (leaf blade). In some leguminous plants the leaf base may become swollen which is called as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



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

Types of Venation :

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



1. Reticulate

2. Parallel

Types of Venation

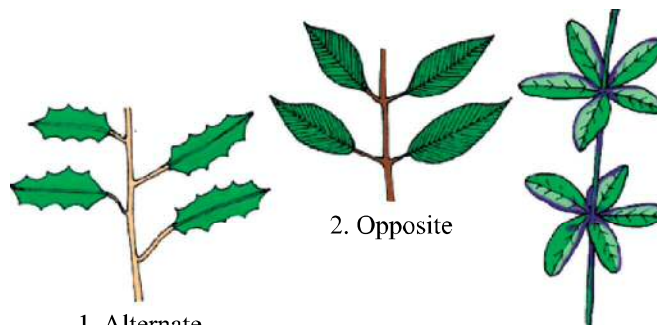
Phyllotaxy : The pattern of arrangement of leaves on the stem or branch.

Types of phyllotaxy

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

Functions of Leaf

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



1. Alternate

2. Opposite

3. Whorled

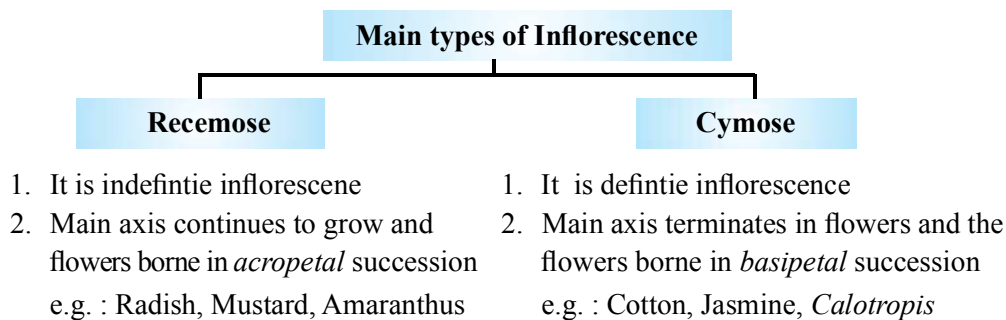
Types of Phyllotaxy

Modifications of Leaves :

Type	Function	Example
● Tendrils	: (Climbing)	— Sweet Pea, Pea
● Spines	: (Protection)	— <i>Aloe, Opuntia, Argemone</i>
● Pitcher	: (Nutrition)	— <i>Nepenthes</i>
● Hook	: (Support)	— Cat's nail
● Fleshy Leaves	: (Stored food)	— Onion and Garlic

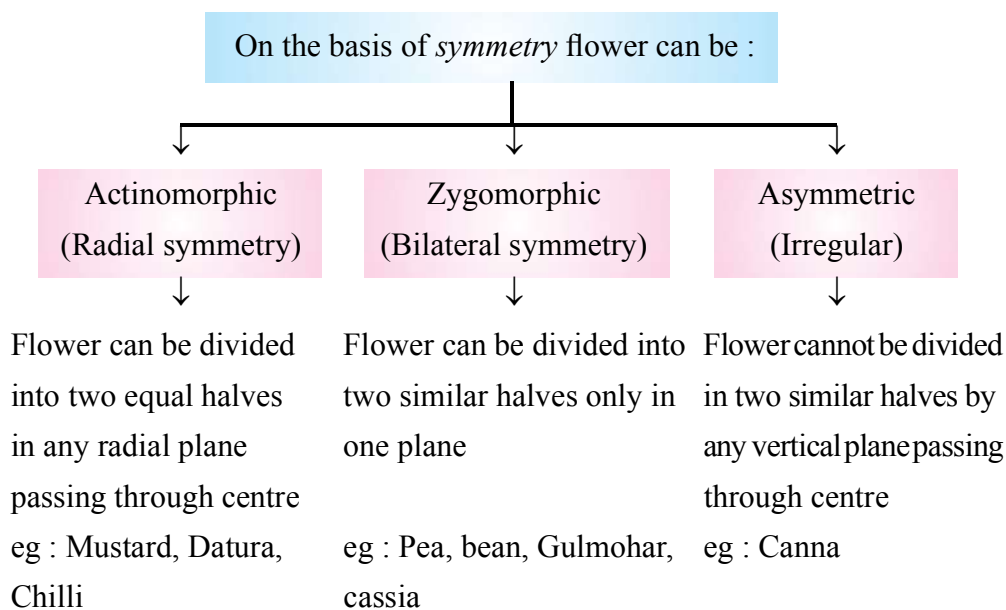
Inflorescence : The arrangement of flowers on the floral axis (Peduncle)

Main types of Inflorescence



Special Inflorescence type—Ficus, Salvia, Euphorbia, Sunflower

Flower—Modified shoot meant for reproduction



On the basis of *floral appendages* flower can be :

Trimerous
(multiples of 3)

Tetramerous
(multiples of 4)

Pentamerous
(multiples of 5)

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

of *position of Calyx, corolla and androecium*

Hypogynous
(Superior Ovary)

Perigynous
(Half inferior ovary)

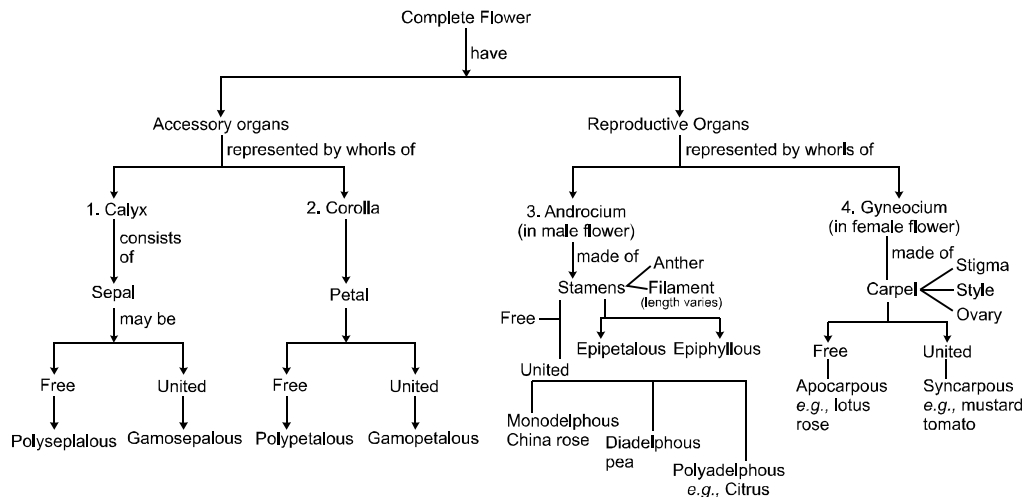
Epigynous
(inferior ovary)

Mustard, China rose,
Brinjal

Plum, Rose, Peach
Plum, Rose, Peach

Guava, Cucumber
ray florets (sun flower)

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



Flower can be

Bisexual
if have both Androecium
and Gynoecium

Unisexual

have only
Androecium/Stamen

have only Gynoecium
Carpel

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

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

Example : Lily

Aestivation: The mode of arrangement of sepals or petals in floral bud.

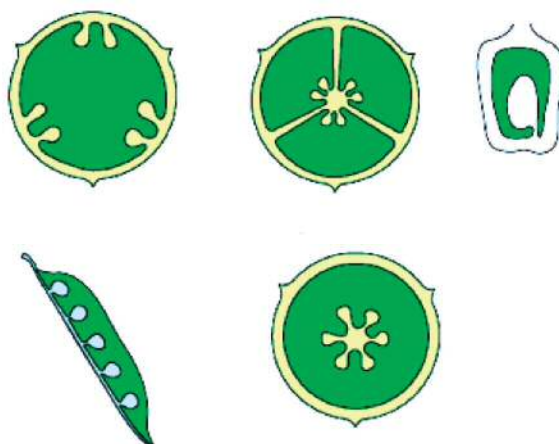
Types of aestivation :

1. **Valvate** : Sepals or petals just touch one another at the margin, without overlapping. *e.g.*, *Calotropis*
2. **Twisted** : Sepals or petals overlap the next sepal or petal *e.g.*, China rose, Cotton, lady's finger.
3. **Imbricate** : The margins of sepals or petals overlap one another but not in any definite direction, *e.g.*, *Cassia*, Gulmohar.
4. **Vexillary** : The largest petal overlaps the two lateral petals which in turn overlap two smallest anterior petals, *e.g.*, Bean, Pea.

Placentation : The arrangement of ovules within the ovary.

Types of Placentation :

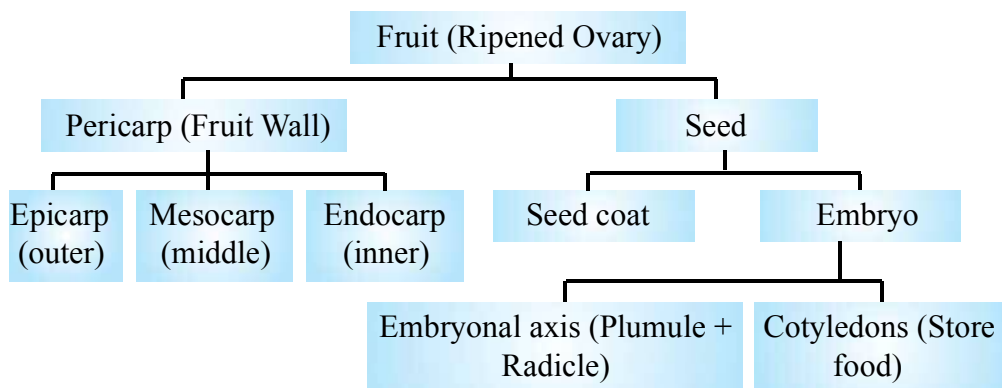
1. **Marginal** : Placenta forms a ridge along the ventral suture of ovary, *e.g.*, Pea.
2. **Axile** : Margins of carpels fuse to form central axis, *e.g.*, China rose, Tomato, Lemon
3. **Parietal** : Ovules develop on inner wall of ovary, *e.g.*, Mustard, *Argemone*
4. **Free central** : Ovules borne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



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

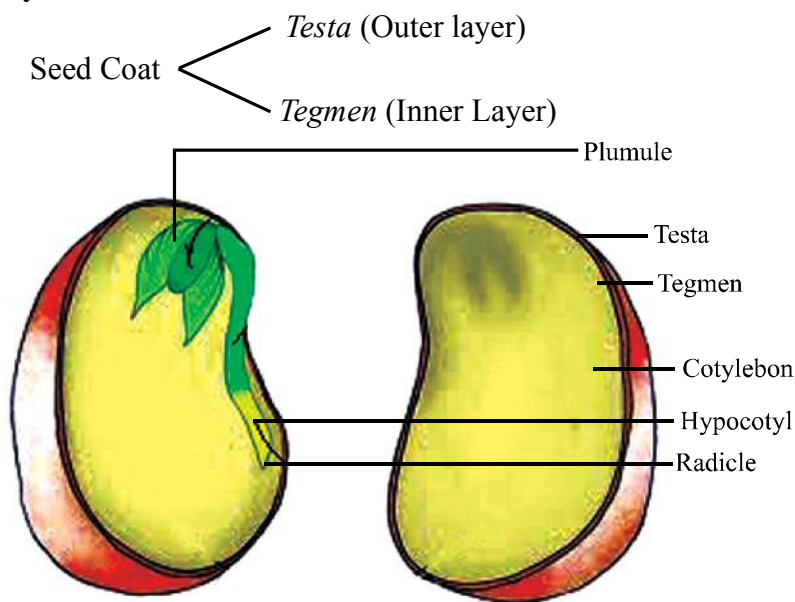
Placenta : Parenchymatous flattened cushion inside ovary where ovules are borne.

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



Monocotyledonous seed—Endosperm bulky and stores food, covered by proteinaceous *Aleurone layer*. Seed has single large cotyledon—*scutellum*. Plumule is enclosed in Coleoptile and Radicle is enclosed in Coleorrhiza.

Dicotyledonous Seed—



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

Microphyte—small pore, above hilum

Cotyledons—two; freshly, full of preserve food materials

Embryonal axis—Radicule and plumule.

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

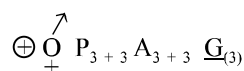
Non-endospermous seed—endosperm not present in mature seeds, eg. bean,

Questions

Very Short Answer Question

(1 mark each)

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



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

Short Answer Questions-I

(2 marks each)

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

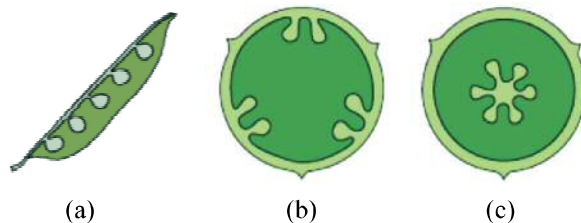
Type of flower	Position of calyx, corolla and respect of the ovary on thalamus	Type of ovary
Hypogynous	..... (a)	Superior
Perigynous	On the rim of the thalamus almost at the same level of ovary.	.....(b).....
..... (c) .....	..... (d)	Inferior

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

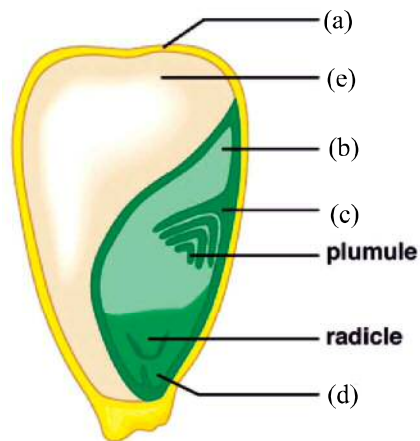
Short Answer Question-II

(3 marks each)

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



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



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

Long Answer Questions (5 marks each)

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

Answers

Very Short Answers

(1 mark each)

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

Short Answers-I

(2 marks each)

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

Short Answers-I

(3 marks each)

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

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

Short Answers SA-II

(3 marks each)

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

China rose – twisted

Calotropis – valvate

Gulmohar – imbricate

Pea – vexillary

22. Type of phyllotaxy

- (i) Alternate
- (ii) Opposite
- (iii) Whorled

Examples

China rose, mustard
Calotropis, guava
 Nerium, *Aistonia*

23. (a)	Actinomorphic Flower	Zygomorphic flower
	(1) Two equal halves are formed by any vertical division passing through the centre.	(1) Two equal halves are produced only by one vertical division
	(2) It has a radial symmetry.	(2) It has a bilateral symmetry.
(b)	Apocarpous Ovary	Syncarpous Ovary
	(1) The flower has several free carpels (ovary).	(1) The flower has fused carpels.
	(2) On maturity it forms fruitlet of aggregate type.	(2) On maturity it forms a single fruit.
(c)	Racemose inflorescence	Cymose inflorescence
	(1) The main axis has unlimited growth.	(1) The main axis has a limited growth.
	(2) Flowers are arranged acropetally <i>i.e.</i> , the lower flower are younger	(2) Flowers are arranged basipetally <i>i.e.</i> , the lower flowers are older

24. (a) Endosperm

(c) Coleoptile

(e) Aleurone layer

(b) Scutellum

(d) Coleorrhiza

Function of (a)—Provide nutrition.

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

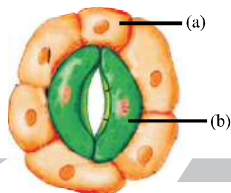
Long Answers

(5 marks each)

26. Stem Modification :

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





Chapter - 6

Anatomy of Flowering Plants

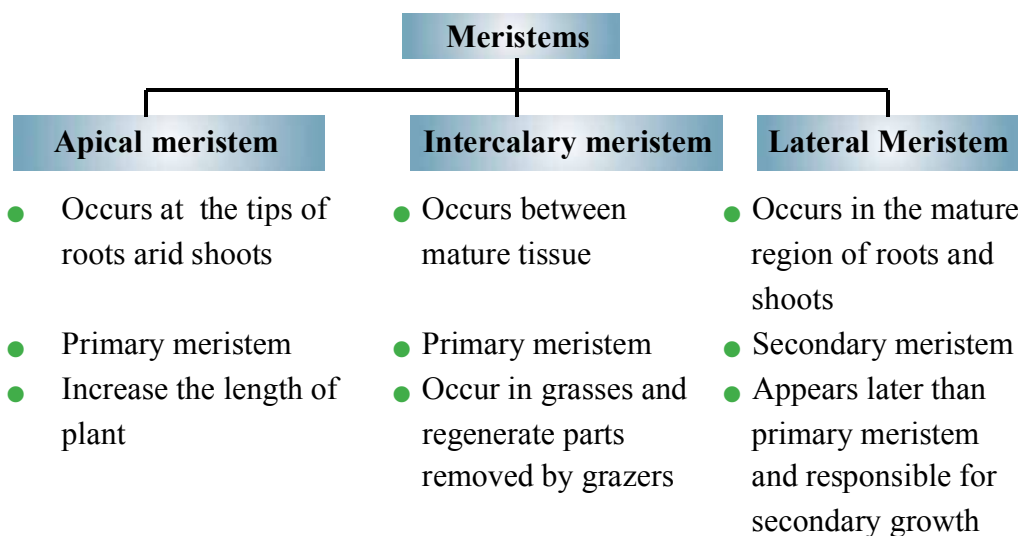
Points to Remember

Anatomy : Anatomy is the study of internal structure of organisms. Plant anatomy includes organisation and structure of tissues.

Tissue is a group of cells having a common origin and usually performing a common function.

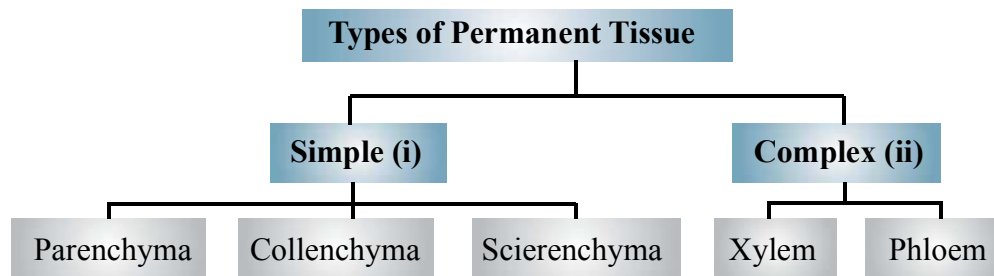
There are two types of tissues (i) Meristematic (ii) Permanent

Meristematic tissues : The meristematic tissue is made up of the cells which have the capability to divide. Meristems in plants are restricted to a specialised regions and responsible to the growth of plants.



Axillary bud : The buds which are present in the axils of leaves (Consist of cells left behind from shoot apical meristem) and are responsible for forming branches of flowers.

Permanent tissues : The permanent tissues are derived from meristematic tissue, are composed of cells, which have lost the ability to divide and have become structurally and functionally specialised.



Parenchyma : Living, thin walled isodiametric cells, with intercellular spaces, cell wall is made up of cellulose. It performs the functions like photosynthesis, storage, secretion.

Collenchyma : It is formed of living, closely packed cells. Its cells are thickened at the corners due to deposition of cellulose and pectin. It provides mechanical support to the growing parts of the plant. It is either found in homogenous layer or patches.

Sclerenchyma : It is formed of dead cells with thick and lignified walls. Provide mechanical support to organs. They have two types of cells : fibres and sclereids.

(a) Fibers—are thick walled, elongated and pointed cells.

(b) Sclereids—are spherical, oval or cylindrical, highly thickened dead cells with narrow lumen. Found in walls of nut, pulp of fruits like guava, seed coat of legumes and leaves of tea.

Xylem : Xylem consists of tracheids, vessels, xylem fibres and xylem parenchyma. It conducts water and minerals from roots to other parts of plant.

(a) Tracheids—Tube like cells with thick and lignified walls and tapering ends; dead, without protoplasm.

(b) Vessel—long cylindrical structure made up of many cells with large central cavity, devoid of protoplasm. Present in angiosperms.

(c) Xylem fibres—highly thickened walls; with obliterated lumens; septate or aseptate.

(d) Xylem parenchyma—living and thin walled; cell walls made up of cellulose, store food material in form of starch or fat.

Radial conduction of water takes place by ray parenchymatous cells

Protoxylem : The first formed primary xylem elements.

Metaxylem : The later formed primary xylem.

Endarch : Protoxylem lies towards the centre and metaxylem towards the periphery of the organ; in stem

Exarch : Protoxylem toward periphery and metaxylem towards centre; in roots.

Phloem : Phloem consists of sieve tube elements, companion cells, phloem fibres and phloem parenchyma; Phloem transports the food material from leaves to various parts of the plant.

(a) Sieve tube elements :

- long tube like structures arranged longitudinally.
- associated with companion cells.
- end walls are perforated to form sieve plates.
- functions of sieve tubes are controlled by the nucleus of companion cells.

(b) Companion cells

- Specialised parenchymatous cells associated with sieve tube elements
- Connected with sieve tube elements by pit fields present between their common longitudinal walls
- help maintain pressure gradient in sieve tubes.

(c) Phloem Parenchyma

- made up of elongated, tapering cylindrical cells with dense cytoplasm and nucleus.
- cell wall made of cellulose with pits through which plasmodesmata connections exist between cells.
- store food material.

(d) Phloem fibers (bast fibers)

- are sclerenchymatous; absent in primary phloem but present in secondary phloem.
- elongated, unbranched pointed, needle like apices with thick cell walls.

Protophloem : First formed phloem with narrow sieve tubes.

Metaphloem : Later formed phloem with bigger sieve tubes.

The Tissue System :

- 1. Epidermal tissue system** : It includes cuticle, epidermis, epidermal hairs, root hairs, trichomes and stomata.

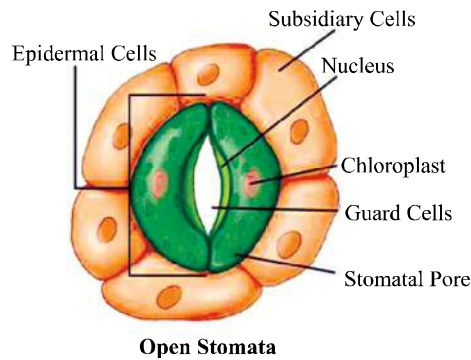
The Tissue System :

- (1) Epidermal tissue system : It includes.

- (a) Cuticle—Waxy thick layer outside epidermis, prevents the loss of water.
- (b) Epidermis : Outer most layer of primary plant body.
- (c) Epidermal hair : help in absorbing water and mineral from soil.
- (d) Trichomes : help in preventing water loss due to transpiration.

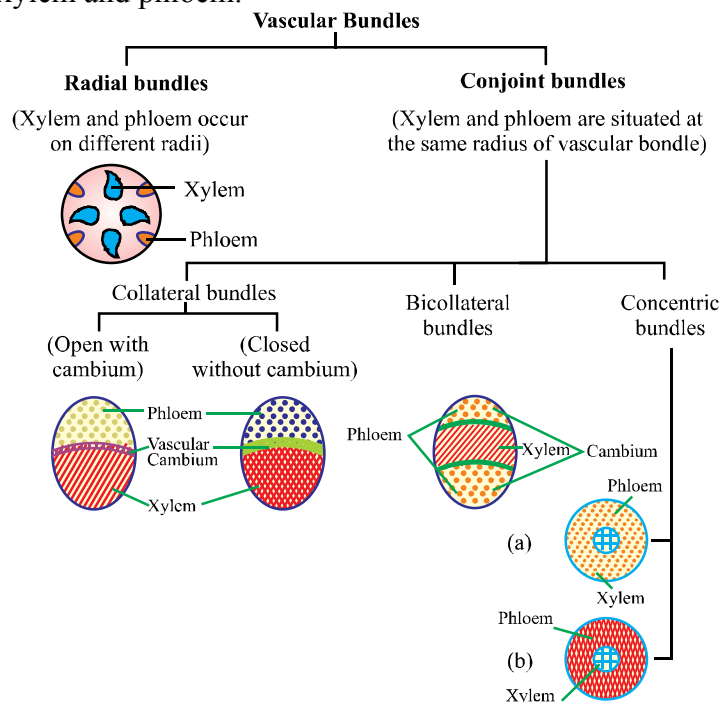
(e) Stomata : Regulate process of transpiration and gaseous exchange.

Stomatal apparatus : The stomatal aperture, guard cells and surrounding subsidiary cells are together called stomatal apparatus.



Casparian Strips : The Tangential as well as radial walls of endodermal cells of dicot roots have deposition of water impermeable, waxy material—Suberin in the form of casparian strips.

- The ground tissue system** : It is made up of parenchyma, collenchyma, sclerenchyma. In dicot stems and roots (both monocots and dicots) the ground tissue is divided into hypodermis, cortex, endodermis, pericycle, medullary rays and pith.
- The vascular tissue system** : It includes vascular bundles which are made up of xylem and phloem.



Anatomy of Root

Dicot Root	Monocot Root
<ol style="list-style-type: none"> 1. Cotext is comparatively narrow. 2. Endodermis is less thickened casparian strips are more prominent. 3. The xylem and phloem bundles varies from 2 to 5. 4. Pith is absent or very small. 5. Secondary growth takes place with the help of vascular cambium and cork cambium. 	<ol style="list-style-type: none"> 1. Cortex is very wide. 2. Endodermal cells are highly thickened Casparian strips are visible only in young roots. 3. Xylem and phloem are more than 6 (polyarch). 4. Well developed pith is present. 5. Secondary growth is absent.

Casparian Strips—The tangential as well as radial walls of endodermal cells of dicot roots have deposition of water impermeable, waxy material, suberin in the form of casparian strips.

Antomy of Stem

Dicot Stem	Monocot Stem
<ol style="list-style-type: none"> 1. The ground tissue is differentiated into cortex, endodermis, pericycle and pitch 2. The vascular bundles are arranged in a ring. 3. Vascular bundles are open, without surrounded bundle sheath and wedge-shaped outline. 4. The stem shows secondary growth due to presence of cambium between xylem and phloem. 	<ol style="list-style-type: none"> 1. The ground tissue is made up of similar cells. 2. The vascular bundles are scattered throughout the ground tissue. 3. Vascular bundles are closed, by sclerenchymatous bundle sheath, oval or rounded in shape. 4. Secondary growth is absent.

Secondary growth dicot stem—An increase in the girth (diameter) in plants. Vascular cambium and cork cambium (laternal meristems) are involved in secondary growth.

1. Formation of cambial ring : Intrafascicular cambium + interfascicular cambium.
2. Formation of secondary xylem and secondary phloem from cambial ring.
3. Formation of spring wood and autumn wood.
4. Development of cork cambium(phellogen)

Cork Cambium (Phellogen) — { Cork (phellem) – From outer cells
 Sec. cortex (phelloderm) – from inner cells
 (Phellogen + Phellem + Phelloderm) = Periderm

Secondary growth in dicot roots : Secondary growth in dicot root occurs with the activity of secondary meristems (vascular cambium). This cambium is produced in the stele and cortex, and results in increasing the girth of dicot roots.

Anatomy of Leaf

Dorsiverntal (Dicot) Leaf	Isobilateral (monocot) Leaf
1. Stormata are absent or less abundant on the upper side.	1. The somtata are equally distributed on both sides.
2. Mesophyll is differntiated into two parts upper palisade parenchyma and lower spongy parenchyma.	2. Mesophyll is undifferentiated.
3. Bunldle sheath is single layered and formed of colourless cells.	3. Bundle sheath may be single or double layered.
4. Hypodermis of the mid-rib region, is collenchymatous.	4. Hypodermis of the mid-rib region is sclerenchymatous.
5. Stomata have kidney shaped guard cells.	5. Stomata have dumb bell shaped guard cells.

Spring Wood	Autumn Wood
1. Also called early wood.	1. Also called late wood
2. Cambium is active	2. Cambium less active
3. Xylary elements more	3. Xylary elements less
4. Vessels with wide cavities	4. Vessels narrow
5. Light in colour, low density	5. Dark, high denisty

Heartwood	Sapwood
<ol style="list-style-type: none"> 1. Central or innermost region of stem which is hard, durable and resistant to attack of Microorganisms and insects. 2. Not involved in conduction of water, gives mechanical support to stem 	<ol style="list-style-type: none"> 1. Peripheral region stem, light in colour 2. Involved in conduction of water and mineral

Lenticels—Produced when phellogen cuts off parchymatous cells on outer side. These cells rupture the epidermis forming lens shaped opening called lenticels.

Function—Permit exchange of gases.

Bulliform Cells—Large, empty, colourless adaxial cells with vein in leaves which maintain turgidity of leaves.

Questions

Very Short Answer Question

(1 mark each)

1. Name the tissue represented by the jute fibres used for making the ropes.
2. Which kind of roots have polyarch vascular bundles ?
3. Write the significance and location of heart wood.
4. State the role of pith in stem.
5. Where are bulliform cells found in leaves ?
6. Why are xylem and phloem called complex tissues ?
7. Which meristem is responsible for longitudinal growth in plants ?
8. What forms the cambial ring in a dicot stem during the secondary growth ?
9. Name the anatomical layer in the root from which the lateral branches of root originate.
10. Which tissue of the leaf contains chloroplast ?
11. A plant tissue when stained, showed the presence of hemicellulose and pectin in cell wall of its cells. Name the tissue.
12. Write the function of phloem parenchyma.
13. Name the cells which make the leaves curl in plants during water stress.
14. Give the function of lenticels.

15. The vascular bundles are surrounded by a thick layer of cells in leaves. What is the name of cells ?
16. Mention the significance of casparian strips. Where do you find them ?
17. Give the function of companion cells.

Short Answer Questions (SA-I) (2 marks each)

18. Why is cambium considered to be lateral meristem ?
19. Give any four differences between tracheids and vessels.
20. How are open Vascular bundles differ from closed vascular bundles ?
21. What are trichomes ? State their functions.
22. Give below are the various types of tissue and their functions. Which out of these is not a matching pair and why;

(a) Collenchyma :	provides mechanical support to the growing parts of plant.
(b) Sclerenchyma :	photosynthesis, storage and secretion.
(c) Chlorenchyma :	perform the function of photosynthesis
(d) Xylem :	conduction of water and minerals.
23. In which part of the plant you would see the following :

(a) Radial vascular bundle	(b) Well developed pith
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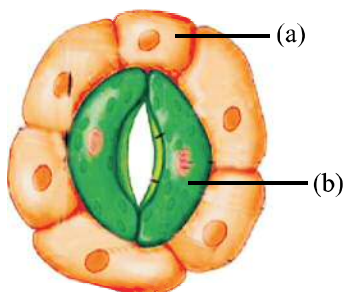
Short Answer Question (SA-II) (3 marks each)

24. Give the points of difference between lenticels and stomata.
25. Even being a monocotyledonous plant the Palm increases in girth. Why and how does it take place ?
26. Differentiate between endarch and exarch conditions.
27. If you are provided with microscopic preparation of transverse section of a meristemic tissue and permanent tissue, how would you distinguish them ?
28. Differentiate between aerenchyma and collenchyma on the basis of their structure and function.
29. Are there any tissue elements to phloem which are comparable to those of xylem ? Explain.



30. Observe the figure and answer the following questions :

- (i) Name parts (a) and (b).
- (ii) Are these types of stomata observed in monocot or in dicot plants ?
- (iii) Which parts of stomata constitute the stomatal apparatus ?



Long Answer Questions

(5 marks each)

- 31. (i) What are meristems ?
 - (ii) Name the various kinds of meristems in plants.
 - (iii) State the location and functions of meristems.
- 32. (i) Suppose you are examining a cross section of a stem under compound microscope, how would you determine whether it is monocot stem or dicot stem ?
 - (ii) Write the characteristics of collenchyma.
- 33. What is secondary growth in plants ? Describe various steps of secondary growth in dicot stem with the help of diagrams.

Answers

Very Short Answers

(1 mark each)

- 1. Sclerenchyma.
- 2. Monocotyledonous roots.
- 3. The hard central region of tree trunk made up of xylem vessels, which provide mechanical strength to stem.
- 4. Pith stores the food material.
- 5. Bulliform cells are found in the upper epidermis of monocot leaves.
- 6. As they are made up of more than one kind of cells.
- 7. Primary meristem.

8. Fascicular and intrafascicular strips of meristem.
9. Pericycle of mature zone.
10. Mesophyll tissue.
11. Collenchyma.
12. Lateral conduction of food and supply of water from xylem.
13. Bulliform or motor cells.
14. Permit exchange of gases.
15. Bundle sheath cells.
16. Casparian strips are found in endodermis and make them water impermeable.
17. Maintain pressure gradient in Sieve tubes.

Short Answers (SA-I)

(2 marks each)

18. The cambium is considered as a lateral meristem because it occurs along the lateral sides of the stem and roots and appears later than primary meristem. Cells of this meristem divide periodically and increase the thickness of the plant body.

19.	Tracheid	Vessels
	<ol style="list-style-type: none"> 1. A tracheid is formed from a single cell. 2. The ends are rounded or transverse. 3. They are comparatively narrower. 4. The lumen is narrower. 	<ol style="list-style-type: none"> 1. A vessel is made of a number of cells. 2. The ends are generally oblique and tapering. 3. They are comparatively wider 4. The lumen is wide.

20. **Open Vascular bundles :** These vascular bundles contain a strip of cambium in between phloem and xylem. Open vascular bundles are collateral and bicollateral.

Closed Vascular bundles : Intrafascicular cambium is absent. Closed vascular bundles can be collateral or concentric.

21. Trichomes are multicellular epidermal hairs on the stem, seeds or fruits. Trichomes help in protection, dispersal of fruits and seeds and reduction in water loss.
22. (b) Sclerenchyma : photosynthesis, storage and secretion is not a matching pair. The function of sclerenchyma is to provide mechanical support to organs.
23. (a) Root (b) Monocot root

Short Answers (SA-II)

(3 marks each)

24. **Lenticels** : Opening that are found in old stems and roots in the cork tissues containing a number of complimentary cells and they are permanently opened pores.

Stomata : Opening that are found in leaves and young stems in the epidermis and have two guard cells. They open and close in response to turgidity of their guard cells.

25. Palms possess residual meristem below their leaf primordial, which adds ground parenchyma and vascular bundles. The ground parenchyma can also undergo further divisions even after the completion of elongation.

26.	Endarch condition	Exarch condition
	1. Protoxylem towards pith and metaxylem towards periphery 2. Found in Stem	1. Protoxylem towards periphery and metaxylem towards pith 2. Found in root.

27. **Meristematic tissues** are composed of cells that have the capability to divide. These cells are exist in different shapes without intercellular space. Cells are thin walled, rich in protoplasm, without vacuoles.

Permanent tissues are derived from meristematic tissue and are composed of cells have their definite shape, size and function. These cells may be thin walled (living) or thick walled (dead).

28.	Aerenchyma	Collenchyma
	(a) Parenchymatous tissue containing large air space. (b) Thin walled cells, isodiametric in in shape with intercellular space. (c) Provides buoyancy to the plant.	(a) Tissue contains deposits of cellulose and large pectin at the corner of cells. (b) Consists of oval and polygonal cells without intercellular space. (c) Provides elasticity and mechanical strength.

29. (a) The sieve elements of phloem is comparable to the vessel of the xylem because both lack nucleus.
(b) Phloem fibre is similar to the xylem fibre because both provide tensile strength to the tissue.
(c) Phloem parenchyma and xylem parenchyma is the living components of phloem and xylem respectively.

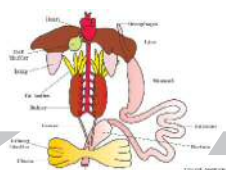
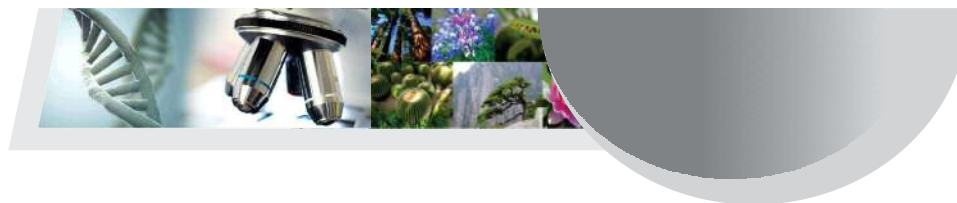
30. (i) a : epidermal cell
b : guard cell
(ii) In dicot plants.
(iii) The stomatal apparatus includes the stomatal aperture, guard cells and the surrounding subsidiary cells.

Long Answers

(5 mark each)

31. (i), (ii) and (iii) : Refer 'Points to remember'
32. (i) and (ii) : Refer 'Points to remember'.
33. ● **Secondary growth** : Refer 'Points to remember'.
● **Steps of secondary growth** : Refer page 94–97, NCERT, Text Book of Biology for Class XI.
● Figure 6.9, page 95 NCERT, Text Book of Biology for Class XI.

● ●



Chapter - 7 Structural Organisation In Animals

Points to Remember

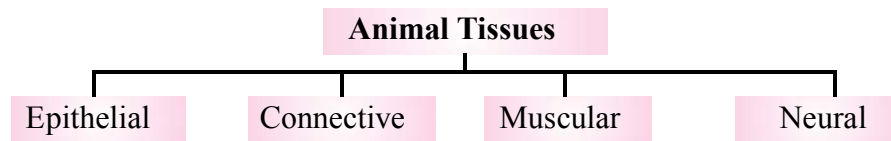
Cell junctions—In nearly all animal tissues, specialised junction provide structural and functional links between its individual cells.

Three Types of Cell junctions—

1. **Tight junctions** : Plasma membranes of adjacent cells are fused at intervals. They help to stop substances from leaking across a tissue.
2. **Adhering junctions** : Perform cementing function to keep neighbouring cells together.
3. **Gap junction** : Facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells for rapid transfer of ions, small molecules and soometimes big molecules.

Types of Fundamental Animal Tissues

S.No.	Type	Location	Functions
1.	Epithelial Tissues	Free Surfaces	Protection, Secretion, Excretion, absorption, Sensory and reproduction
2.	Connective Tissues	Inside body, its organs other tissues and below skin	Holding or binding, support, transport and circulation, protection and storage.
3.	Muscular Tissues	Inside movable parts	Movements and locomotion
4.	Nervous Tissues	Central Peripheral and every organ	Communication and control



Epithelia Tissue

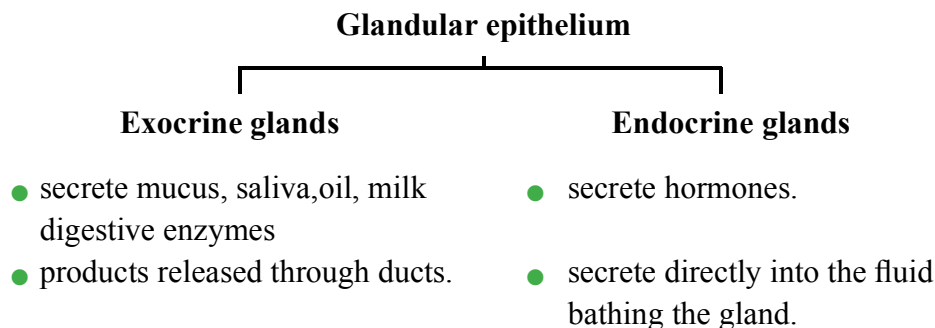
Simple : ● Composed of single layer of cells.

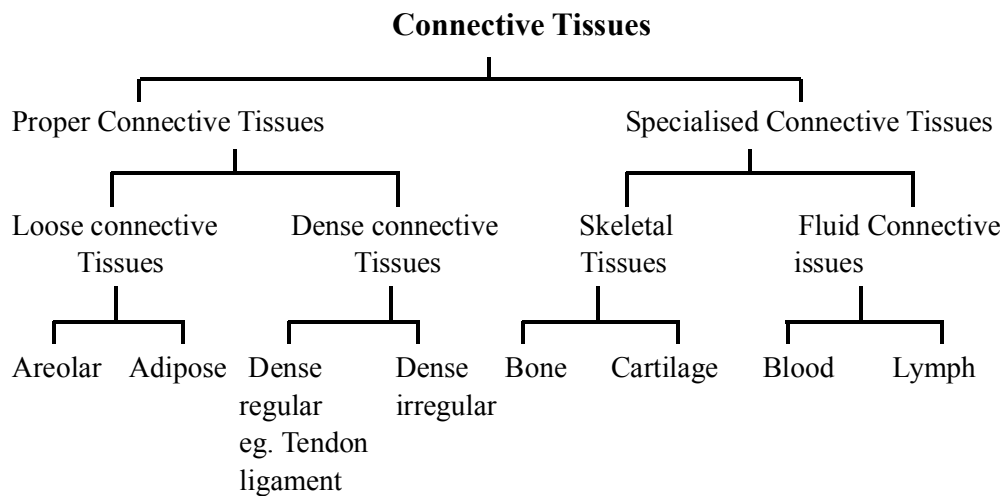
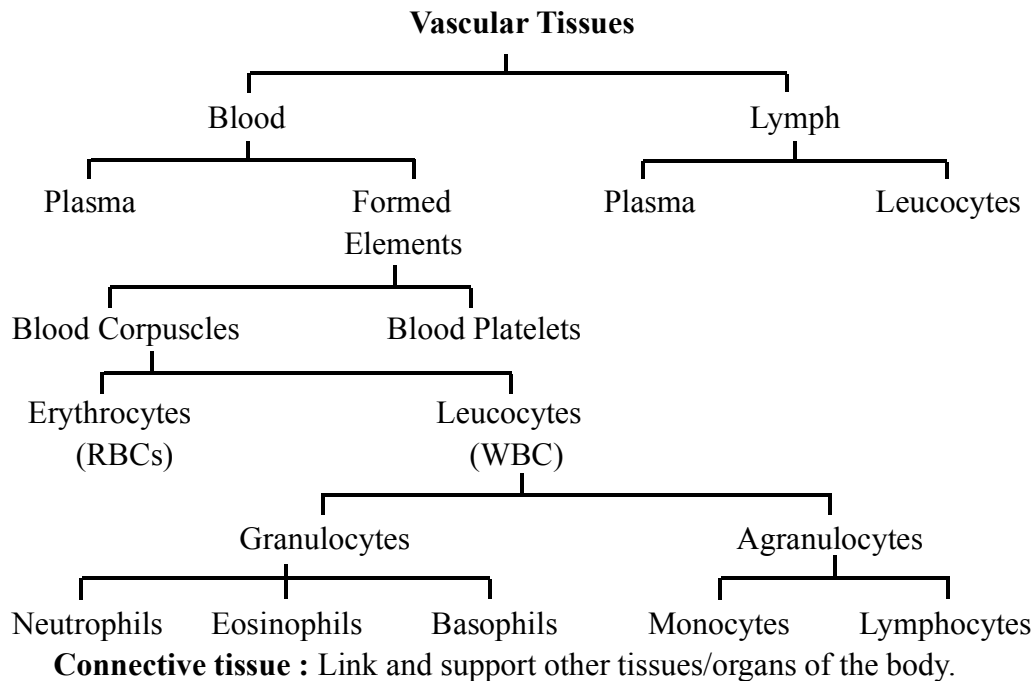
● Functions as lining for body cavities, ducts and tubes.

1. Squamous
 - single thin layer of flattened cells.
 - found in walls of blood vessels, air sacs of lungs.
2. Cuboidal
 - single layer of cube like cells.
 - found in ducts of glands and tubular parts of nephron.
3. Columnar
 - single layer of tall and slender cells.
 - free surface may have microvilli.
 - found in lining of stomach and intestine
4. Ciliated
 - columnar or cuboidal cells with cilia.
 - move particles or mucus in specific direction, in bronchioles, fallopian tubes.

Compound

- Made of more than one layer of cells.
- Provide protection against chemical and mechanical stresses.
- Cover dry surface of skin, moist cavity, pharynx, inner lining of ducts of salivary glands and pancreatic ducts.





Loose Connective Tissue

(has cells and fibres loosely arranged in semi-fluid ground substance)

(i) Areolar Tissue :

- present beneath the skin.
- contains fibroblasts, macrophages and mast cells.
- serves as a support framework for epithelium

(ii) Adipose Tissue :

- located beneath the skin.
- cells are specialised to store fats.

Dense Connective Tissue

Fibres and fibroblasts are compactly packed.

(i) Dense Regular

- Collagen fibres present in rows.
- Tendons attach skeletal muscle to bone.
- Ligaments attach bone to bone.

(ii) Dense Irregular

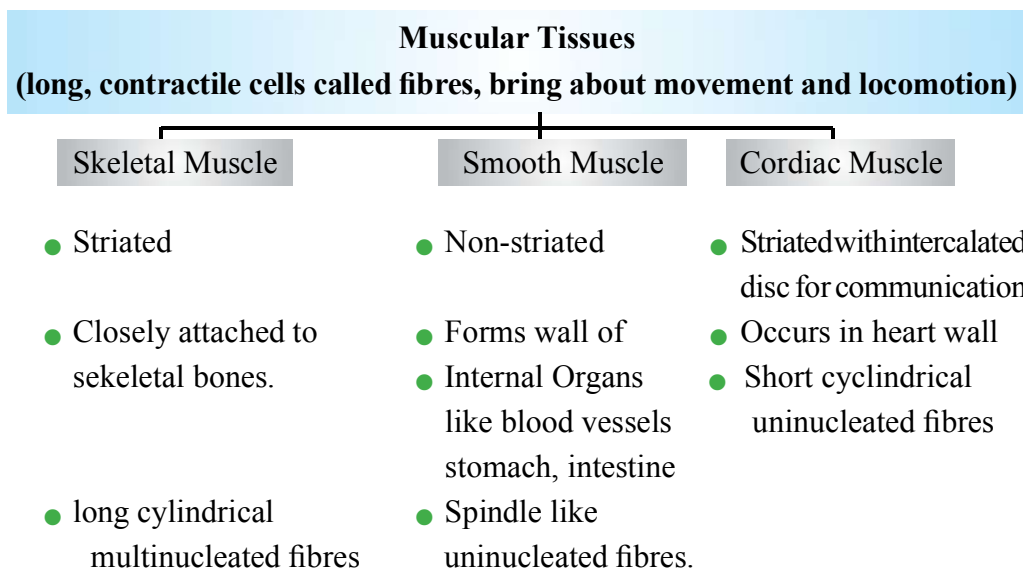
- Has collagen fibres and fibroblasts oriented differently.
- This tissue is present in the skin.

Specialised Connective Tissues

(i) Cartilage : made up of chondrocytes and collagen fibres; inter cellular material is solid and resists compression. Present in tip of nose outer ear joints, etc.

(ii) Bones : Ground substance is rich in calcium salts and collagen fibres Osteocytes are present in lacunae. Bones support and protect softer tissues and organs. They interact with skeletal muscles to bring about movements. Bone marrow in some bones is the site of blood cell formation.

(iii) Blood : Fluid connective tissue, consists of plasma and blood cells.



Neural Tissues

- Neurons are the functional unit and are excitable cells.
- Neuroglia cells make up more than half the volume of neural tissue.

They protect and support neurons.

Cockroach—*Periplaneta americana* (Phylum-Arthropoda, Class-Insecta)

Cockroach is a terrestrial, nocturnal, omnivorous, unisexual, oviparous insect. Body covered by a chitinous, hard exoskeleton of hard plates called sclerites.

Head : Triangular, formed by fusion of 6 segments. Bears a pair of antennae, compound eyes. Mouth parts consist of labrum (upper lip), a pair of mandibles, a pair of maxillae, labium (lower lip), hypopharynx (acts as tongue).

Thorax : 3 segments; prothorax, mesothorax and metathorax.

Bears 2 pairs of wings :

Forewings : tegmina (mesothoracic).

Hindwings : transparent, membranous (metathoracic)

3 pairs of legs in thoracic segments. (one pair in each thoracic segment.)

Abdomen : 10 segments. Bears a pair of long, segmented **anal cerci** in both sexes and a pair of short, unjoined **anal styles** in males only 7th segment is boat shaped.

Also has anus and genital aperture at the hind end. Genital aperture surrounded by external genitalia called **gonapophysis or phallomere**.

Male Cockroach

1. abdomen long and narrow
2. All nine sterna visible
3. Anal style present

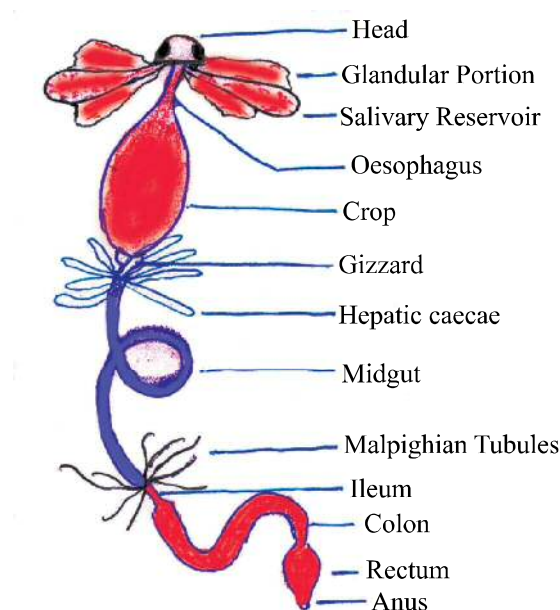
Female Cockroach

1. Abdomen short and broad
2. Seven sterna visible. (7th sternum fused with 8th and 9th sterna)
3. Anal style absent

Anatomy : Study of the morphology of internal organs.

Alimentary canal : Divided into foregut, midgut and hindgut.

Mouth → Pharynx → Oesophagus → Crop (stores food) → Gizzard (grinding of food) → Hepatic caecae (at junction of fore and midgut; secretes digestive juice) → Hindgut (ileum, colon, rectum) → Anus.



Alimentary Canal of Cockroach

Blood vascular system : Open type, visceral organs bathed in haemolymph (colourless plasma and haemocytes).

Heart consists of elongated muscular tube and differentiated into funnel shaped chambers with ostia on either side. Blood from sinuses enters heart through ostia and is pumped anteriorly to sinuses again. Blood is colourless (haemolymph).

Respiratory system : Network of trachea which open through 10 pairs of spiracles. Spiracles regulated by sphincters. Oxygen delivered directly to cells.

Excretion and osmoregulation : by malpighian tubules; uricotelic (Uric acid as excretory product).

Nervous system : Consists of series of fused segmentally arranged ganglia joined by paired longitudinally connectives on the ventral side, three ganglia in thorax, six in abdomen. Brain represented by supraoesophageal ganglion. Each eye consists of 200 hexagonal ommatidia.

Reproductive system :

Male reproductive system : Pair of testes (4th-6th segments) → vas deferens → ejaculatory duct → male gonophore.

Glands–Seminal vesicle (stores sperms), mushroom shaped gland (6th-7th segment).

Female reproductive system :

A pair of ovaries (with 8 ovarian tubules) → Oviduct → Genital chamber. Sperms transferred through spermatophores female produces 9–10 Ootheca. Fertilised eggs encased in capsules called oothecae (contains 14-16 eggs on an average) development of *P. americana* paurometabolous incomplected metamorphosis). Nymph grows by moulting 13 times to reach adult form.

Interaction with man

- Pests as destroy food and contaminate it.
- Can transmit a variety of bacterial diseases (Vector).

Questions

Very Short Answer Questions

(1 mark each)

1. Name the tissue which contains Haversian canals.
2. Mention two special properties of nervous tissues.
3. Name the large cells present in adipose tissue.
4. Name the cells responsible for clotting of blood.
5. What are exocrine glands ?
6. Differentiate between tendon and ligament.
7. Where are RBC's formed ?
8. A muscular fiber having no striations and tapers at both ends. Name it.
9. Mention the site, where sclerite is present in cockroach.
10. Name the mouth part of cockroach which is comparable to our tongue.
11. "Sexual dimorphism is found in cockroach". Explain the statement.

Short Answer Questions-I

(2 marks each)

11. What is the function of ciliated epithelium ? Where do we find this epithelium ?
12. What are the two types of fibres of connective tissues ? Distinguish between the two.
13. To which tissue do the following belong to :
 - (a) Osteocytes
 - (b) Chondrocytes
 - (c) Neuroglia
 - (d) Intercalated discs
14. Give the location of hepatic caecae in cockroach ? What is their function ?
15. Name the locomotory appendages of cockroach on the basis of external morphology.

Short Answer Questions–II

(3 marks each)

16. Differentiate between skeletal and smooth muscles.
17. Differentiate between male and female cockroach on the basis of external morphology.
18. (a) What is open circulatory system ?
(b) Explain the respiratory system of cockroach.
19. (a) Give the common name of *Periplaneta americana*.
(b) How many spermathecae found in cockroach ?
(c) What is the position of ovaries in cockroach ?
(d) How many segments are present in the abdomen of cockroach ?
(e) Where do you find malpighian tubules ?
(f) What is mosaic vision ?
20. Name the different cell junctions found in tissues.
21. Mention the special features of eye in cockroach.
22. Write the appropriate type of tissue in column B accounting to the functions mentioned in column A.

Column A

Column B

- | | |
|--------------------------------------|-------|
| a. Linking and supporting frame work | ..... |
| b. Protective covering | ..... |
| c. Secretion and absorption | ..... |

Long Answer Questions

(5 marks each)

23. (a) What is compound epithelium ? What are their main function ?
(b) Where do we find areolar tissue ?
(c) How is adhering junction different from gap junction ?
24. Make a neat and well labelled diagram showing alimentary canal of cockroach.

Answers

Very Short Answers

(1 mark each)

1. Mammalian bone.
2. Excitability and conductivity.
3. Adipocytes.
4. Blood platelets.
5. Glands which discharge their secretions into ducts.

6. Tendon

Attach skeletal muscles to bones

Ligament

Attach bone to bone

7. Bone narrow

8. Smooth or non striated muscle fibre.

9. In the exoskeleton all over the body.

10. Hypopharynx = lingua

11. Male and female cockroaches show morphological differences.

Short Answers-I

(2 marks each)

11. Refer 'Points to Remember'.

12. White and yellow fibres. White fibres are thin, wavy, unbranched, inelastic, occur in bundles and formed of protein collagen. Yellow fibres are thick, straight, elastic, branched, occurring singly, formed of protein elastin.

13. (a) Bone tissue

(b) Cartilage

(c) Neural tissue

(d) Cardiac muscle

14. Refer 'Points to Remember'.

15. Three pairs of legs and two pairs of wings.

Short Answers-II

(3 marks each)

16. Refer 'Points to Remember'.

17. Refer 'Points to Remember'.

18. Refer 'Points to Remember'.

19. (a) American Cockroach.

(b) One pair, present in 6th segment.

(c) Between 2nd and 6th abdominal terga.

(d) 10 segments.

(e) At the beginning of ileum in cockroach.

(f) Vision where several images of an object are formed by compound eye.
Helps to detect movement of objects very efficiently.

20. (i) Gap junctions

(ii) Tight junctions

(iii) Adhering junctions

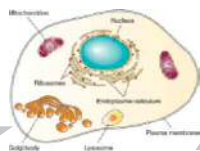
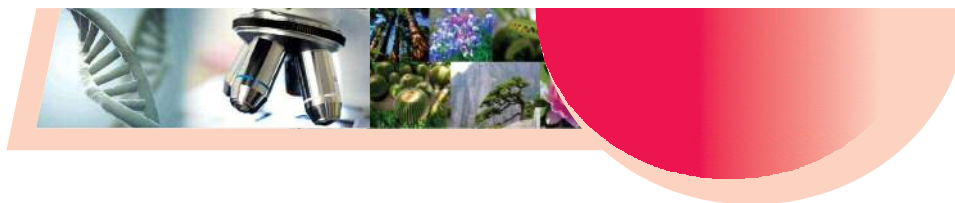
21. See text in NCERT at page No. 114.
- (i) Situated at dorsal surface of head.
 - (ii) Each eye consists of about 2000 hexagon ommatidia.
 - (iii) It can receive several images of an object.
 - (iv) This kind of vision is known as mosaic vision.
 - (v) It is more sensitivity but less resolution.
22. (a) Connective tissues
- (b) Stratified epithelium
 - (c) Columnar epithelium

Long Answers

(5 marks each)

23. Refer 'Points to Remember'.
24. Refer Fig. 7. 16 NCERT Text Book of Biology class-XI.





Chapter - 8

Cell : The Unit of Life

Points to Remember

Cell Theory : Cell Theory was formulated by Scheleiden and Schwann, and was modified by Rudolf Virchow. Cell theory States.

- (A) All living organisms are composed of cells and products of cells.
- (B) All cells arise from pre-existing cells.

Cell : Cell is the structural and functional unit of life.

Prokaryotic Cell

- Generally small sized (1–10 μm)
- Well defined nucleus absent
- Membrane bounded cell organelles absent
- DNA without histone covering
e.g., Bacteria, Mycoplasma, Blue green Algae

Prokaryotic Cell

- Gram positive bacteria
- Bacteria that take up gram Stain. *e.g., Bacillus*

Eukaryotic Cells

- Generally large sized (5–10 μm)
- Well defined nucleus present
- Membrane bounded cell organelles present
- DNA with histone covering
e.g., Amoeba, Euglena and other higher organism

Cell envelope

- Gram negative bacteria
- Bacteria do not take up gram stain
escherichia coli

Modification of cell envelope

- Slime layer : Glycocalyx in form of loose sheath.
- Capsule : Glycocalyx in form of thick and tough sheath.
- Mesosomes : Extension of plasma membrane. These can be in the form of vesicles, tubules and lamellae.

Functions : Cell wall formation, DNA replication and distribution to daughter cells, respiration, secretion processes, to increase surface area of plasma membrane and enzyme content.

- **Flagella :** Extension of cell wall. It is composed of three structure—filament, hook and basal body. They help in motility of bacteria.
- **Pili and fimbriae :** Surface structure of some bacteria which attaches them to rocks in streams and to host tissues.

Genetic Material : It is not covered by nuclear envelope. In addition to the genomic DNA (the single chromosome/circular DNA), many bacteria have small circular self replicating, double stranded DNA which is called as plasmid, plasmid contain genes like antibiotic resistance.

Eukaryotic cells

Possess an organized nucleus with nuclear envelope and have a variety of complex locomotory and cytoskeletal structures.

Cell Membrane—Singer and Nicolson (1972) gave ‘fluid mosaic model’. According to this the quasi-fluid nature of lipid enables lateral movement of proteins within the overall bilayer; two types of proteins (Peripheral and integral proteins) with cholesterol, glycolipids and glycoproteins. Erythrocyte membrane has 52% protein and 40% lipids.

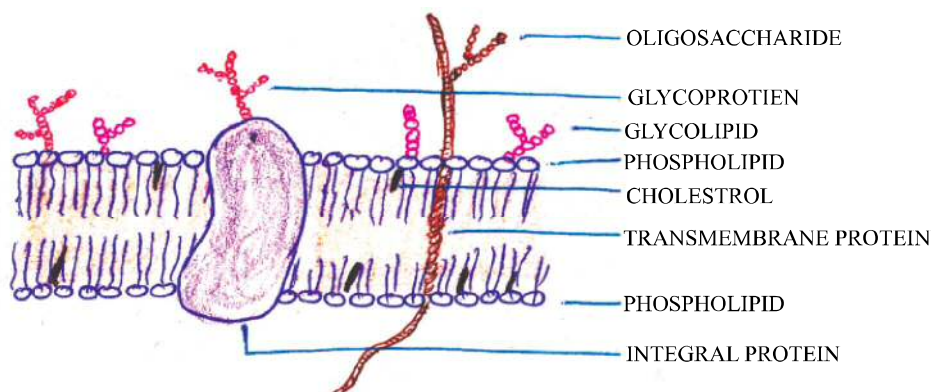
Function—It is semi permeable and helps in transport of molecule across it.

Passive transport

- Transport of molecules from higher to lower concentration.
- It do not utilise energy (ATP).
e.g., diffusion

Active transport

- Transport of molecules from lower to higher concentration
- It utilises energy (ATP)
e.g., Na⁺/k⁺ ATPase Pump.



Fluid Mosaic Model of Plasma Membrane

Cell Wall is non-living rigid structure which gives shape to the cell and protects cell from mechanical damage and infection, helps in cell-to-cell interaction and provides barrier to undesirable macromolecules.

Cell wall of algae is made of cellulose, galactans, mannans and minerals like calcium carbonate. Plant cell wall consists of cellulose, hemicellulose, pectins and proteins.

Middle lamella is made of calcium pectate which holds neighbouring cells together.

Plasmodesmata connect the cytoplasm of neighbouring cells.

Endoplasmic Reticulum (ER)

Consists of network of tiny tubular structure. ER divides the intracellular space into two distinct compartments—luminal (inside ER) and extra luminal (cytoplasm).

(i) Rough Endoplasmic Reticulum (RER) :

- Ribosomes attached to outer surface.

Function : ● Involved in protein synthesis and secretion.

(ii) Smooth Endoplasmic Reticulum (SER) : ● Lack ribosomes.

Function ● Site for synthesis of lipid.

Golgi apparatus : First observed by Camillo Golgi (in 1898)

Consist of cisternae stacked parallel to each other. Two faces of the organelle are convex/cis or forming face and concave/**trans** or maturing face.

Functions : Performs packaging of materials, to be delivered either to the intra-cellular targets or secreted outside the cell. Important site of formation of glycoproteins and glycolipids.

Lysosomes :

Membrane bound vesicular structures formed by the process of packaging in the golgi apparatus. Contain hydrolysing enzymes (lipases, proteases, carbohydrases) which are active in acidic pH. Also called 'Suicidal Bag'.

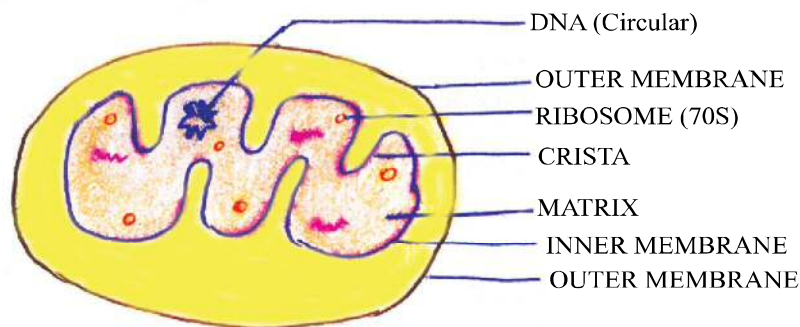
Function : Intracellular digestion.

Vacuoles : Membrane bound space found in the cytoplasm. Contain water, sap, excretory product, etc. In plant cell, vacuole occupies 90% of space.

Function : In plants **tonoplast** (single membrane of vacuole) facilitates transport of ions and other substances.

Contractile vacuole for excretion in *Amoeba* and food vacuoles formed in protists for digestion of food.

Mitochondria : Double membraned structure. Out membrane smooth and inner membrane forms a number of infoldings called cristae The inner compartment is called matrix. The cristae increase the surface area.



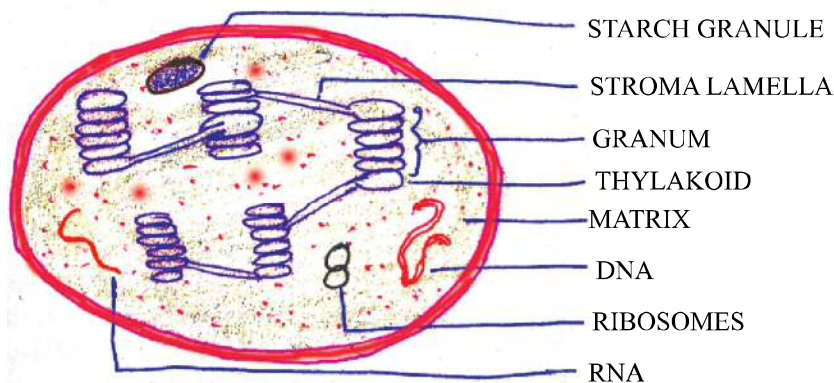
Mitochondria

Function : Sites of aerobic respiration. Called 'power houses' of cell as produce cellular energy in the form of ATP. Matrix possesses single circular DNA molecule, a few RNA molecules, ribosomes (70S). It divides by binary fission.

Plastids : Found in plant cells and in euglenoides. Chloroplasts, chromoplasts and leucoplasts are 3 types of plastids depending on pigments contained.

Types of Plastids		
Chloroplast (green coloured plastids) contains chlorophyll, double stranded DNA and 70S ribosomes	Chromoplast carotenoid (fat soluble) carotens (give colour to plant parts) Xanthophylls. Others (Yellow, red, orange)	Leucoplast Amyloplast (Starch) Elaioplasts (oil + fat) Aleuroplast (store proteins)

Function : Site of photosynthesis, and imparts colours to fruits and flowers.



Chloroplast

Ribosomes

Composed of RNA and proteins; without membrane. Eucaryotic ribosomes are 80S. S = Svedberg's unit)

Function : Site of protein synthesis.

Cytoskeleton : Network of filaments.

Proteinaceous structure in cytoplasm made up of microtubules and micro filaments.

Function : Mechanical support, motility, maintenance of the shape of the cell.

Cilia and Flagella

Cilia are small structures which work like oars which help in movement.

Flagella are longer and responsible for cell movement. They are covered with a plasma membrane. Core is called **axoneme** which has 9 + 2 arrangement of axonemal microtubules.

Centrosome and Centrioles

Centrosome contains two cylindrical structures called centrioles. Surrounded by amorphous pericentriolar material. Has 9 + 0 arrangement. Centrioles form the basal body of cilia or flagella and spindle fibres for cell division in animal cells. They produce spindle apparatus during cell division.

Nucleus : With double membrane with perinuclear space and nuclear pores; has Chromatin, nuclear matrix and nucleoli (site for rRNA synthesis). (Named by Robert Brown – 1831)

Chromatin DNA + nonhistone proteins. (Named by Flemming)

Nucleoplasm – Nucleolus + Chromatin

Nuclear membrane—It is with perinuclear space and nucleopores.

Chromosomes—DNA/RNA + Histone protein/Nonhistone protein.

Centromere : Primary constriction—disc is known as kinetochores.

No nucleus in Erythrocytes (RBC) of mammals and sieve tubes in vascular plants.

Chromosomes (on basis of position of centromere) :

Metacentric : Middle centromere.

Sub-metacentric : Centromere nearer to one end of chromosomes.

Acrocentric : Centromere situated close to its end.

Telocentric : Has terminal centromere.

Satellite : Some chromosomes have non-staining secondary constructions at a constant location, which gives the appearance of small fragment called satellite.

Questions

Very Short Answer Questions

(1 mark each)

1. Name the parts of bacterial flagella.
2. Name the nutrient stored in (i) elaioplasts (ii) aleuroplasts
3. Name the scientist who first saw and described a live cell.
4. What are plasmids ?
5. Name the scientist who first explained that new cells arose from pre-existing cells (*Omnis cellule-e-cellula*)
6. What is the composition of plasma membrane of human erythrocyte.
7. Eukaryotic ribosomes are 80S. What does 'S' stand for ?
8. Write the function of cytoskeleton in a cell ?

Short Answer Questions–I

(2 marks each)

9. What are nuclear pores ? State their function.
10. State the cell theory.
11. Differentiate between active and passive transport.
12. Differentiate between RER and SER.
13. List two functions of golgi apparatus.
14. List two functions of mesosome.
15. Differentiate between the electron microscopic structure of cilia/flagella and centriole.
16. Give the specific terms for the following :
 - (a) Cluster of ribosomes found in cytoplasm
 - (b) Extensive infolding to the inner membrane of mitochondria
 - (c) Stacks of closely packed thylakoids
 - (d) Stalked particles on the inner membrane of mitochondria
17. (a) Write the function of inclusion bodies in prokaryotic cells ?
 - (b) Where are they present ?
 - (c) Give two examples of inclusion bodies.

Short Answer Questions–II

(3 marks each)

18. With the help of labelled diagram explain the 'fluid mosaic model' structure of cell membrane.
19. Differentiate between a prokaryotic and eukaryotic cell.
20. What are lysosomes ? How are they formed ? Write their functions.
21. Give the structural details of an eukaryotic nucleus along with its diagram.

22. The ribosomes of prokaryotes are of 70 S type ribosomes and 80 S type while of eukaryotes are of 80S type.
- (a) Give the composition of 70 S type ribosomes and 80 S type ribosome (two sub units, from each of them are made of)
 - (b) Name two cell organelles of eukaryotic cells which have their own independent ribosomes of 70 S type

Long Answer Questions

(5 marks each)

23. (a) Give the structural details of mitochondria.
(b) Draw its diagram.
(c) Why is it called 'powerhouse of the cell' ?
24. (a) Diagrammatically represent the types of chromosomes based on the position of centromere.
(b) What does chromatin contain ?
(c) What is perinuclear space ?

Answers

Very Short Answers

(1 mark each)

1. Filament, hook, basal body.
2. Elaioplasts : fats and oils.
Aleuroplasts : proteins.
3. Anton Von Leeuwenhoek
4. The small circular DNA, outside the genomic DNA of bacteria.
5. Rudolf Virchow.
6. 52% proteins, 40% lipids.
7. Sedimentation coefficient (Svedberg unit)
8. Mechanical support, motility, maintenance of shape of cell.

Short Answers-I

(2 marks each)

9. Minute pores present in the nuclear envelope; provide passage for movement of RNA and proteins between nucleus and cytoplasm.
10. Refer 'Points to Remember'.
12. Refer 'Points to Remember'.
13. Refer 'Points to Remember'.
14. Refer 'Points to Remember'.

- | 15. | Flegella/Cilia | Centriole |
|------|---|---|
| (i) | Possess (9 + 2) pattern of axoneme
microtubules enclosed by a membrane | : Possess (9 + 0) pattern,
membrane less organelle |
| (ii) | Each tubule is doublet | : Each tubule is a triplet |
16. (a) Polyribosome/Polysome
(b) Cristae
(c) Grana
(d) Fo–F₁ particles ...
17. (a) Reserve materials are stored,
(b) They are free in the cytoplasm
(c) *e.g.*, Phosphate granules, cyanophycean granules, glycogen granules.

Short Answers–II

(3 marks each)

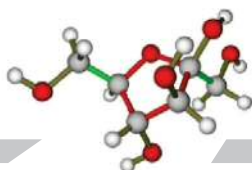
18. Refer page no. 131–132, NCERT, Text Book of Biology for Class XI.
19. Differences in nucleus/chromosomes/mesosome/membrane bound cell organelles/ribosomes/compartments in cell.
20. Refer page no. 134 NCERT, Text Book of Biology for Class XI.
21. Refer page no. 138, NCERT, Text Book of Biology for Class XI.
22. (a) 70 S ribosomes have 50 S and 30 S sub units; 80S ribosomes have 60 S and 40 S sub units.
(b) Mitochondria and chloroplast.

Long Answers

(5 marks each)

23. Refer page no. 134-135, NCERT, Text Book of Biology for Class XI.
24. Refer page no. 138–139, NCERT, Text Book of Biology for Class XI.





Chapter - 9

Biomolecules

Points to Remember

Biomolecules : All the carbon compounds that we get from living tissues.

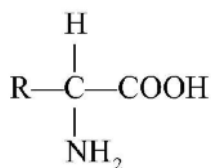
Macromolecules : Molecules which have molecular weights less than one thousand dalton. They are also known as monomers.

Macro molecules : Known as polymers.

Primary and secondary metabolites :

- Primary metabolites have identifiable functions and play important roles in normal physiological process eg. Amino acids, nitrogenous bases, proteins and nucleic acid.
- Secondary metabolites are product of certain metabolic pathways from primary metabolites, eg. carotenoids, drugs, alkaloids, essential oils, rubber, gum, cellulose and resins etc.

Amino acids : Organic compounds containing an amino group and one carboxyl group (acid group) and both these groups are attached to the same carbon atom called α carbon and so they are called α amino acids.



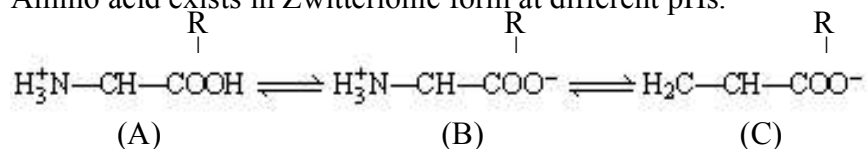
e.g. (1) In Glycine R = H

(2) In alanine R = CH₃

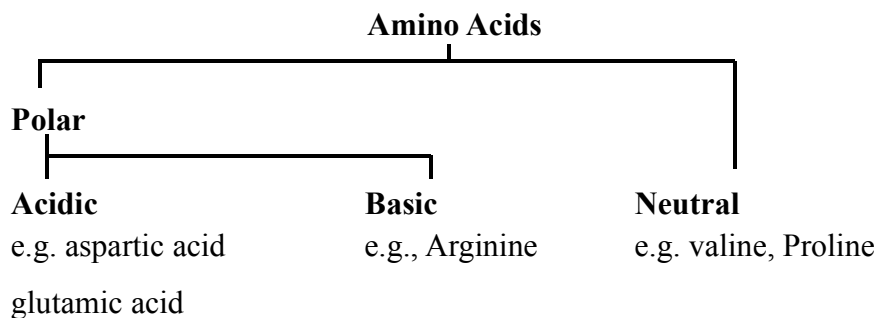
(3) In serine R = CH₂ – OH

- Twenty types of amino acids.

Amino acid exists in Zwitterionic form at different pHs.



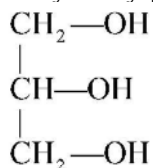
- Based on number of amino and carboxyl groups, amino acids can be :
 - (i) **Aromatic**—Tryptophan, phenylalanine and Tyrosine are aromatic (give smell) amino acids.



- (ii) **Non Polar**—Glutamine, tyrosine, serine

Lipids :

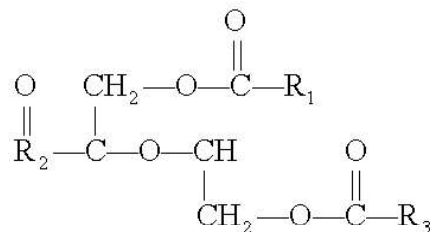
- Water insoluble, containing C, H, O.
- Fats on hydrolysis yield fatty acids.
- Fatty acid has a carboxyl group attached to an R group (contains 1 to 19 carbons).
- **Fatty Acids : Saturated :** With single bonds in carbon chain, *e.g.*, Palmitic acid, butyric acid.
- **Unsaturated :** With one or more double bonds, *e.g.*, oleic acid, linoleic acid.
- **Glycerol :** A simple lipid, is trihydroxy propane.



- Some lipid have fatty acids esterified with glycerol. $\rightarrow \text{CH}_3 - (\text{CH}_2)_{14} - \text{COOH}$ fatty acid (Palmitic acid)



- They can be monoglycerides, diglycerides and triglycerides.



Triglyceride ($\text{R}_1, \text{R}_2, \text{R}_3$ are fatty acids.)

Phospholipids (Lecithin) found in cell membrane and lipids made complex structure in neural tissue.

- **Phospholipids** are compound lipids with phosphorus and a phosphorylated organic compound *e.g.*, Lecithin.

Nitrogen bases

(Carbon compounds with heterocyclic rings)

Purine : Adenine, Guanine, **Pyrimidine** : Cytosine, Uracil, Thymine.

Lipids are not strictly macromolecules as their molecular weight do not exceed 800 Da but form a part of the acid insoluble pool.

Biomacromolecules : Biomolecules with molecular weights in the range of ten thousand daltons and above; found in acid insoluble fraction. *e.g.* polysaccharides, nucleic acids, proteins and lipids.

Nucleic acids : Deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).

Nucleoside : Nitrogenous base + Sugar *e.g.* Adenosine, guanosine.

Nucleotide : Nitrogenous base + Sugar + Phosphate group. *e.g.* Adenylic acid, Guanylic acid. Thymidylic acid.

DNA structure (Watson and Crick Model) : DNA is a right handed, double helix of two polynucleotide chains, having a major and minor groove. The two chains are antiparallel, and held together by hydrogen bonds (two between A and T and three between C and G). The backbone is formed by sugar-phosphate-sugar chain. The nitrogen bases are projected more or less perpendicular to this, backbone and face inside. The pitch is 34\AA . At each step of ascent, the strand turns 36° . The rise per base pair is 3.4°\AA , so one full turn involves ten base pairs.

Protein : proteins are polypeptides.

- They are polymers of amino acids linked by peptide bond.
- Is a heteropolymer (different monomers repeating 'n' number of times).
- For functions of proteins refer Table 9.5, Page no. 147 NCERT, Text Book of Biology for Class XI.

Structure of Proteins

- (a) **Primary structure** : Is found in the form of linear sequence of amino acids. First amino acid is called N-terminal amino acid and last amino acid is called C-terminal amino acid.
- (b) **Secondary structure** : Polypeptide chain undergoes folding or coiling which is stabilized-by hydrogen bonding. Right handed helices are observed; *e.g.*, fibrous protein in hair, nails.
- (c) **Tertiary structure** : Long protein chain is folded upon itself like a hollow woollen ball. Gives a 3-dimensional view of protein, *e.g.*, myosin.
- (d) **Quaternary structure** : Two or more polypeptides with their foldings and coilings are arranged with respect to each other, *e.g.*, Human haemoglobin molecule has 4 peptide chains - 2 α and 2 β submits.

Monosaccharides are joined by glycosidic acid bond, right end is reducing and left end is non reducing

Polysaccharides : Are long chain of polymers of monosaccharides.

- (a) **Starch** : Store house of energy in plant tissues. Forms helical secondary structures, made of only glucose monomers.
- (b) **Cellulose** : Homopolymer of glucose. It does not certain complex helices. Cotton fibre is cellulose.
- (c) **Glycogen** : Is a branched homopolymer, found as storage polysaccharide in animals.
- (d) **Inulin** : Is a polymer of fructose.
- (e) **Chitin** : Chemically modified sugar (amino-sugars) N-acetyl galactosamine form exoskeleton of arthropods; heterpolymer.

Metabolic Pathways :

- (a) **Anabolic pathways** : Lead to formation of more complex structure from a simpler structure with the consumption of energy, *e.g.*, Protein from amino acids., also known as biosynthetic pathways.
- (b) **Catabolic pathway** : Lead to formation of simpler structure from a complex structure, *e.g.*, Glucose \rightarrow Lactic Acid + energy

The most important energy currency in living systems is ATP (adenosine tri – phosphate).

“There is no uncatalysed metabolic conversion in living system”

The living state is a non-equilibrium steady state to be able to perform work. Without metabolism, there cannot be a living state.



Bonds linking monomers in a polymer

Peptide bond—formed between the carboxyl ($-\text{COOH}$) group of one amino acid, and the amino ($-\text{NH}_2$) group of the next amino with the elimination of water moiety, (dehydration).

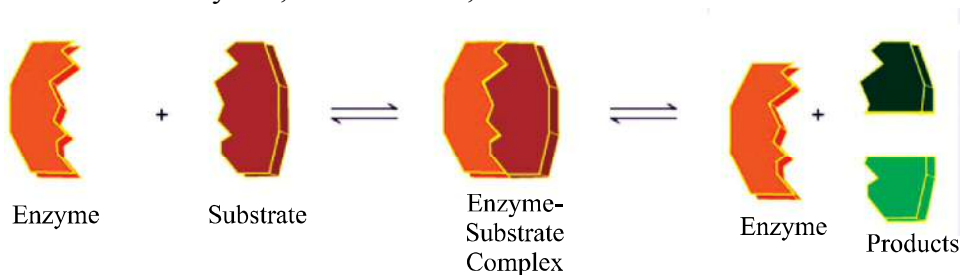
Glycosidic bond—bond formed between two carbon atoms of two adjacent monosaccharides, by dehydration.

Phosphodiester bond—bond formed in nucleic acids where in a phosphate moiety links the 3-carbon of one sugar of one nucleotide to the 5-carbon of the sugar of the succeeding nucleotide. (The bond between phosphate group and hydroxyl group of sugar)

Ezymes : Are biocatalyst.

- Almost all enzymes are proteins.
- Ribozymes—Nucleic acid that behave like enzymes.
- Has primary, secondary and tertiary structure.
- Active site of an enzyme is a crevice or pocket into which substrate fits.
- Enzymes get damaged at high temperatures.
- Enzymes isolated from thermophilic organisms (live under high temperatures) are thermostable.
- Enzymes accelerate the reactions many folds.
- Enzymes lower the activation energy of reactions. (Fig. 9.6, Page no. 156, NCERT Text Book of Biology for Class XI).
- $\text{E} + \text{S} \rightleftharpoons \text{ES} \rightarrow \text{EP} \rightarrow \text{E} + \text{P}$

where E = Ezymes, S = Substrate, P = Product



Steps of Enzyme Action

Factors affecting enzyme activity :

- Temperature :** Show highest activity at optimum temperature. Activity declines above and below the optimum value.
- pH :** Enzymes function in a narrow range of pH. Highest activity at optimum pH. (Fig. 9.7, Page no. 157, NCERT, Text Book of Biology for Class XI).

(c) **Concentration of substrate** : The velocity of enzymatic reaction rises with increases in substrate concentration till it reaches maximum velocity (V_{max}). Further increase of substrate does not increase the rate of reaction as no free enzyme molecules are available to bind with additional substrate.

Enzyme inhibition : When the binding of a chemical shuts off enzyme activity, the process is called inhibition and chemical is called **inhibitor**.

Competitive inhibition : Inhibitor closely resembles the substrate in its molecular structure and inhibits the enzyme activity. E.g., inhibition of succinic dehydrogenase by malonate. (Actual is succinic acid).

Classification of enzymes :

1. **Oxidoreductase/dehydrogenases** : Catalyse oxidation-reduction between 2 substrates. $S_{reduced} + S'_{oxidised} \rightarrow S'_{oxidised} + S_{reduced}$.
2. **Transferases** : Catalyse transfer of a group between a pair of substrates.
 $S - G + S' \rightarrow S + S' - G$
3. **Hydrolases** : Catalyse hydrolysis of ester, ether, peptide, glycosidic, C-C, P-N bonds.
4. **Lyases** : Catalyse removal of groups from substrates by mechanisms other than hydrolysis. Leave double bonds.
5. **Isomerases** : Catalyse inter-conversion of optical, geometrical or positional isomers.
6. **Ligases** : Catalyse linking together of 2 compounds.
C-O, C-S, C-N, P-O

Co-factors : Enzymes become catalytically active when they bind to non protein constituent called co-factors. Protein portion of enzyme is called apoenzyme.

- **Prosthetic group** : These are organic compounds which are tightly bound to the apoenzyme.
e.g., Haem is prosthetic group in peroxidase and catalase.
- **Coenzyme** : These are organic compounds whose association with the apoenzyme is only transient, usually occurring during the course of catalysis.
e.g., Coenzyme Nicotinamide adenine dinucleotide (NAD) and NADP contain vitamin niacin.
- **Metal ions** : Metal ions form coordination bond with side chains at the active site and at the same time form one or more coordination bonds with substrate.
e.g. zinc in enzyme carboxy peptidase.



Questions

Very Short Answer Questions

(1 mark each)

1. Why do oils generally remain in liquid state even in winters ?
2. Name an element found in proteins but not in lipids and carbohydrates.
3. What is the difference between RNA and DNA in terms of nitrogenous base ?
4. What does an enzyme do in terms of energy requirement of a reaction ?
5. What is the function of ATP in cell metabolism ?
6. Name the protein which form the intercellular ground substance.
7. What are biomacromolecules ?
8. Why enzymes are called bio-catalysts ?

Short Answer Questions-I

(2 marks each)

9. Differentiate between prosthetic group and coenzyme ?
10. What are glycosidic bonds and peptide bonds ?
11. Why are amino acids also known as substituted methane?
12. Amino acids exist as zwitter ions. Give its structure. Why is it formed ?
13. Why do starch give blue black colour with iodine ?
14. Why are starch and glycogen more suitable than glucose as a storage product ?
15. What would happen when salivary amylase which acts on starch in mouth enter in stomach ?
16. Differentiate between homo polysaccharides saccharides and hetero polysaccharides.
17. Why do physicians recommend vegetable oils rich in polyunsaturated fat for persons suffering from cardiovascular diseases ?
18. Why does the shelf life of fruits and vegetables increase in a refrigerator ?

Short Answer Questions-II

(1 mark each)

19. Differentiate between primary and secondary metabolites with examples ?
20. List out some major proteins and their function ?
21. Explain the structure of proteins.
22. Explain Watson-Crick model on DNA structure.
23. Explain peptide bond, glycosidic bond and phosphodiester bond.
24. Explain competitive inhibition along with an example.

Long Answer Questions

(5 marks each)

25. List the 6 classes of enzymes along with their functions.

Answers

Very Short Answer

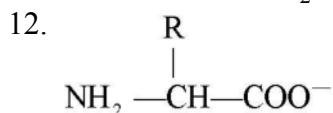
(1 marks each)

1. Oils are unsaturated lipids, hence have lower melting points.
2. Nitrogen.
3. RNA has uracil instead of thymine.
4. Lowers the activation energy of reaction.
5. Are the energy currency of cell.
6. Collagen.
7. Refer point to remember.
8. Enzymes are proteins that catalyze metabolic/chemical reactions inside the living being. That's why they are called biocatalysts.

Short Answer-I

(2 marks each)

9. Refer 'Points to remember'.
10. Refer, 'Points to rememblers'.
11. The α -carton has 4 substituted groups occupying the 4 valency positions :
H,—COOH,—NH₂ and—R group.



Due to ionizable nature of —NH_2 and —COOH groups.

13. Starch form helical secondary structure which can hold I₂.
14. Occupy lesser space as less bulky and can hydrolysed to glucose when required.
15. In mouth, salivary amylase changes starch into maltose. Action of amylase stops in stomach as it cannot act in an acidic medium.
16.

Homopolysaccharides	Heteropolysaccharides
(a) Constituted of single type of monosaccharide units	Constituted by two or more type of monosaccharide unit and their derivatives
(b) e.g., starch, glycogen, cellulose	e.g., Peptidoglycans, chitin
17. Polyunsaturated oils contain fatty acids having one or more double bonds which does not clog arteries due to high proportion of polyunsaturated fatty acids.

18. Low temperature prevents growth of food spoiling micro organisms and also inhibits the action of enzymes present in the food, because, enzymes are inactivated at low temperature.
19. **Secondary metabolites**—The metabolites like alkaloids lectins Drugs, Pigments, Spices and scents etc. which are useful to human welfare and have ecological importance.
- Primary metabolites**—The metabolites having identifiable functions and play important role in normal physiological processes, *e.g.*, sugars, amino acids, fats and oils and nucleotides, etc.
20. Refer Page No. 147, Table 9, 5, NCERT, text book of biology class XI.

Short Answers-I

(3 marks each)

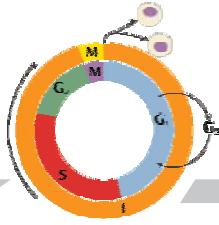
21. Refer 'Points to remember'.
22. Refer 'Points to remember'.
23. Refer Page No. 151. NCERT, Text Book of Biology for Class XI.
24. Refer 'Points to remember'.

Long Answers

(5 marks each)

25. Refer Page No. 158., NCERT, Text Book of Biology for Class XI.



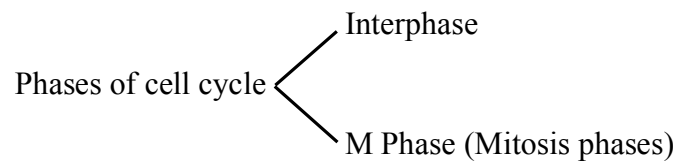


Chapter - 10

Cell Cycle and Cell Division

Points To Remember

Cell cycle : The sequence of events by which a cell duplicates its genome, synthesises the other constituents of the cell and eventually divides into two daughter cells.



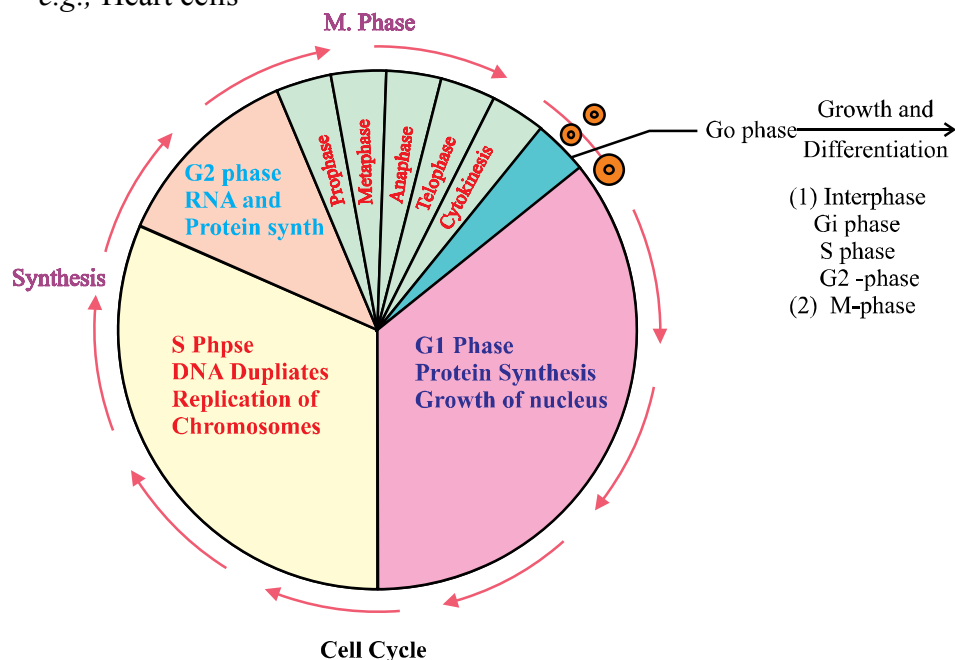
Interphase : (Resting Phase)

- **G₁ Phase :** Cell metabolically active and grows continuously but does not replicate DNA
- **S Phase :** DNA synthesis occurs, DNA content increases from 2C to 4C, but the number of chromosomes remains same *i.e.*, $2n$.
- **G₂ Phase :** Proteins are synthesised in preparation for mitosis while cell growth continues.

M Phase (Mitosis Phase) : Starts with nuclear division, corresponding to separation of daughter chromosomes (karyokinesis) and usually ends with division of cytoplasm, (cytokinesis).

Quiescent stage (G₀) In adult animals cells that do not divide and exit G₁ phase to enter an inactive stage called G₀. Cells at this stage remain metabolically active but do not proliferate.

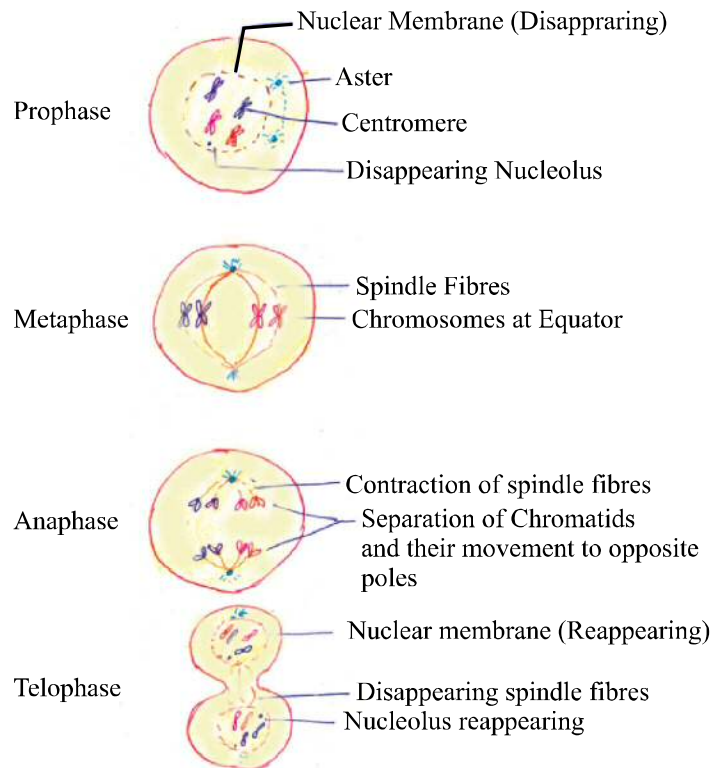
e.g., Heart cells



Mitosis

Since the number of chromosomes in the parent and progeny cells is the same, it is called as equational division. Mitosis is divided into four sub stages.

- 1. Prophase :** (i) Replicated chromosomes, each consisting of 2 chromatids, condense and become visible.
 - (i) Microtubules are assembled into mitotic spindle.
 - (iii) Nucleolus and nuclear envelope disappear.
 - (iv) Centriole moves to opposite poles.
- 2. Metaphase :** (i) Spindle fibres attached to kinetochores (small disc-shaped structures at the surface of centromere) of chromosomes.
 - (ii) Chromosomes line up at the equator of the spindle to form metaphase plate.
- 3. Anaphase :** (i) Centromeres split and chromatids separate.
 - (ii) Chromatids move to opposite poles due to shortening of spindle fibres.
- 4. Telophase :** (i) Chromosomes cluster at opposite poles.
 - (ii) Nuclear envelope assembles around chromosomes clusters.
 - (iii) Nucleolus, Golgi Complex, E.R. reforms.



Stages of Mitosis

Cytokinesis : Is the division of protoplast of a cell into two daughter cells after karyokinesis (nuclear division)

Animal Cytokinesis :

Appearance of furrow in plasma membrane which deepens and joins in the centre, dividing cell cytoplasm into two.

Plant cytokinesis : Formation of new cell wall begins with the formation of a simple precursor — **cell plate** which represents the middle lamella between the walls of two adjacent cells.

- When karyokinesis is not followed by cytokinesis, a multinucleated condition arises. This is called **syncytium**.

Significance of Mitosis :

1. Growth-addition of cells.
2. Maintenance of surface/volume ratio. Maintain Nucleo—cytoplasmic ratio.
3. Maintenance of chromosomes number.
4. Regeneration.

5. Reproduction in unicellular organisms, lower plants and some insects.
6. Repair and wound healing.
7. Vegetative reproduction in plants takes place by mitosis.

Meiosis :

- Specialised kind of cell division that reduces the chromosomes number by half. hence it is called reductional division.
- Occurs during gametogenesis in plants and animals.
- Involves two sequential cycles of nuclear and cell division called Meiosis I and Meiosis II.
- It results in 4 haploid daughter cells.
- Interphase occurs prior to meiosis which is similar to interphase of mitosis except the S phase is prolonged.

Meiosis I

Prophase I : Subdivided into 5 phases.

(i) Leptotene :

- Chromosomes make their appearance as single stranded structures.
- Compaction of chromosomes continues.

(ii) Zygotene :

- Homologous chromosomes start pairing and this process of association is called synapsis.
- Chromosomal synapsis is accompanied by formation of synaptonemal complex.
- Complex formed by a pair of synapsed homologous chromosomes is called bivalent or tetrad.

(iii) Pachytene : Crossing over occurs between non-sister chromatids of homologous chromosomes. The enzymes involved in the process is 'recombinase'. Recombination between homologous chromosomes is completed. Exchange of genetic material.

(iv) Diplotene : Dissolution of synaptonemal complex occurs and the recombined chromosomes separate from each other except at the sites of crossing over. These X-shaped structures are called **chiasmata**. In oocytes of some vertebrates diplotene can last for month or years.

(v) **Diakinesis** : Terminalisation of chiasmata.

- Chromosomes are fully condensed and meiotic spindles assembled.
- Nucleolus disappear and nuclear envelope breaks down.

Metaphase I : Bivalent chromosomes align on the equatorial plate.

- Microtubules from opposite poles of the spindle attach to the pair of homologous chromosomes.

Anaphase I : Homologous chromosomes, separate while chromatids remain associated at their centromeres.

Telophase I :

- Nuclear membrane and nucleus reappear.
- Cytokinesis follows (diad of cells).

Interkinesis : Stage between two meiotic divisions, (meiosis I and meiosis II) generally short lived.

Meiosis II: (It resembles the normal mitosis).

Prophase II

- Nuclear membrane disappears.
- Chromosomes again become compact.

Metaphase II

- Chromosomes align at the equator.
- Microtubules from opposite poles of spindle get attached to kinetochores of sister chromatids.

Anaphase II

- Simultaneous splitting of the centromere of each chromosome, allowing them to move towards opposite poles of the cell.

Telophase II

- Two groups of chromosomes get enclosed by a nuclear envelope.
- Cytokinesis follows resulting in the formation of tetrad of cells *i.e.*, 4 haploid cells.

Significance of Meiosis

1. **Formation of gametes** : In sexually reproducing organisms.
2. **Genetic variability** : Variations are very important for evolution.
3. **Maintenance of chromosomal number** : By reducing the chromosome number in gametes. Chromosomal number is restored by fertilisation of gametes.



Questions

Very Short Answer Questions

(1 mark each)

1. What are kinetochores ?
2. Name the term used for the stage between two meiotic divisions.
3. Why is mitosis called equational division ?
4. Name the stage of meiosis during which synaptonemal complex is formed.
5. What is G₀ phase of cell cycle ?
6. Where does mitosis take place in plants and animals ?

Short Answer Questions-I

(2 marks each)

7. Differentiate between cytokinesis of plant and animal cell.
8. What is chiasmata ? State its significance.
9. Differentiate between chromatin and chromatid.
10. Give the terms for the following :
 - (a) The period between 2 successive mitotic divisions.
 - (b) Cell division in which chromosome number is halved.
 - (c) Phase in cell cycle where DNA is synthesised.
 - (d) Division of nuclear material.
11. What happens during S phase of interphase ?
12. Distinguish between metaphase of mitosis and metaphase I of meiosis.
13. What will be the DNA content of a cell at G₁ after S and G₂ if the content after M phase is 2C.

Short Answer Questions-II

(3 marks each)

14. Differentiate between mitosis and meiosis.
15. List the significance of mitosis.
16. Describe the following :
 - (a) Synapse
 - (b) Bivalent
 - (c) Leptotene

Long Answer Questions

(5 marks each)

17. With the help of labelled diagram, explain the following :
 - (a) Diplotene
 - (b) Anaphase of mitosis
 - (c) Prophase I of meiosis

18. What is cell cycle ? Explain the events occurring in this cycle.
19. With the help of labelled diagrams, explain various stages of mitosis cell division.
20. (a) Write a note on significance of meiosis.
 (b) Differentiate between anaphase I of meiosis and Anaphase of mitosis.
 (c) In which phase of interphase duplication of DNA will occur ?

Answers

Very Short Answers

(1 mark each)

1. Small disc-shaped structure at the surface of the centromeres.
2. Interkinesis.
3. The chromosomes number in daughter cells is equal to that of the parent.
4. Zygotene.
5. Cells which enter a stage where they are Metabolically active but no longer proliferate.
6. Plant – Meristematic tissue; Animals – somatic cells.

Short Answers-I

(2 marks each)

7. Refer 'Points to Remember'.
8. Refer 'Points to Remember'.
9. **Chromatin Chromatid :**
 - (a) Diffuse, deep staining hereditary material longitudinally split half of a chromosome, light staining hereditary material.
 - (b) Metabolically inert Metabolically active.
10. (a) Interphase
 (b) Meiosis
 (c) S phase
 (d) Karyokinesis
11. Refer 'Points to Remember' :

Metaphase	Metaphase I
(a) Chromosome align along the equator of the cell	(a) Bivalent chromosomes arrange along the equatorial plane.
(b) Figure 10.2 (b) page 165, Text Book of Biology for Class XI	(b) Figure 10.3, meta phase I page 169, NCERT Text Book of Biology for Class XI.

Short Answers-II

(3 marks each)

13. $G_1 - 2C$, $S_1 - 4C$, $G_2 - 4C$

14.	Mitosis	Meiosis
(a)	Occurs in Somatic cells	(a) Occurs in germ cells
(b)	Number of chromosomes remain same in daughter cells	(b) Number of chromosomes reduces to half in daughter cells.
(c)	No exchange of genetic material	(c) Exchange of genetic material occurs due to crossing over
(d)	Involve single division	(d) Involve two successive division

15. Refer 'Points to Remember'.

16. Refer 'Points to Remember'.

Long Answer

(5 mark each)

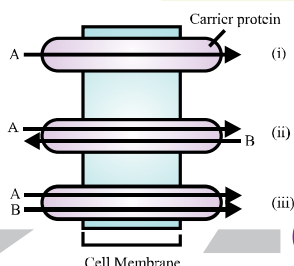
17. Refer 'Points of Remember'.

18. Refer 'Points of Remember'.

19. Refer 'Points of Remember'.

20. (a) Refer 'Points of Remember'
(b) Refer 'Points of Remember'.
(c) During A phase or synthesis phase.





Chapter - 11

Transport In Plants

Points To Remember

Translocation (Long distance transport) : Transport of substances in plants over longer distances through the vascular tissue (Xylem and Phloem) The transport of water and mineral in Xylem is unidirectional while transport of organic and mineral nutrients in phloem is multi-directional.

Means of transport (Short distance transport) : The transport of material into and out of the cells is carried out by a number of methods. These are diffusion, facilitated diffusion and active transport.

(i) **Diffusion :** Diffusion occurs from region of higher concentration to region of lower concentration across the permeable membrane. It is passive and slow process. No energy expenditure takes place.

Factors affecting diffusion : Permeability of membrane, Temperature, pressure, gradient of concentration and the size of substances.

(ii) **Facilitated diffusion :** The diffusion of hydrophilic substances along the concentration gradient through fixed membrane transport protein without involving energy expenditure. For this the membrane possess aquaporins and ion channels. No ATP energy is utilized in this process.

Porins—The proteins that form huge pores in the outer membranes of the plastids, mitochondria and some bacteria which allow the small size molecules to pass through.

Aquaporins—Proteins that facilitate diffusion of water molecules.

Methods of Facilitated Diffusion

Symport

(Two molecules cross the membrane in the same direction at the same time.)

Antiport

(Two molecules move in opposite direction at the same time.)

Uniport

(Single molecule moves across membrane independent of other molecules.)

Transport Proteins—They are present in the membrane. They allow the passage of substances through membrane.

(i) **Carrier Proteins**—They bind to the particular solute particle to be transported and deliver these to other side of membrane.

(ii) **Channel Proteins**—**Ion Channel**—They are specific for different ions like K^+ , Cl^- , NO_3^- , PO_4^{3-} , Mg^{2+}

Water Channel—Surrounded by eight proteins called aqua protein and allow passage of water or water soluble substance.

(iii) **Active transport** : Active transport is carried by the movable carrier proteins (pumps) of membrane. Active transport uses energy to pump molecules against a concentration gradient from a low concentration to high concentration (uphill-transport). It is faster than passive transport.

Different Transport Mechanisms

S. No.	Property	Simple Diffusion	Facilitated Transport	Active Transport
1.	Required Special membrane protein	No	Yes	Yes
2.	Uphill transport	No	No	Yes
3.	Requires ATP Energy	No	No	No

- **Water potential**—(ψ_w)—Greater the concentration of water in a system, greater is its kinetic energy and greater is the water potential. It is measured in pascal (Pa). or mega pascal.
- If two systems are in contact, then there is movement of water from the solution with higher potential to lower water potential.
- **Solute potential**—(ψ_s)—Magnitude of lowering of water potential, when a solute is added to the water.
- **Pressure Potential**—(ψ_p)—Magnitude of increase of water potential, when pressure greater than atmospheric pressure is applied to pure water or a solution.
- Water potential of pure water is zero (0).
- Solute potential is always negative (–) and water potential is always positive (+)

$$\psi_w = \psi_s + \psi_p$$

- **Osmotic Pressure**—External pressure applied to prevent the diffusion of water. It depends upon solute concentration.
- Numerically, osmotic pressure is equal to osmotic potential osmotic pressure has positive (+) sign. Osmotic potential has negative (–) sign.

Turgor Pressure—Due to osmotic entry of water, the protoplasm of a plant cell presses the cell wall towards the outside with a force, it is called Turgor Pressure.

Diffusion Pressure—The pressure exerted by the tendency of the particles to diffuse from the area of higher concentration to lower concentration. It is directly proportional to the concentration of particles of diffusing substance.

Osmosis : Osmosis is movement of solvent or water molecules from the region of their higher diffusion pressure or free energy to the region of their lower diffusion pressure of free energy across a semipermeable membrane.

Water molecules move from higher water potential to lower water potential until equilibrium is reached.

Plasmolysis : Process of shrinkage of protoplast in a cell due to exosmosis in hypertonic solution. If a plasmolysed cell is placed in water or a hypotonic solution it becomes turgid.

Hypotonic solution : The external solution which is more dilute than the cytoplasm.

Hypertonic solution : The external solution, which is more concentrated than the cytoplasm.

Isotonic solution : When the external solution balances the osmotic pressure of the cytoplasm.

Casparian strip : It is the tangential as well as radial walls of endodermal cells having the deposition of water impermeable suberin.

Imbibition : Imbibition is the phenomenon of absorption of water by the solid particles of an adsorbent causing it to enormously increase in volume without forming a solution.

Some examples of Imbibition :

- If a dry piece of wood is placed in water, it swells and increases in its volume.
- If dry gum or pieces of agar-agar are placed in water, they swell and their volume increases.
- When seeds are placed in water they swell up.
- Swelling of wooden door during rainy season.

Conditions essential for imbibition

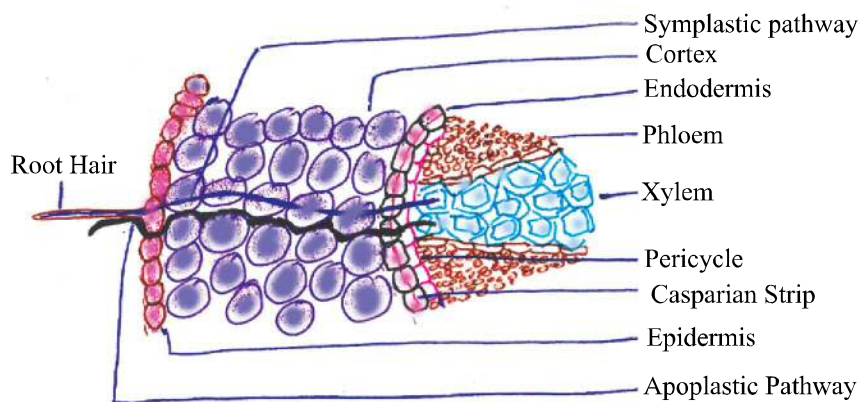
1. Water potential gradient between the surface of the adsorbent and the imbibed liquid, is essential.
2. Affinity between the adsorbent and the imbibed liquid.



Transport of water in plants : Water is absorbed by root hairs by diffusion. Then water moves upto xylem by two pathways—apoplast and symplast pathway.

Apoplast Pathway—Movement occurs through the intercellular spaces or walls of the cell, without entering the cytoplasm. This movement is fast. In roots, movement of water occurs via apoplast except at the carparian strip, most of water enters through apoplast.

Symplast Pathway—Water enters the cell through cell membrane and travels intercellularly through plasmodesmata. This movement is slow. At casparian strip region water moves through symplast.



Apoplastic And Symplastic Pathways of Water Transport

Ascent of Sap—Upward movement of water in the form of dilute solution of mineral ions from roots to the top aerial parts of plants through tracheary elements of xylem against the gravitational force is called ascent of sap. It involves two theories—

(i) **Cohesion**—Tension-transpiration pull theory.

(ii) **Root pressure theory.**

(1) **Cohesion-Tension-transpiration pull theory**—

(i) **Continuity of water column**—The transport of water to the top of trees occurs through xylem vessels. The forces of adhesion and cohesion maintain a thin and unbroken column of water in the capillaries of xylem vessels through which it travels which is travels upward. Water is mainly pulled by transpiration from leaves.

(ii) **Transpiration Pull**—Transpiration accounts for loss of 99% of water in the form of water vapours the surface of leaves. The loss is mainly through stomata.

- Pull of water as a result of tension created by transpiration is the major driving force of water movement upward in a plant.

Three physical properties of water which affect the ascent of xylem sap due to transpiration pull.

(iii) **Cohesion force or Tensile strength of water—**

- **Cohesion**—Mutual attraction between water molecules.
- **Adhesion**—Attraction of water molecules to polar surface.
- **Surface tension**—Attraction of water to each other in liquid phase to a greater extent than to water in gaseous phase.

(2) **Root pressure Theory** : A hydrostatic pressure existing in roots which pushes the water up in xylem vessels upto certain height to herbaceous plant.

Guttation : The water loss in its liquid phase in the form of water droplets at night and early morning through special openings of vein near the tip of leaves. These openings are called hydathodes.

Transpiration : The loss of water through stomata of leaves and other aerial parts of plants in form of water vapours.

Factors affecting transpiration : Temperature, light, relative humidity, wind speed, number and distribution of stomata, water status of plant, canopy structure.

Significance of transpiration—Advantages—Helps in ascent of sap removal of excess water, cooling effect, distribution of mineral salts, supply water for photosynthesis.

Disadvantages—May cause reduced growth, wilting (loss of turgidity), reduced yield and waste of energy.

This is why—‘Transpiration is called a necessary evil’.

Opening and closing of stomata—Mechanism of opening and closing of stomata involves two steps—

- (i) Change to the turgidity of guard cells.
- (ii) Orientation of cellulose microfibrils in the cell wall of guard cells.

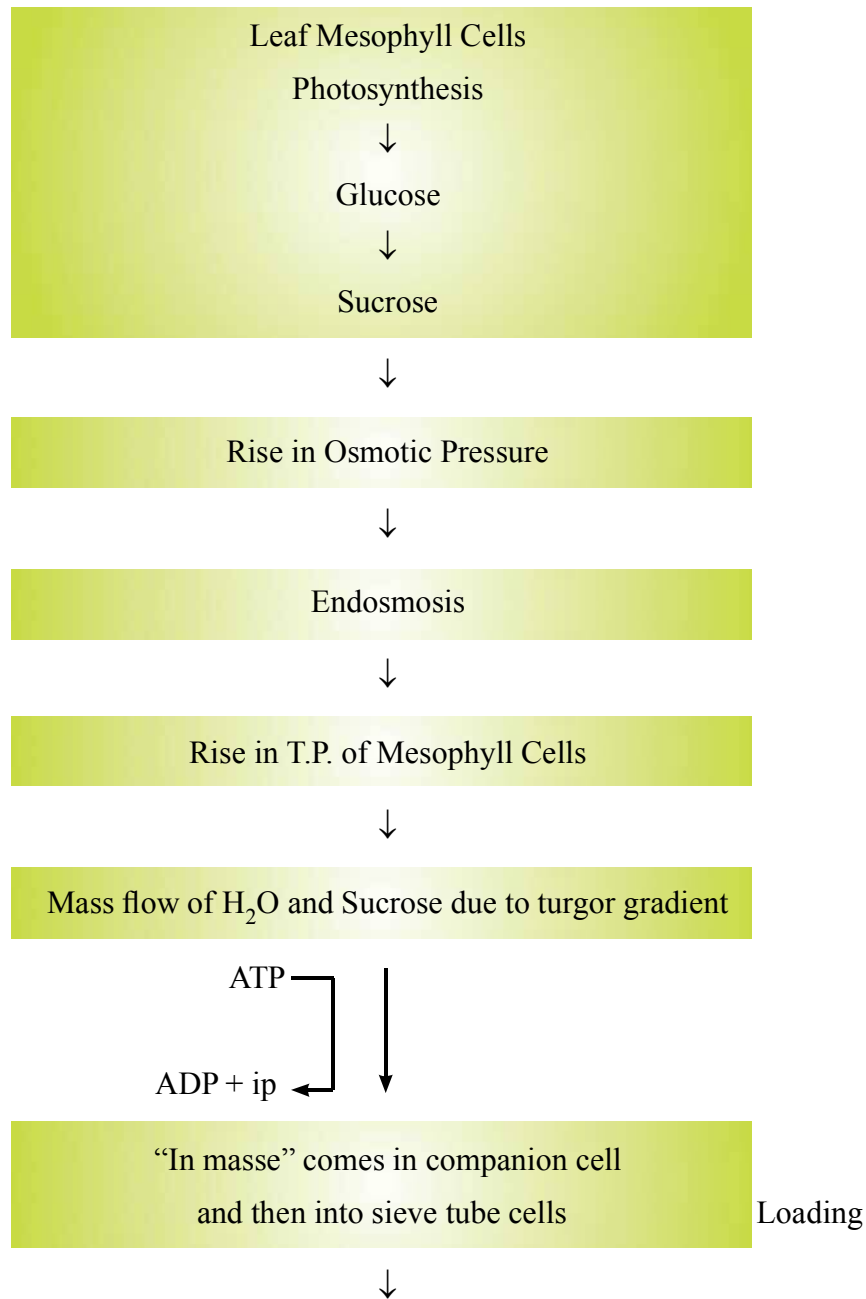
Endosmosis—When a cell is placed in water or hypotonic solution, water enters into the cell. This is called endosmosis. Due to it the volume of cell increases and it creates turgor pressure.

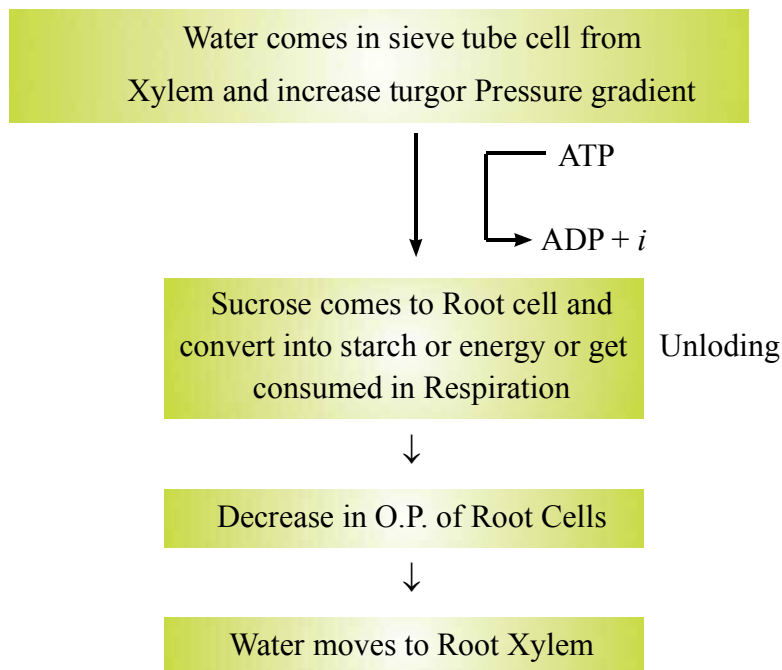
Exosmosis—When a cell is placed in hypertonic solution, water comes out of the cell, this is called exosmosis. It decreases volume of the cell.

Uptake and transport of mineral nutrients—Ions are absorbed by the roots by passive and active transport. The active uptake of ions requires ATP energy. Specific proteins in membranes of root hair cells actively pump ions from the soil into the cytoplasm of epidermal cells and then xylem. The further transport of ions to all parts of the plant is carried through the water stream. Older dying leaves export much of their mineral content to younger leaves. Elements phosphorus, sulphur, nitrogen and potassium are most readily mobilised.

Mass flow : Mass flow is the movement of substances (water, minerals and food) in bulk from one point to another as a result of pressure differences between two points.

The pressure or mass flow Hypothesis :





Mycorrhiza—A mycorrhiza is a symbiotic association of a fungus with a root system. The fungal hyphae absorb mineral ions and water from the soil, and provide them to the roots of plant, in turn the roots provide sugars and nitrogen containing compounds to the mycorrhizae.

Questions

Very Short Answer Questions

(1 mark each)

1. Which part of the root is related with the absorption of water ?
2. What makes the raisins to swell up when kept in water ?
3. Casparian strip is made of a substance which is impervious to water. Name this substance.
4. What will happen to water potential when a solute is added to water ?
5. A plant cell when kept in a solution got plasmolysed. What was the nature of the solution.
6. Mention two ways of absorption of water by root hairs in plants.
7. Which form of sugar is transported through phloem ?
8. Give one example of imbibition.

9. A flowering plant is planted in an earthen pot and irrigated. Urea is added to make the plant grow faster, but after some time the plant dies. Give its possible reason.
10. Why is energy required to develop root pressure ?
11. Correct the statements :
 - (a) Imbibition is a special type of diffusion when water is absorbed by living cell.
 - (b) Most of water flow in the roots occurs via symplast.
 - (c) Cells shrink in hypotonic solution and swell in hypertonic solution.

Short Answer Questions-I

(2 marks each)

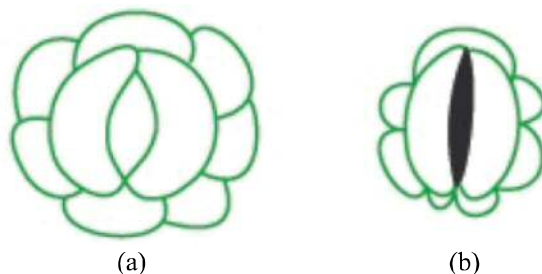
12. A well watered potted herbaceous plant shows wilting in the afternoon of a dry sunny day. Give reason.
13. Do different species of plants growing in the same soil show the same rate of transpiration at a particular time ? Justify your answer.
14. What is casparian strip ? Write its significance in plants.
15. Xylem transport is unidirectional and phloem transport bi-directional why ?
16. How is transpiration different from guttation ? Give two points.
17. Suggest two methods to increase the life of cut plants in a vase.
18. Write the chemical composition of xylem and phloem sap.
19. Transpiration is a necessary evil in plants. Explain.

Short Answer Questions-II

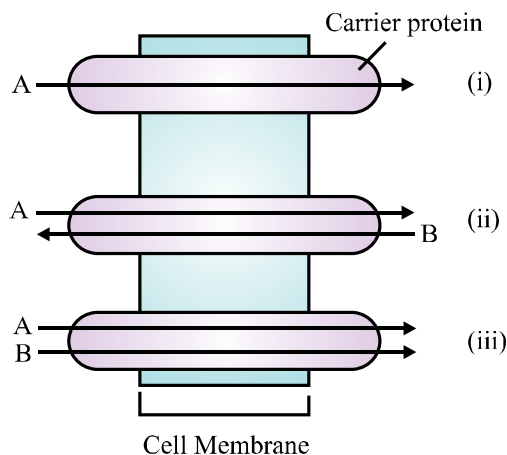
(3 marks each)

20. Why is solute potential always negative ? Explain.
- $$\Psi_w = \Psi_s + \Psi_p$$
21. Water has a very important role in sustaining the life list properties of water which make it useful for all biological processes on earth.
 22. When any dry plant material or seeds is/are kept in water, they swell up.
 - (a) Name the phenomenon involved in this change.
 - (b) Define this phenomenon.
 - (c) Give two conditions essential for the phenomenon to occur.
 23. Differentiate between temporary and permanent wilting. Do any of them indicate the water status of the soil ?

24. Observe the diagram and answer the following :



- (a) Which of these guard cells show a higher water content, A or B ?
 - (b) Are these types of guard cells found in monocots or dicots ?
 - (c) Name the element which plays an important role in the opening and closing of stomata.
25. What is mycorrhiza ? How is the mycorrhizal association helpful in absorption of water and minerals in plants ?
26. Observe the given figure and give the answers of the following :
- (a) Identify the process occurring in (I), (II) and (III).
 - (b) Differentiate between the process II and III.
 - (c) How many types of aquaporins form the water channels in the cell membrane.



27. Give scientific term for the following statements/processes :
- (a) Movement of water in roots exclusively, through the cell wall
 - (b) The positive hydrostatic pressure developed inside the cell or cell wall.
 - (c) A solution having relatively less concentration.
 - (d) Loss of water vapour from the aerial parts of the plants in the form of water vapours.



- (e) Movement of a molecule across a membrane independent of other molecule.
- (f) Water loss in its liquid phase through the special opening of veins near the tip of leaves of many herbaceous plants.

Long Answer Questions

(5 marks each)

- 28. Minerals are present in the soil in sufficient amount. Do plants need to adjust the types of solutes that reach the xylem ? Which molecules help to adjust this ? How do plants regulate the type and quantity of solutes that reach xylem.
- 29. How do plants absorb water ? Explain transpiration pull model in this regard.
- 30. (a) Describe the pressure flow hypothesis of translocation of sugar in plants.
(b) Explain the mechanism of closing and opening of stomata.

Answers

Very Short Answer

(1 mark each)

- 1. Root hairs.
- 2. Endosmosis.
- 3. Suberin
- 4. Water potential will decrease.
- 5. Hypertonic.
- 6. Apoplast and symplast pathway.
- 7. Sucrose.
- 8. Swelling of seed when put in water/moist soil.
- 9. Due to exosmosis *i.e.*, water comes out the plant.
- 10. Every activity requires energy. Root pressure develops due to activity of living cell.
- 11. (a) Osmosis is a special type, of diffusion when water is absorbed by living cells.
(b) Most of the water flows in the roots occurs via the apoplast.
(c) Cells shrink in hypertonic, solution and swell in a hypotonic solution.

Short Answers-I

(2 marks each)

- 12. During noon, the rate of transpiration becomes higher than the rate of water absorption by plant. It causes loss of turgidity and leads to wilting.

13. Rate of transpiration is not same because transpiration is affected by numbers and distribution of stomata, and their opening.
14. Refer page 185, NCERT, Text Book of Biology for Class XI
15. Refer page 190, NCERT, Text Book of Biology for Class XI

16.	Transpiration	Guttation
	(i) Loss of water by a plant in form of vapours.	(i) The loss of water in the form of liquid droplets from the plant.
	(ii) Occurs through the general surface of leaves (stomata) and the young stems.	(ii) Occurs at the margins and the tips of the leaves.

17. (a) By adding cytokinin into water of the vasa.
(b) Preventing entry of air in the cut plants by immediately immersing the cut end in water.
18. Xylem Sap-Water, traces of all minerals.
Phloem sap-5-10% sucrose, 1% amino acids, traces of bound mineral, hormones, other organic substances and rest is water.
19. Refer to 'Points of Remember'.
20. Refer to 'Points of Remember' (Significance and disadvantages of Transpiration)

Short Answers-I

(3 marks each)

21. Refer to 'Points of Remember'. (Solute Potential, Pressure Potential and Water potential)
22. Refer to 'Points of Remember', (Cohesion, Adhesion and surface tension)
23. (a) Imbibition.
(b) Refer to 'Points to Remember.'
(c) Condition necessary to imbibition.
 - (i) Water potential between the absorbent and the liquid imbibed.
 - (ii) Affinity between the adsorbent and the liquid imbibed.



24.	Temporary wilting	Permanent wilting
	(i) Plant recovers from temporary wilting after sometimes.	(i) Automatic recovery is not possible. It may recover if water is provided soon.
	(ii) Much damage is not caused.	(ii) Much damage is caused.
	(iii) It commonly occurs during mid-day only.	(iii) It occurs throughout day and night.

When wilting is permanent, water present in soil is largely unavailable form. The soil contains 10-15% water depending, upon its texture.

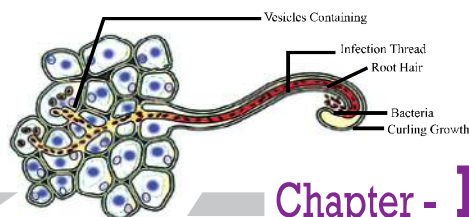
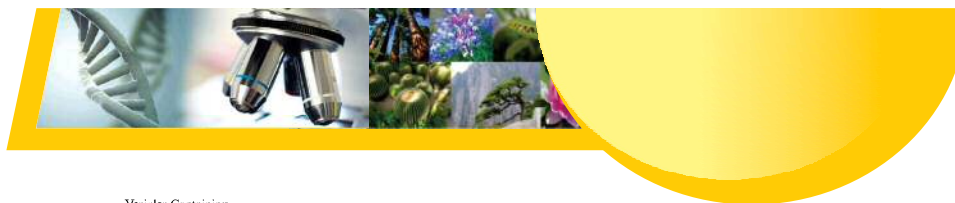
25. (a) A
(b) Dicots
(c) K^+ (Potassium ions)
26. Refer points to remember.
27. (a) (i) Uniport (ii) Antiport (iii) Symport
(b) Refer 'Points to Remember'.
(c) 8 types of aquaporins.
28. (a) Apoplast pathway
(b) Turgor pressure
(c) Hypotonic
(d) Transpiration
(e) Uniport
(f) Guttation

Long Answers

(5 marks each)

29. Refer page 189, NCERT, Text Book of Biology for Class XI.
30. Refer page 186-187, NCERT, Text Book of Biology for Class XI.
31. (a) Refer points to remember.
(b) Refer page 191, NCERT, Text Book of Biology for Class XI.





Chapter - 12

Mineral Nutrition

Points To Remember

Autotroph : An organism that synthesizes its required nutrients from simple and inorganic substances; Example—plants, blue green algae (cyanobacteria)

Heterotroph : An organism that cannot synthesize its own nutrients and depends on others. Example—Bacteria, protists, members of animalia.

Biological nitrogen fixation: Conversion of atmospheric nitrogen into organic compounds by living organisms.

Nitrification : Conversion of ammonia (NH_3) into nitrite and then to nitrate.

Denitrification : A process of conversion of nitrate into nitrous oxide and nitrogen gas (N_2).

Leg-hemoglobin : Pinkish pigment found in the root nodules of legumes. It acts as an oxygen scavenger and protects the nitrogenase enzyme from oxidation.

Flux : The movement of ions is called flux. Influx is inward movement of ions into the cells and efflux is the outward movement of ions.

Inhibition of cell division : Deficiency of N, K, S, and Mo.

Necrosis : Death of tissues particularly leaf tissue due to deficiency of Ca, Mg, Cu, K.

Delayed Flowering : due to deficiency of N, S, Mo.

Mineral Nutrition : Plants require mineral elements for their growth and development. The utilization of various absorbed ions by a plant for growth and development is called mineral nutrition of the plant.

Hydroponics : Soil-less culture of plants, where roots are immersed in nutrient solution (without soil) is called hydroponics. The results obtained from hydroponics may be used to determine deficiency symptoms of essential elements.

Essential Elements

Macronutrients	Micro-nutrients
Macronutrients are present in plant tissues in concentrations of more than 10 mole Kg^{-1} of dry matter. C, H, O, N, P, K, S, Ca, Mg	Micro-nutrients are needed in very low amounts : less than 10 m mole Kg^{-1} matter. Fe, Mn, Cu, Mo, Zn, B, Cl, Ni

In addition to the 17 essential elements, Na, Si, Co and Si are required by some higher plants.

Criteria for essentiality :

1. The element must be necessary for supporting normal growth and reproduction.
2. Requirement must be specific and not replaceable by another element.
3. The element must be directly involved in the metabolism of the plant.

Chlorosis : Yellowing of leaves due to loss of chlorophyll.

Active Transport : Absorption occurring at the expense of metabolic energy.

Passive Transport : Absorption of minerals with concentration gradient by the process of diffusion without the expense of metabolic energy.

Role of Minerals Elements in Plants

MACRO NUTRIENTS

Element	Obtained as	Functions	Deficiency symptoms
Nitrogen (N)	Mainly as NO_3^- some as NO_2^- or NO_4^-	Constituent of proteins, nucleic acids, vitamins and hormones.	Stunted growth Chlorosis, dormancy of causal buds.
Phosphorus (P)	Phosphate ions (H_2PO_4^- or HPO_4^{2-}).	Constituent of cell membrane. Required for the synthesis of nucleic acids, nucleotides, ATP NAD and NADP for phosphorylation reactions.	Poor growth of plant. Leaves dull green, delay in seed germination purple or red spots on leaves, premature leaf fall.

Potassium (K)	K^{+}	Helps to maintain an anion-cation balance in cells. Involved in protein synthesis, in opening and closing of stomata; activation of enzymes; maintenance of turgidity of cells.	Stunted growth; yellow leaves edges of leaves; mottled appearance of leaves. Premature death.
Calcium (Ca)	Ca^{2+}	Required in formation of mitotic spindle; involved in normal functioning of cell membranes; activates certain enzymes; as calcium pectate in middle lamella of the cell wall.	Stunted growth, chlorosis of young leaves.
Magnesium (Mg)	Mg^{2+}	Activates enzymes in phosphate metabolism, constituent of chlorophyll; maintains ribosome structure.	Chlorosis between the leaf veins necrotic purple colours spots on older leaves
Sulphur (S)	SO_4^{2-}	Constituent of two amino-acids-Cysteine and methionine and proteins, coenzymes, vitamins and ferredoxin.	Chlorosis of younger leaves, stunted growth

MACRO NUTRIENTS

Element	Obtained as	Functions	Deficiency symptoms
Iron (Fe)	Fe^{3+}	Constituent of Ferredoxin and cytochrome; needed for synthesis of chlorophyll.	Chlorosis of leaves
Manganese (Mn)	Mn^{2+}	Activates certain enzymes involved in photosynthesis, respiration and nitrogen metabolism.	Chlorosis, grey spots on leaves.

Zinc (Zn)	Zn^{2+}	Activates various enzymes like carboxylases. Required for synthesis of auxins.	Malformation of leaves
Copper (Cu)	Cu^{2+}	Activates certain enzymes. Essential for overall metabolism	Stunted growth, inter-veinal chlorosis in leaves. Necrosis of the tip of young leaves, die back of shoot.
Boron (B)	BO_3^{3-} , $\text{B}_4\text{O}_7^{2-}$	Required for uptake of water and Ca, for membrane functioning, pollen germination, cell elongation carbohydrate translocation.	Death of stem and root apex, loss of apical dominance, abscission of flowers, small size of fruits
Molybdenum (Mo)	MoO_4^{2-} (molybdate ions)	Activates certain metabolism.	Nitrogen deficiency inter-veinal chlorosis retardation of growth
Chlorine (Cl)	Cl^-	Maintains solute concentration along with Na^+ & K^+ ; maintain anion-cation balance in cells; essential for oxygen evolution in photosynthesis.	Wilted leaves; stunted root growth and reduced fruiting.

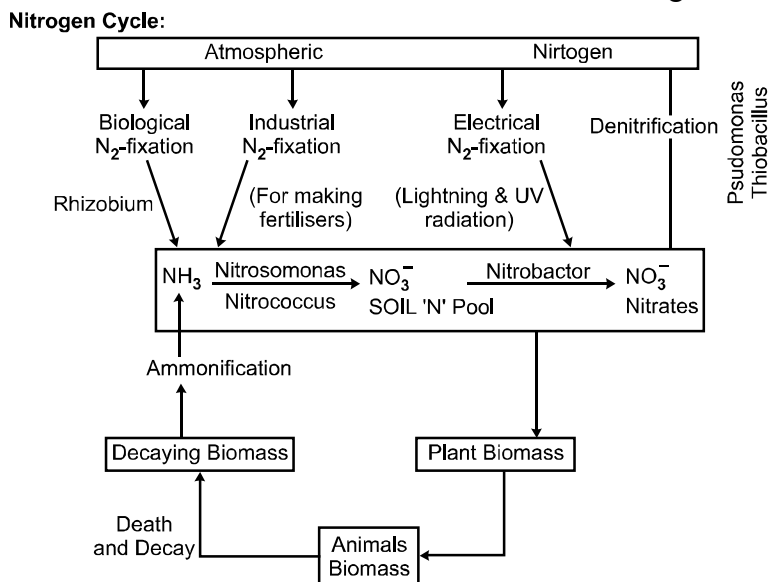
Critical Concentration : The concentration of the essential element below which plant growth is retarded. The element is said to be deficient when present below the critical concentration.

Deficiency symptoms : Chlorosis, stunted growth, premature fall of leaves and buds and inhibition of cell division.

Toxicity of micronutrient : Any mineral ion concentration in tissues that reduces the dry weight of tissues by 10% is considered toxic. Toxicity of one element may lead to deficiency of other element since the former may inhibit the uptake of latter., e.g., Mn competes with Fe, Mg for uptake and also inhibits Ca translocation to shoot apex. Therefore Mn toxicity symptoms are actually same as deficiency symptoms of Fe, Mg and Ca.

Role of microbes in nitrogen cycle :

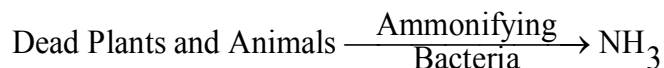
- *Rhizobium*, *Azotobacter*, *Rhodospirillum*; Fix atmospheric nitrogen
- *Nitrosomonas* and/or *Nitrococcus* :—Conversion of ammonia to nitrite
- *Nitrobacter* : Conversion of nitrite into nitrate.
- *Pseudomonas* and *Thiobacillus* : reduce nitrate into nitrogen.



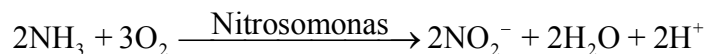
Nitrogen Cycle

Nitrogen fixation—The process of conversion of Nitrogen (N₂) into ammonia (NH₃).

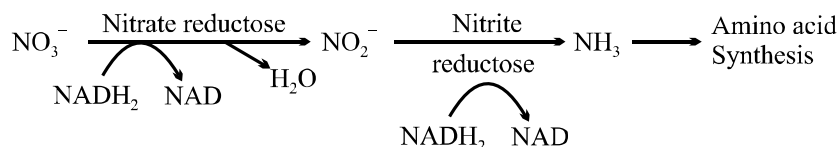
Ammonification—The process of decomposition of organic nitrogen of plants and animals (proteins) into ammonia.



Nitrification—The ammonia so formed may volatilise and re-enter the atmosphere, or some of the ammonia may be converted into nitrate by soil bacteria



The Nitrate so formed can be easily absorbed by the plants and transported to leaves. In leaves, nitrate is reduced to ammonia to form amino-acids, because nitrate can not be used by plants as such.



Denitrification—Process of reduction of the nitrate present in soil to nitrogen. It is carried out by bacteria like *Pseudomonas* and *Thiobacillus*.

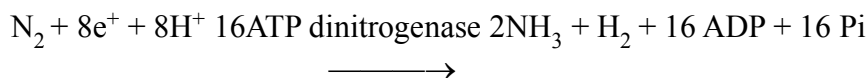
Biological Nitrogen Fixation—Reduction of nitrogen to ammonia by living organisms. Certain prokaryotes are able to fix nitrogen because of presence of ‘nitrogenase’ enzyme in them.

Nitrogen fixing microbes may be

- (a) Free living—(i) Aerobic—*Azotobacter*
(ii) Anaerobic—*Rhodospirillum*
- (b) Cyanobacteria—*Nostoc*, *Anabaena*
- (c) Symbiotic—(i) With leguminous plants—*Rhizobium*
(ii) With non-leguminous plants—*Frankia*

Enzyme nitrogenase—The enzyme nitrogenase is Mo-Fe protein and catalyses the conversion of atmospheric nitrogen to ammonia (First stable product of nitrogen fixation)

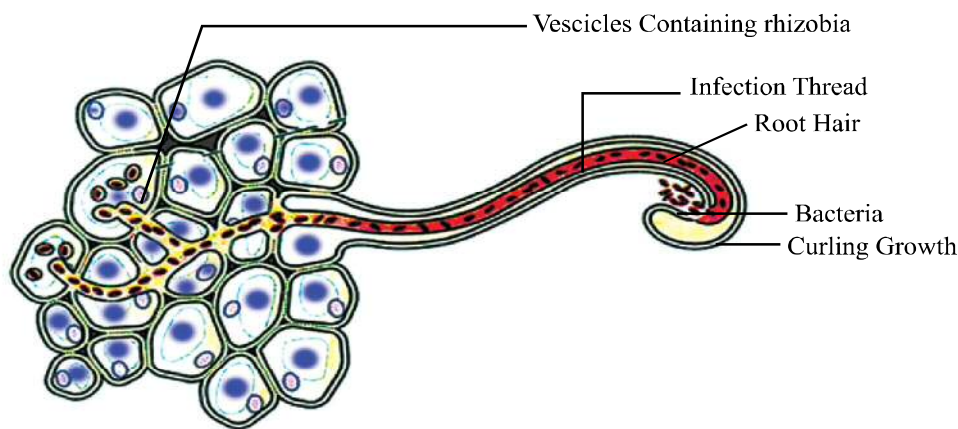
Leg-hemoglobin—A pink colour pigment, similar to hemoglobin of vertebrates and functions as an oxygen scavenger and protects nitrogenase from oxygen.



Steps of nodule formation :

- (a) *Rhizobium* bacteria present in soil contract a susceptible root hair.
- (b) Infection of the root hair causes it to curve and deform due to chemical secretion.
- (c) An infection thread is produced carrying the bacteria into the cortex of the root.
- (d) The bacteria get modified into rod-shaped bacteria and cause inner cortical and pericycle cells to divide. Plant produces cytokinin and auxin to stimulate cell division and enlarge to form nodules.

- (e) Division and growth of cortical and pericycle cells lead to nodule formation.



Nodule Formation in Roots of Leguminous Plants

(Refer Figure 12.4 page 203 NCERT Text Book)

Mechanisms of N_2 fixation

It requires 3 components—

- (a) A strong reducing agent like $FADH_2$, $NADPH_2$
- (b) Nitrogenase enzyme
- (c) ATP (as energy service)

Steps

- (a) Formation of Diamide
- (b) Formation of Hydrazine (N_2H_4)
- (c) Formation of Ammonia,

See Fig. 12.5 Page 203 NCERT

Questions

Very Short Answer Questions

(1 mark each)

1. Name one symbiotic nitrogen-fixing bacteria.
2. Give two examples of photosynthetic microorganisms, which also fix atmospheric nitrogen.
3. Name two organisms each which fix nitrogen *symbiotically* and symbiotically.
4. Which substance imparts pink colour to the root nodule of a leguminous plant and also mention its role ?

5. What is the term used for mineral deficiency symptom in plants in which leaves become yellow in different pattern ?
6. Define hydroponics.
7. Give the name of an insectivores angiosperm plant.
8. Give the name of one non-symbiotic nitrogen fixing prokaryote.
9. Name the green house gas produced in rice fields.

Short Answer Questions-I

(2 marks each)

10. Differentiate between two types of absorption of minerals in plants from soil.
11. Name the following :
 - (a) Bacteria which converts ammonia into nitrite.
 - (b) Bacteria which oxidises nitrite into nitrate.
12. How does Leghemoglobin protect the enzyme nitrogenase ?
13. Name the enzyme found in root nodules for N_2 fixation ? Name the pink coloured pigment required for its functioning.

Short Answer Questions-II

(3 marks each)

14. Write the deficiency symptoms of the following three elements :
 - (a) Phosphorus
 - (b) Magnesium
 - (c) Potassium
15. Describe the following three deficiency symptoms and co-relate them with concerned mineral deficiency :
 - (a) Phosphorus
 - (b) Magnesium
 - (c) Potassium
16. Explain in brief the steps involved in biological nitrogen fixation.
17. Describe the two main processes of synthesis of amino acids from Ammonium ion (NH_4^+) in plants.

18. Define critical concentration, also mention four deficiency symptoms of nutrients in plants.
19. Write a short note on toxicity of micronutrient. Give an example which show toxicity of one element may lead to deficiency of other element.

Long Answers

(5 marks each)

20. Describe all the steps of nitrogen cycle in nature.
21. Describe with diagrams how root nodules are formed in leguminous plants.
22. Explain adaptations in leguminous root nodules for N_2 fixation.

Answers

Very Short Answers

(1 mark each)

1. *Rhizobium*
2. *Anabaena*, *Nostoc*
3. **Asymbiotically**-*Azotobacter*, *Bacillus polymyxa* **Symbiotically**-*Rhizobium*, *Anabaena*.
4. Leghemoglobin. It is an oxygen scavenger, which protects the enzyme nitrogenase.
5. Necrosis.
6. The technique of growing plants in a nutrient solution without soil is called hydroponics.
7. *Nepenthes* (Pitcher plant)
8. *Azotobacter*
9. Methane (CH_4)

Short Answers-I

(2 marks each)

10. Refer to NCERT Book, Page no. 200 (12.3).
11. (i) Nitrifying Bacteria—*Nitrosomonas*.
(ii) Nitrifying Bacteria—*Nitrobacter*
12. Refer to page no. 203.
13. Enzyme-Nitrogenase
Pink coloured pigment-Leghaemoglobin

Short Answers-II

(3 marks each)

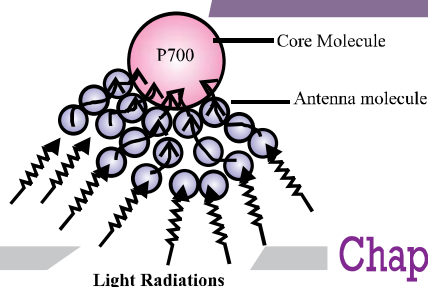
14. Refer to 'Points to Remember'.
15. Refer to 'Points to Remember'.
16. Refer to 'Points to Remember'.
17. Refer to 'Points to Remember' (Fate of Ammonia)
18. Refer to 'Points to Remember'.
19. Refer to 'Points to Remember'.

Long Answers

(5 marks each)

20. Refer to 'Points to Remember'.
21. Refer to 'Points to Remember'.
22. Refer to NCERT Book Page No. 203.



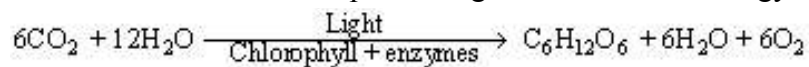


Chapter - 13

Photosynthesis in higher Plants

Points To Remember

Photosynthesis : Photosynthesis is an enzyme regulated anabolic process of manufacture of organic compounds inside the chlorophyll containing cells from carbon dioxide and water with the help of sunlight as a source of energy.



Historical Perspective

Josheph Priestley (1770) : Showed that plants have the ability to take up CO_2 from atmosphere and release O_2 . (Candle with belljar and mouse expt.)

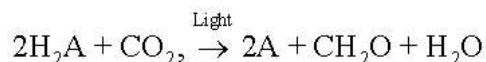
Jan Ingenhousz (1779) : Release of O_2 by plants was possible only in sunlight and only by the green parts of plants. (Expt. with aquatic plant in light & dark)

Theodore de Saussure (1804) : Water is an essential requirement for photosynthesis to occur.

Julius Von Sachs (1854) : Green parts in plant produce glucose which is stored as starch.

T.W. Engelmann (1888) : The effect of different wavelength of light on photosynthesis and plotted the first action spectrum of photosynthesis.

C.B. Van Niel (1931) : Photosynthesis is essentially a light dependent reaction in which hydrogen from an oxidisable compound reduces CO_2 to form sugar. He gave a simplified chemical equation of photosynthesis.



Hill (1937) : Evolution of oxygen occurs in light reaction.

Calvin (1954-55) : Traced the pathway of carbon fixation.

Hatch.and Slack (1965) : Discovered C_4 pathway of CO_2 fixation.

Site for photosynthesis : Photosynthesis takes place only in green parts of the plant, mostly in leaves. Within a leaf, photosynthesis occurs in mesophyll cells which contain the chloroplasts. Chloroplasts are the actual sites for photosynthesis. The thylakoids in chloroplast contain most of pigments required for capturing solar energy to initiate photosynthesis : The membrane system (grana) is responsible for trapping the light energy and for the synthesis of ATP and NADPH. Biosynthetic phase (dark reaction) is carried in stroma.

(Refer figure 13.2, Page 209, NCERT Text Book of Biology, Class XI)

Importance of Photosynthesis—(1) Synthesis of organic compounds (2) Change of radiant energy into chemical energy (3) Useful products are obtained from plants gums, oils timber fire wood, resins rubber, fibers and drugs, etc. (4) Balance the percentage of O₂ and CO₂ in atmosphere (5) Fossil fuels like coal, natural gas and petroleum have been formed inside the earth indirectly as a product of photosynthesis.

Pigments involved in photosynthesis :

Chlorophyll a : (Bright or blue green in chromatograph). Major pigment, act as reaction centre, involved in trapping and converting light into chemical energy. It is called universal photo-synthetic pigment.

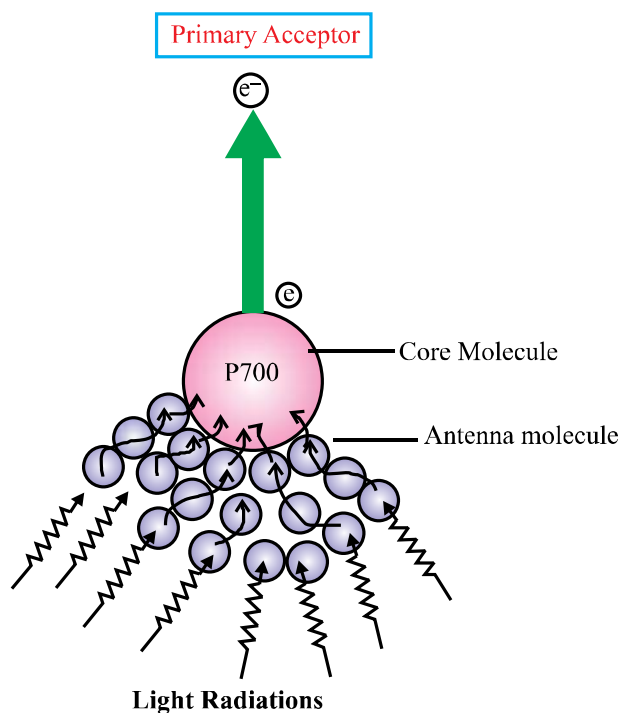
Chlorophyll b : (Yellow green)

Xanthophylls : (Yellow)

Carotenoids : (Yellow to yellow-orange)

- In the blue and red regions of spectrum shows higher rate of photosynthesis.

Light Harvesting Complexes (LHC) : The light harvesting complexes are made up of hundreds of pigment molecules bound to protein within the photosystem I (PS-I) and photosystem II (PS-II). Each photosystem has all the pigments except one molecule of chlorophyll 'a' forming a light harvesting system (antennae). The reaction centre (chlorophyll a) is different in both the photosystems. (Refer fig. 13.4, Page 211, NCERT-Biology).



Light Harvesting Complex

Photosystem I (PS-I) : Chlorophyll 'a' has an absorption peak at 700 nm (P700).

Photosystem II (PS-II) : Chlorophyll 'a' has absorption peak at 680 nm (P680),

Process of photosynthesis : It includes two phases-Photochemical phase and biosynthetic phase. (Formerly known as Light reaction and dark reaction)

(i) **Photochemical phase (Light reaction) :** This phase includes-light absorption, splitting of water, oxygen release and formation of ATP and NADPH. It occurs in grana region of chloroplast.

(ii) **Biosynthetic phase (Dark reaction) :** It is light independent phase, synthesis of food material (sugars). (Calvin cycle). It occurs in stroma region of chloroplast.

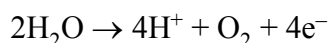
Photophosphorylation : The process of formation of high-energy chemicals (ATP and NADPH) in presence of light.

Non-Cyclic photophosphorylation : Two photosystems work in series—First PSII and then PSI. These two photosystems are connected through an electron transport chain (Z. Scheme). Both ATP and NADPH + H⁺ are synthesised by this process. PSI and PSII are found in lamellae of grana, hence this process is carried here. (Fig. 13.6) Page 213, NCERT-BIOLOGY. Class-XI.

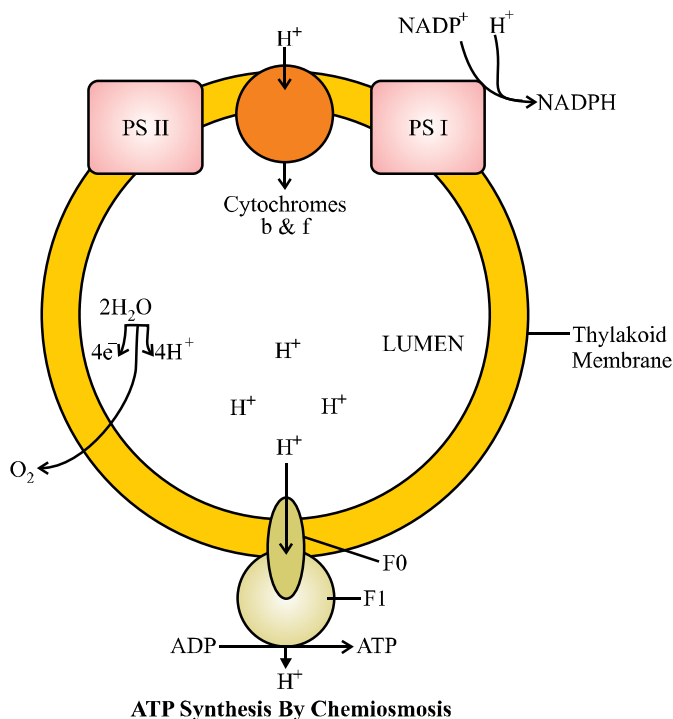
Cyclic photophosphorylation : Only PS-I works, the electron circulates within the photosystem. It happens in the stroma lamellae (possible location) because in this region PSII and NADP reductase enzyme are absent. Hence only ATP molecules are synthesised. It occurs when only light of wavelengths beyond 680 nm are available for excitation.

The electron transport (Z-Scheme) : In PS II, reaction centre (chlorophyll a) absorbs 680 nm wavelength of red light which make the electrons to become excited. These electrons are taken up by the electron acceptor that passes them to an electron transport system (ETS) consisting of cytochromes. The movement of electron is down hill. Then, the electron pass to PS I and move down hill further. (Fig. 13.5) Page 212, NCERT-BIOLOGY-Class XI

The splitting of water : It is linked to PS II. Water splits into H^+ and O_2 and electrons.



Chemiosmotic Hypothesis : Chemiosmotic hypothesis explain the mechanism of ATP synthesis in chloroplast. In photosynthesis, ATP synthesis is linked to development of a proton gradient across a membrane. The protons are accumulated inside of membrane of thylakoids (in lumen). ATPase enzyme has a channel of that allow diffusion of protons back across the membrane. This release energy to activate ATPase enzyme that catalyses the formation of ATP. (Fig. 13.7). Page 214



Biosynthesis phase in C₃ plants :

ATP and NADPH, the products of light reaction are used in synthesis of food. The first CO₂ fixation product in C₃ plant is 3-phosphoglyceric acid or PGA. The CO₂ acceptor molecule is RuBP (ribulose biphosphate). The cyclic path of sugar formation is called Calvin cycle on the name of Melvin Calvin, the discover of this pathway. **Calvin cycle** proceeds in three stages.

(1) Carboxylation : CO₂ combines with ribulose 1, 5 bisphosphate to form 3 PGA in the presence of RuBisCo enzyme (present in stroma)

(2) Reduction : Carbohydrate is formed at the expense of ATP and NADPH.

It involves 2ATP for phosphorylation and 2NADH₂ for reduction per CO₂ molecule fixed.

(3) Regeneration : The CO₂ acceptor ribulose 1, 5-bisphosphate is formed again.

6 turns of Calvin cycles and 18 ATP molecules are required to synthesize one molecule of glucose. (Fig. 13.8)



Input		Output
6CO ₂	—	One Glucose
18 ATP	—	18 ADP
18NADPH	—	12 NADP

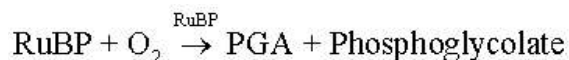
The C₄ pathway : C₄ plants such as maize, sorghum, sugarcane have special type, of leaf anatomy, they tolerate higher temperatures. In this pathway, oxaloacetic acid (OAA) is the first stable product formed. It is 4 carbon atoms compound, hence called C₄ pathway (Hatch and Slack Cycle). The leaf has two types of cells : mesophyll cells and Bundle sheath cells (Kranz anatomy). Initially CO₂ is taken up by phosphoenol pyruvate (PEP) in mesophyll cell and changed to oxaloacetic acid (OAA) in the presence of PEP carboxylase. Oxaloacetate is reduced to maltate/aspartate that reach into bundle sheath cells.

The decarboxylation of maltate/aspartate occurs with the release of CO₂ and formation of pyruvate (3C). In high CO₂ concentration RuBisCo carboxylase and not as oxygenase, hence the photosynthetic losses are prevented. RuBP operates now under Calvin cycle and pyruvate transported back to mesophyll cells and changed into phosphoenol pyruvate to keep the cycle continue. (Fig., 13.9) Page 219, NCERT BIOLOGY.





Photorespiration : The light induced respiration in green plants is called photorespiration. In C_3 plants some O_2 binds with RuBisCo and hence CO_2 fixation is decreased. In this process RuBP instead of being converted to 2 molecules of PGA binds with O_2 to form one molecule of PGA and phosphoglycerate.



There is neither synthesis of ATP nor NADPH_2 or sugar. There is 25% loss of fixed CO_2 so it is wasteful process.

C₄ Plants :

- (1) Lack Photorespiration
- (2) Show response to high light intensities
- (3) Have greater productivity of biomass.

Adaptations in C₄ Plants :

- (i) Kranz Anatomy
- (ii) Occurrence of two types of cells
- (iii) Dimorphic chloroplast
- (iv) Presence of RuBisCo in Bundle Sheath cells and PEPase in mesophyll cells.
- (v) Mechanism to increase CO_2 concentration near RuBisCo in Bundle Sheath cells.

CAM (/Crassulacean Acid Metabolism) Plants—Stomata open at night. *e.g.*, Cacti (Bryophyllum), Pineapple.

Law of Limiting Factors : If a chemical process is affected by more than one factor, then its rate will be determined by the factor which is nearest to its minimal value. It is the factor which directly affects the process if its quantity is changed Factors affecting photosynthesis :

1. **Light** : Rate of photo synthesis increases at low light intensities. At high intensities of light beyond a point the rate of CO_2 fixation decreases. Longer hours of light duration favour more photosynthesis rate.
2. **Carbon dioxide** : Increase in CO_2 concentration causes increases in CO_2 fixation. It is the major limiting factor for photosynthesis.
3. **Temperature** : The rate of photosynthesis at optimum temperature is, high. It is 20°C - 25°C For C_3 plants and 30 - 45°C for C_4 plants.

4. **Water :** Water is one of the reactant in photosynthesis, but it effects the rate of CO_2 fixation. Low water content causes the stomata to close and reduces the CO_2 availability.

Questions

Very Short Answer Questions

(1 marks each)

1. Name two photosynthetic pigments belonging to Carotenoids :
2. How many molecules of ATP are required for synthesis of one molecule of glucose in C_3 and C_4 pathways ?
3. What part of sunlight is most suitable for photosynthesis ?
4. Which one of the photosystems can carry on photophosphorylation independently ?
5. Name two plants that can carry out photosynthesis at night.
6. Name the most abundant enzyme found in the world.
7. Name the scientist who proposed the C_4 pathway. Name one such plants.
8. Where does carbon fixation occur in chloroplast ?
9. Which compound acts as CO_2 acceptor in Calvin cycle ?
10. Name the end products of light reaction.
11. Does the photosynthesis occur in moon light ? Why ?

Short Answer Questions-I

(2 marks each)

12. Why does the rate of photosynthesis decline in the presence of continuous light ?
13. Why do green plants start evolving carbon dioxide instead of oxygen on a hot sunny day ?
14. Fill in the space, left blank in the given table to bring the difference between C_3 and C_4 plants :

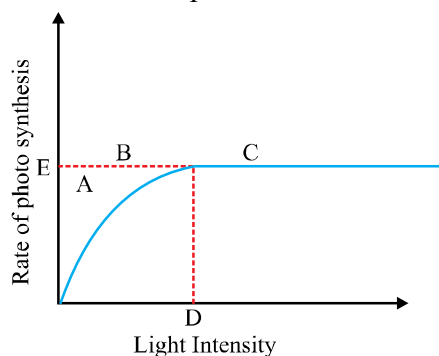
S.No.	Characteristics	C_3 plants	C_4 plants
1.	Cell type	mesophyll	...(a)... and mesophyll Phosphoenol
2.	CO_2 acceptor	...(b)...	pyruvate (PEP)
3.	First CO_2 fixation product	3-PGA	...(c)...
4.	Optimum temperature	...(d)...	30° C to 45° C

15. State two functions of accessory pigments, found in thylakoids.
16. Why do C_4 plants are more expensive (in energy requirement) than C_3 plants ?
17. What is limiting factor ? State the law of limiting factors.

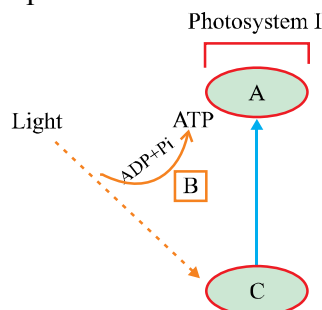
Short Answer Questions-II

(3 marks each)

18. The figure shows the effect of light on the rate of photosynthesis. Based on the graph, answer the following questions :
 - (i) At which point(s) A, B or C in the curve, light is a limiting factor ?
 - (ii) What could be the limiting factor(s) in region A ?
 - (iii) What do region C and D represent on the curve ?



19. When and why does photorespiration take place in plants ? How does this process result in a loss to the plant ?
20. What are the steps that are common to C_3 and C_4 photosynthesis ?
21. Two potted plants were kept in an oxygen free environment in transparent containers, one in total darkness and the other in sunlight. Which one of the two is likely to survive more ? Justify your answer by giving the reason.
22. (a) In the diagram shown below, label A, B and C. What type of phosphorylation is possible in this ?



- (b) Give any two points of difference between cyclic and non-cyclic photophosphorylation.

23. Name the pigment found in tomato, carrots, chillies etc. which gives red colour to them. Is it a photosynthetic pigment ?
24. Chloroplast and mitochondria are believed to be semi-autonomous organelles. Justify the statement.
25. Mention the conditions under which the C_4 plants are superior to C_3 plants.

Long Answer Questions

(5 marks each)

26. Describe C_4 pathway in a paddy plant. How is this pathway an adaptive advantage to the plant ?
27. Explain, the process, of biosynthetic phase of photosynthesis occurring in chloroplast.
28. (a) Give steps to ATP synthesis in chloroplasts through chemiosmosis.
(b) Schematically represent non-cyclic photophosphorylation in plants.

Answers

Very Short Answer

(1 mark each)

1. Carotene and Xanthophyll.
2. In C_3 pathway = 18 ATP molecules In C_4 pathway = 30 ATP molecules
3. Blue and red regions of the light spectrum are the most effective in photosynthesis.
4. PS-I.
5. Opuntia, Chenopodium, Bougainvillea.
6. RuBisCO.
7. Hatch and Slack. Maize and Sorghum.
8. Carbon fixation takes place in stroma.
9. Ribulose 1, 5 biphosphate.
10. ATP, NADPH and O_2 .
11. No, the moonlight is unable to perform light reactions of photosynthesis (ATP-NADPH Synthesis as it is 1/50,000 the intensity of sunlight and not strong enough to enable plants to photosynthesise).

Short Answers-I

(2 marks each)

12. Increase incident light beyond a point causes the breakdown of chlorophyll.
13. On a hot sunny day, enzyme RuBP carboxylase becomes active and its affinity for CO_2 decreases and for O_2 increases. Consequently more and more photosynthetically fixed carbon is lost by photorespiration.

14. (a) Bundle sheath
(b) RuBP
(c) OAA (oxaloacetic acid)
(d) 20°C-25°C
15. (a) Absorption of light and transfer of energy to chlorophyll 'a'.
(b) Protect chlorophyll 'a' from photo oxidation.
16. Because they require more energy (30 ATPs) in synthesizing one glucose molecule as compared to C₃—(18ATPs).
17. Limiting Factor—A factor which is deficient to such an extent that increase in its concentration directly increase the rate of the process.
(For the law of limiting factors see text in NCERT Book.) Page 222

Short Answers-II

(3 marks each)

18. (i) 'B'
(ii) CO₂ and temperature
(iii) 'C' represents to constant rate of photosynthesis, 'D' is the light saturation intensify at which rate of photosynthesis is maximum.
19. Refer Page no. 220, NCERT, Text Book Biology for class XI.
20. **Hints :**
(a) Photolysis of H₂O and photophosphorylation occurs in both C₃ and C₄ plants.
(b) In both, dark reaction occurs in stroma.
(c) Calvin cycle results in the formation of starch in both the plants.
(d) During dark reaction both types of plants undergo the phases of carboxylation and regeneration :
21. **Hints :**
● The plant in sunlight will survive for longer period.
● Light is essential for photosynthesis.
22. (a) (A) e⁻ acceptor
(B) Electron transport system
(C) Chlorophyll P700
(b) Refer A Page no. 212, NCERT Text Book of Biology for Class XI.
23. **Carotenoid :** It is an accessory photosynthetic pigment which takes part in harvesting light energy only if chlorophyll is present.

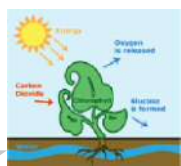
24. Mitochondria and chloroplast both contain DNA and can reproduce independently of the cell and chloroplasts even have a built in feeding mechanism both have their own ribosomes of 70S type and capable of synthesising their own kind of proteins.
25. C_4 Plant grow in regions with high temperatures and intense light. The rate of transpiration in C_4 plant is 25% of a C_3 plant, thus they conserve water and have greater photosynthetic rate gives greater rate of growth in intense sunshine and high temperature.

Long Answers

(5 marks each)

26. Refer Page no. 218, NCERT Text Book of Biology for Class XI.
27. Refer Points to Remember.
- Hints :** Three stages of Calvin cycle : Carboxylation, Reduction and Regeneration.
28. (a) Refer Page no. 213 (Chemiosmotic Hypothesis), NCERT Text Book of Biology for Class XI.
- (b) Refer Fig. 13.5 (Z-Scheme of light reaction), NCERT Text Book of Biology for Class XI.





Chapter - 14

Respiration in Plants

Points To Remember

Aerobic respiration : Complete oxidation of organic food in presence of oxygen thereby producing CO_2 , water and energy.

Anaerobic respiration : Incomplete breakdown of organic food to liberate energy in the absence of oxygen.

ATP Synthetase : An enzyme complex that catalyses synthesis of ATP during oxidative phosphorylation.

Biological oxidation : Oxidation in a series of reaction inside a cell.

Cytochromes : A group of iron containing compounds of electron transport system present in inner wall of mitochondria.

Dehydrogenase : Enzyme that catalyses removal of H atom from the substrate.

Electron acceptor : Organic compound which receives electrons produced during oxidation-reduction reactions.

Electron transport : Movement of electron from substrate to oxygen through respiratory chain during respiration.

Fermentation : Breakdown of organic substance that takes place in certain microbe like yeast under anaerobic condition with the production of CO_2 and ethanol.

Glycolysis : Enzymatic breakdown of glucose into pyruvic acid that occurs in the cytoplasm.

Oxidative phosphorylation : Process of formation of ATP from ADP and P_i using the energy from proton gradient.

Respiration : Biochemical oxidation of food to release energy.

Respiratory Quotient : The ratio of the volume of CO_2 produced to the volume of oxygen consumed.

Proton gradient : Difference in proton concentration across the tissue membrane.

Mitochondrial matrix : The ground material of mitochondria in which pyruvic acid undergoes aerobic oxidation through Kreb's cycle.

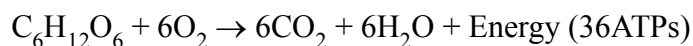
Electron Transport Chains (ETC)—A series of co-enzymes and electron carriers where electrons can pass along increasing redox potential losing a bit of energy at every step of transfer.

Abbreviations

ATP	—	Adenosine tri phosphate
ADP	—	Adenosne di phosphate
NAD	—	Nicotinamide Adenine dinucleotide
NADP	—	Nicotinamide Adenine dinucleotide Phosphate
NADH	—	Reduced Nicotinamide Adenine dinucleotide
PGA	—	Phosphoglyceric acid
PGAL	—	Phospho glyceraldehyde
FAD	—	Flavin adenine dinucleotide
ETS	—	Electron transport system
ETC	—	Electron transport chain
TCA	—	Tricarboxylic acid (Cycle)
OAA	—	Oxalo acetic acid
FMN	—	Flavin mono nucleotide
PPP	—	Pentose phosphate pathway

Cellular Respiration—The process of oxidation/breakdown of food materials within the cell to release energy. Respiratory substrate to be oxidized during respiration is usually glucose, but these can also be proteins, fats or organic acids. In plants respiration gas exchange occurs through stomata and lenticels :

Overall cellular respiration is :



Aerobic Respiration

Overall mechanism of aerobic respiration can be studied under the following steps :

- (A) Glycolysis (EMP pathway) in cytoplasm
- (B) Oxidative Decarboxylation—(Gateway Reaction)—in Mitochondrial matrix
- (C) Kreb's cycle (TCA—cycle)—Matrix of mitochondria
- (D) Oxidative phosphorylation



A. Glycolysis : The term has originated from the Greek word, *glycos* = glucose, *lysis* = splitting, or breakdown means breakdown of glucose molecule to pyruvic acid. It was given by Embden Meyerhof and Parnas. It is a chain of 10 reactions to convert glucose into pyruvate. It is common for aerobic and anaerobic respiration.

Steps for Glycolysis—(EMP Pathway)

1. Phosphorylation of glucose
 2. Formation of fructose 6—phosphate
 3. Second phosphorylation
 4. Lysis (splitting)
 5. Isomerisation of DiHAP
 6. Oxidation
 7. Substrate Level ATP synthesis
 8. Isomerisation or Rearrangement
 9. Dehydration
 10. Substrate Level ATP Synthesis and formation of Pyruvate.
- It is also called Embden—Meyerhof—Paranas pathway. (EMP pathway)
 - It is common in both aerobic and anaerobic respiration.
 - It takes place outside the mitochondria, in the cytoplasm.
 - One molecule of glucose (Hexose sugar) ultimately produces two molecules of pyruvic acid through glycolysis.
 - During this process 4 molecules of ATP are produced while 2 molecules ATP are utilised. Thus net gain of ATP is of 2 molecules.

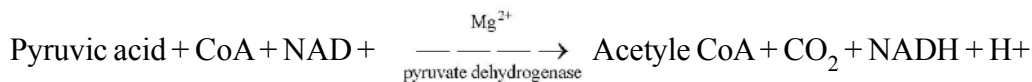
Input and Output of glycolysis

S. No.	Input	Output
1.	Glucose (6—C) —1 molecule	Pyruvate (3—C) 2 molecules
2.	2 ATP	2 ADP
3.	4 ADP + 2 Pi	4 ADP + 2H ₂ O
4.	2 NAD ⁺	2 NADH (H ⁺)

Net output 2 Pyruvate + 2ATP + 2NADH (+ H⁺) OR 2 Pyruvate + 8 ATP

The pyruvate, so produced, may undergo (i) Lactic acid fermentation, Alcoholic fermentation or Aerobic Respiration (Krebs Cycle)

B. Oxidative decarboxylation : Pyruvic acid is converted into Acetyl CoA in presence of pyruvate dehydrogenase complex.



The Acetyl CoA enters in TCA cycle.

C. Tri Carboxylic Acid Cycle (Krebs's cycle) or Citric acid Cycle : This cycle starts with condensation of acetyl group with oxaloacetic acid and water to yield citric acid which undergoes a series of reactions.

- It is aerobic and takes place in mitochondrial matrix.
- Each pyruvic acid molecule produces 4 NADH + H⁺, one FADH₂, one ATP.
- One glucose molecule has been broken down to release CO₂ and eight molecules of NADH + H⁺, two molecules of FADH₂ and 2 molecules of ATP.

Compensation Point : It is the value of a factor at which the rate of photosynthesis controlled by it is just equal to the rate of respiration and photorespiration so that there is no net exchange of gases between the photosynthetic organ and the environment.

At compensation point the photosynthetic tissue manufactures only such amount of food which is sufficient for it to remain alive. No food is supplied to rest of the plant. Therefore, net photosynthesis is zero.

(D) Oxidative Phosphorylation

The synthesis of ATP from ADP and inorganic phosphate using energy from proton gradient is called oxidative phosphorylation. This takes place in elementary particles present on the inner membrane of cristae of mitochondria. This process in mitochondria is catalysed by ATP synthetase (complex V). This complex has two major components F₀ and F₁. F₀ acts as a channel for proton and F₁ acts as an ATP synthetase.

Electron Transport System and Oxidative Phosphorylation

Name of Complex	Components of ETS
Complex I	FMN and Fe-S are prosthetic groups and NADH dehydrogenase
Complex II	FADH ₂ dehydrogenase (succinate dehydrogenase), Fe-S, UQ
Complex III	Cytochrome bc ₁ complex—cytochrome b, cytochrome c, Fe-S, UQ
Complex IV	Cytochrome c oxidase—Cytochrome a ₁ , cytochrome a ₃ which possess two copper centres.
Complex V	F ₀ –F ₁ particles. Flow of protons through F ₀ channel induces F ₁ particle to function as ATP synthetase.

Respiratory Balance Sheet :



Total ATP Production

Process	Total ATP produced
1. Glycolysis	$2\text{ATP} + 2\text{NADH}_2$ (6ATP) = 8ATP
2. Oxidative decarboxylation	2NADH_2 (6ATP) = 6ATP
3. Kreb's Cycle	2GTP (2ATP) + 6NADH_2 (18ATP) + 2FADH_2 (4ATP) = 24 ATP

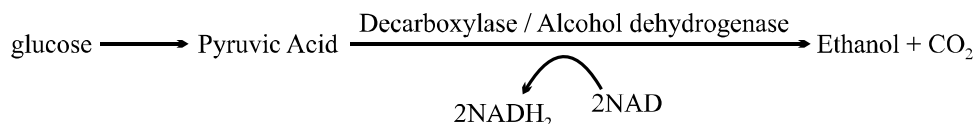
Energy production in prokaryotes during aerobic respiration = 38 ATP

Energy production in eukaryotes during aerobic respiration = $38 - 2 = 36$ ATP

In eukaryotes 2 ATP are used in transporting 2 molecules of $\text{NADH} + \text{H}^+$ formed in glycolysis from cytoplasm to mitochondria for oxidation through ETS shuttle.

(2) Anaerobic Respiration—In anaerobic respiration, Glycolysis is followed by formation of Ethyl alcohol, lactic acid in the cytoplasm.

Fermentation : It is the process of anaerobic respiration which occurs in yeast and some bacteria. Fermentation involves incomplete oxidation of food into ethanol and carbon-dio-oxide. It results in the production of 2 ATP molecules.



(i) Conversion of Acetyl CoA into fatty acid and PGA.

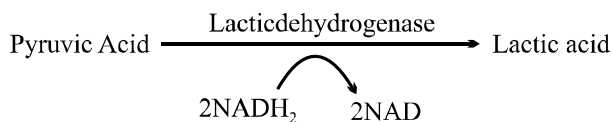
(ii) Synthesis of chlorophyll and cytochromes from Succinyl CoA

(iii) Synthesis of Amino acids from OAA and α -ketoglutaric acid

(iv) Synthesis of Alkaloid from OAA.

Enzymes involved-Pyruvic acid decarboxylase, Alcohol dehydrogenase

Anaerobic respiration in muscles : During vigorous exercise a person feels pain and fatigue in his muscles. This is due to accumulation of lactic acid in muscles. When oxygen inadequate pyruvic acid is reduced to lactic acid in presence of enzyme-lactic dehydrogenase.



During rest lactic acid is reconverted to pyruvic acid.

Amphibolic Pathway :

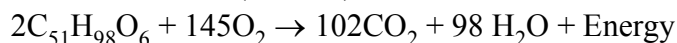
During the process of cellular respiration Carbohydrates, fats and proteins are broken down to release energy and hence respiration is a catabolic process/ catabolic pathway. From this pathway many compounds are withdrawn for synthesis of substrates. Some anabolic processes are—respiratory pathway is involved in both catabolism and anabolism, it is better to consider the respiratory pathway as an amphibolic pathway.

RQ (Respiratory quotient)

- (a) RQ = 1 (When carbohydrate is used as substrate)



- (b) RQ is less than 1 (*i.e.*, < 1) for fats.



$$R.Q. \Rightarrow \frac{102 CO_2}{145 O_2} = 0.7$$

- (c) RQ is 0.9 for proteins.
(d) RQ is more than 1 (*i.e.*, > 1) for organic acids.
(e) RQ is infinite in case of anaerobic respiration, because CO_2 is evolved but O_2 is not consumed.

Questions

Very Short Answer Question

(1 mark each)

1. Name the molecule which is terminal acceptor of electron.
2. How many ATP molecules are produced from a molecule of glucose on its complete oxidation in eukaryotes ?
3. Where does ETC found in eukaryotic cell ?
4. Name the enzyme which convert sugar into glucose and fructose.
5. How many molecules of ATP are produced by the oxidation of one molecule of $FADH_2$?
6. Why do the person with sufficient white fibres get fatigued in a short period ?
7. Write the name of end product of glycolysis.
8. Name the first product formed in Krebs's cycle.
9. Define the term 'Respiratory substrate'.

10. Which intermediate undergoes lysis in glycolysis ?
11. Write the other two names of Krebs cycle.
12. Name the acceptor molecule of Krebs cycle.
13. Name the substrate entrant of Krebs cycle.
14. Name the first chemical produced in Krebs cycle.
15. What is Electron Transport Chain ? (ETC).
16. F_0-F_1 Protein complexes participate in the synthesis of

Short Answer Questions-I

(2 mark each)

17. Differentiate between aerobic respiration and anerobic respiration.
18. Mention two steps of glycolysis in which ATP is utilised.
19. Why does anaerobic respiration produces less energy than aerobic respiration ?
20. Define Respiration Quotient. What is its value for fat and protein ?
21. Distinguish between glycolysis and fermentation.
22. What are respiratory substrates ? Name the most common respiratory substrate.

Short Answer Questions-II

(3 marks each)

23. Pyruvic acid is the end product of glycolysis. What are the three metabolic fates of pyruvic acid under aerobic and anaerobic conditions ?
24. Give the schematic representation of an overall view of TCA cycle.
25. Where does electron transport system operate in mitochondria ? Explain the system giving the role of oxygen ?
26. Give a brief account of ATP molecules produced in aerobic respiration in eukaryotes.
27. Discuss the respiratory pathway is an amphibolic pathway.
28. Expand ETC., ETS and TCA.

Long Answer Questions

(5 marks each)

29. What is glycolysis ? Where does glycolysis take place in a cell ? Give schematic representation of glycolysis.

Answers

Very Short Answers

(1 mark each)

1. Oxygen.
2. 36 ATP.
3. Mitochondrial membrane.
4. Invertase.
5. 2 ATP molecules.
6. due to formation of Lactic acid.
7. Pyruvic acid.
8. Citric acid.
9. The organic substances which is catabolised or broken down enzymatically in cellular respiration for releasing energy.
10. Fructose, 6-bisphosphate.
11. (i) Citric acid cycle (ii) Tricarboxylic acid cycle.
12. Oxaloacetate.
13. Acetyl Co-A.
14. Citrate
15. See text (Points to remember)
16. ATP

Short Answers-I

(2 mark each)

17. Refer NCERT Text Book Chapter 14 (14.3 and 14.4).
18. (i) ATP molecules are formed by direct transfer of P_i to 'ADP'.
(ii) By oxidation of NADH.
19. Refer NCERT Text Book Chapter 14, Page 230.
20. Refer NCERT Text Book Page no. 236.
21. Refer NCERT Text Book Page no. 229 and page no. 230.
22. Refer NCERT Text Book Page no. 227.

Short Answers-II

(3 marks each)

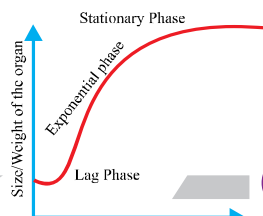
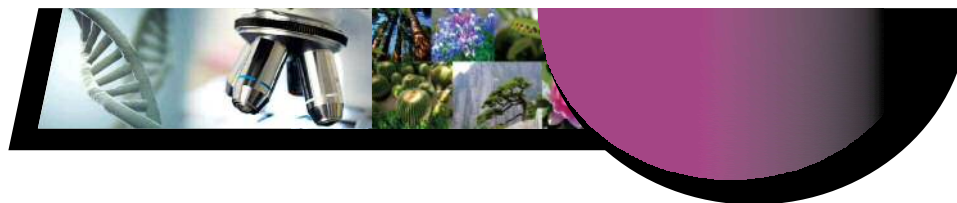
- 23. (i) Aerobic conditions— $\text{CO}_2 + \text{H}_2\text{O} + \text{Energy}$
(ii) Anaerobic conditions—(fermentation)
 - (a) In muscles – Lactic acid + Energy
 - (b) Yeast-Ehtanol + CO_2 + Energy
- 24. Refer NCERT Text Book Fig. 14.3 Page 232.
- 25. Refer NCERT Text Book Page no. 232 and page no. 233.
- 26. Refer notes.
- 27. Refer NCERT Text Book Page no. 235.
- 28. Seet text (abbreviations).

Long Answers

(5 mark each)

- 29. Refer NCERT Text Book Page no. 228 and page no. 229.





Chapter - 15

Plant Growth and Development

Points To Remember

Seed Germination : The seed germinates only when favourable conditions for growth exists in the environment. In absence of favourable conditions it goes into a period of suspended growth or rest, called dormancy.

Abscission : Shedding of plant organs like leaves, flowers and fruits etc. from the mature plant.

Apical dominance : Suppression of the growth of lateral buds in presence of apical bud.

Dormancy : A period of suspended activity and growth usually associated with low metabolic rate. Some, seeds undergo a period of dormancy and can germinate only after dormancy period gets over.

Phytochrome : A pigment, found in plants which control the light dependent developmental process.

Phytohormone : Chemicals' secreted by plants in minute quantities which influence the physiological activities.

Senescence : The last phase of growth when metabolic activities decrease.

Vernalisation : A method of promoting flowering by exposing the young plant to low temperature.

Growth : An irreversible permanent increase in size, volume and weight of an organ or its parts or even of an individual.

Quiescence : Non germination of a viable seed due to non-availability of proper environmental conditions.

Vivipary : It is the germination of seed while it is still attached to the parent plant and is nourished by it. *e.g.*, Rhizophora and Sonneratia. As the germinating seed forms a seedling. It all down into the mud due to increase in weights. In the mud, lateral roots develops for anchorage.

Heterophylly : Occurrence of more than one type of leaves in plants *e.g.*, larkspur, Coriander leaves of Juvenile plant are different in shape from mature plant.

Bolting : Elongation of internodes prior to flowering in plants like Cabbage.

Photoperiodism : Response of Plants to relative periods of day/night to induce flowering.

According to duration of exposure of plants to light, plants are divided in 3 categories :

1. **Long Day Plants (LDP)**—Plants which need exposure to light for period exceeding critical duration *e.g.*, wheat, rice, cucumber.
2. **Short Day Plants (SDP)**—Plants that need exposure to light for period less than the critical length *e.g.*, Cabbage.
3. **Day Neutral Plants (DNP)**—There is no correlation between exposure to light duration & induction of flowering *e.g.*, Tomato.

Abbreviations

IAA	Indole acetic acid
NAA	Napththalene acetic acid
ABA	Absciscic acid
IBA	Indole-3 butyric acid
2.4D	2.4 dichlorophenoxy acetic acid
PGR	Plant growth regulator

Seed Dormancy	Quiescence
It is the condition of seed when it is unable to germinate in spite of the availability of all environmental conditions suitable for germination.	The condition of a seed when it is unable to germinate because the conditions for germination are not available.

Measurement of growth : Plant growth can be measured by a variety of parameters like increase in fresh weight, dry weight, length, area, volume and cell number.

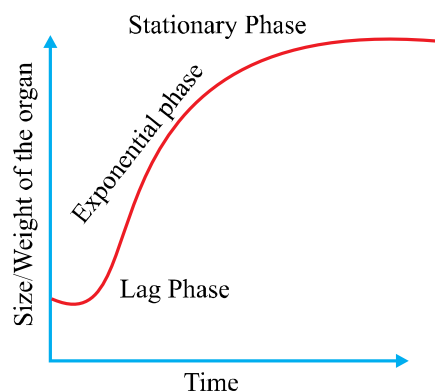
Phases of growth : The period of growth is generally divided into three phases, namely, meristematic, elongation and maturation.

- (i) **Meristematic zone** : New cell produced by mitotic division at root-tip and shoot-tip thereby show increase in size. Cells are rich in protoplasm and nuclei.
- (ii) **Elongation zone** : Zone of elongation lies just behind the meristematic zone and concerned with enlargement of cells.

(iii) **Maturation zone** : The portion lies proximal to the phase of elongation. The cells of this zone attain their maximum size in terms of wall thickening and protoplasmic modification.

Growth rate : The increased growth per unit time is termed as growth rate. The growth rate shows an increase that may be arithmetic or geometrical.

Growth	Mathematical expression	Curve
In Arithmetic growth : Only one daughter cell continues to divide mitotically while other differentiate and matures.	$L_1 = L_0 + rt$ L_1 = Length at time t L_0 = Length at time zero r = growth rate	Linear curve



Sigmoid Growth Curve

Geometrical growth		Sigmoid or
The initial growth is slow (lag phase) and increase rapidly there-after at an exponential rate (log phase)	$W_1 = W_0 e^{rt}$ W_0 = Initial size W_1 = Final Size r = growth rate t = time of growth e = base of natural logarithms	S-curve
In both, the progeny cells divide mitotically and continue to do so. However, with limited nutrient supply, the growth slow down leading to stationary phase.		

Sigmoid growth curve

Lag phase—Growth is slow in initial stage.

Log phase : Period of maximum growth

Stationary phase—When the nutrients become limiting, growth slows down.

Relative Growth : The growth per unit time as percentage of initial size

$$\text{RGR} = \frac{\text{Growth per unit time}}{\text{Initial size}} \times 100$$

Differentiation : A biochemical or morphological change in meristemic cell (at root apex and shoot apex) to differentiate into permanent cell is called differentiation.

Dedifferentiation : The phenomenon of regeneration of permanent tissue to become meristematic is called dedifferentiation.

Redifferentiation : Meristems/tissue are able to produce new cells that once again lose the capacity to divide but nature to perform specific functions.

Conditions or factors influencing Growth

1. Nutrition 2. Availability of water 3. Temperature 4. Oxygen 5. Light 6. Gravity 7. Stress factors like minerals, water or temperature etc.

Phytohormone or Plant Growth-Regulator

Growth promoting hormones : These are involved in growth promoting activities such as cell division, cell enlargement, flowering, fruiting and seed formation. *e.g.*, Auxin, gibberellins, cytokinis.

Growth inhibitor : Involved in growth inhibiting activities such as dormancy and abscission. *e.g.*, Absciscic acid and Ethylene.

Hormones	Functions
Auxins [Ethylene ($\text{H}_2\text{C} = \text{CH}$)	Apical dominance, cell elongation, prevent premature leaf and fruit falling, initiate rooting in stem cutting, as weedicide, induce parthenocarpy.
Gibberellins eg. $\left[\begin{array}{c} \text{GA}_3 (\text{C}_{19}\text{H}_{22}\text{O}_6 \\ \text{GA}_4, \text{GA}_7, \text{GA}_{19} \text{ and} \\ \text{GA}_{20} \text{ etc.} \end{array} \right]$	Delay senescence, speed up malting process, increase in length of axis (grape stalk), increase in length of stem (sugarcane), bolting in beet, cabbages and many plants with rosette habit.

<p>Cytokinins</p> <p>e.g. $\left[\begin{array}{l} \text{Zeatin (trans 6-purine)} \\ \text{DMAA-Dimethylalyl} \\ \text{adenine and Isopentyl} \\ \text{adenine (IP) etc.} \end{array} \right]$</p>	<p>Promote cell division, induce cell enlargement, reduce apical dominance, induce growth in auxiliary bud, chlorophyll preservation, lateral shoot growth, adventitious root formation.</p>
<p>Absciscic acid (ABA)</p> <p>eg. (Abscisin II Dormin)</p>	<p>Promotes senescence and abscission of leaf and fruits, promotes ripening of fruits, break seed and bud dormancy, initiate germination in peanut, sprouting of potato tuber, promotes root growth and root hair formation.</p>
<p>e.g. Indole 3-Acetic Acid</p> <p>[2, 4-D and 2, 4, 5,-T etc.]</p>	<p>Inhibit seed germination, stimulate closure of stomata, increase tolerance to various stress, induce dormancy in seed and bud, promotes ageing of leaf (senescence).</p>
<p>KMnO₄</p>	<p>Can delay the ripening of stored fruits as it absorbs the ethylene.</p>

Questions

Very Short Answer Question

(1 mark each)

1. Write the cause of 'Bakane' disease of rice.
2. Name the plant hormone which was first isolated from human urine.
3. Name the only gaseous plant hormone.
4. How does absciscic acid acts as stress hormone in drought condition ?
5. A farmer observed some broad-leaved weeds in a wheat crop farm. Which plant hormone would you suggest remove them ?
6. Name the plant growth regulators you should use to (a) Increase the yield of sugarcane (b) Promote lateral growth (c) Cause sprouting of potato tuber (d) Inhibit seed germination.
7. Why do lateral buds start developing into branches when apical bud is removed ?
8. Flowering in certain plant occur only when they are exposed to low temperature for a few weeks. Name this phenomenon.

9. Name, the hormone released from over-ripe apples and affects all other apples in a small wooden box.

Short Answer Question-I

(2 marks each)

10. How will you induce lateral branching in a plant which normally does not produce them ? Give reason.
11. What induces ethylene formation in plants ? Give any two different action of ethylene on plants.
12. What is meant by abscission ? Name phytohormone involved in it.
13. What is meant by apical dominance ? Which hormone control it ?
14. Differentiate between photoperiodism and vernalization.
15. Name a hormone which is :
- (a) gaseous in nature
 - (b) responsible for photo tropism
 - (c) used for killing dicot weeds
 - (d) Induces flowering in long day plants.

Short Answer Questions-II

(3 marks each)

16. A primary root grows from 5 cm to 19 cm in a week. Calculate the growth rate and relative growth over the period.
17. Where are the following hormones synthesised in plants (a) IAA (b) Gibberellins (c) cytokinins.
18. What would be expected to happen if :
- (a) GA_3 is applied to rice seedling.
 - (b) a rotten fruit get mixed with unripe fruits.
 - (c) you forget to add cytokinin to the culture medium.
19. Which growth hormone is responsible for the following :
- (a) induce rooting in a twig
 - (b) quick ripening of a fruit
 - (c) delay leaf senescence
 - (d) 'bolt' a rosette plant
 - (e) induce immediate stomatal closure in leaves
 - (f) Induce growth in axillary buds.
20. Define differentiation, dedifferentiation and redifferentiation.
21. Where are auxins generally produced in a plant ? Name any one naturally occurring plant auxin and any one synthetic auxin.

22. Define growth rate. Name two types of growth. Give the shape of curve for these growth.
23. Mention various parameters taken into consideration for measuring the growth.

Long Answer Question

(5 marks each)

24. In list the five categories of phytohormone. Write atleast two uses of each.

Answers

Very Short Answer

(1 mark each)

1. Gibberalla fujkuroi.
2. Auxin
3. Ethylene
4. ABA cause rapid closure of stomata, preventing loss of water by transpiration.
5. 2,4-D
6. (a) Gibberellin (b) Cytokinin
(c) Ethylene (d) Absciscic acid
7. Due to inhibit activity of Auxin lateral growth starts.
8. Vernalisation
9. Ethylene

Short Answers-I

(2 marks each)

10. When apical bud is removed, lateral branches are produced. Removal of apical bud effect the auxin is destroyed inducing the lateral buds to grow rapidly.
11. Refer NCERT Book Page no. 250.
12. ● Premature fall of leaf and fruit is called abscission.
● Absciscic acid
13. Refer NCERT Boof Page no. 250.
14. Refer NCERT Boof Page no. 252.
15. (a) Ethylene C_2H_2 (b) Auxin (c) 2, 4-D (d) Gibberellin

Short Answers-II

(3 marks each)

16. (a) Growth = $19 - 5 = 14$ cm, Period = 7 days

$$\text{Growth rate} = \frac{14}{7} = 2\text{cm/day}$$

(b) Initial growth = $\frac{7}{5}$ cm

Growth rate per day $\frac{19-5}{7} = 2$ cm

Relative growth rate = $\frac{2}{5} \times 100 = 40\%$

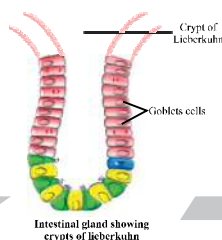
17. (a) 1AA = Shoot apex
(b) Gibberellin – young leaves of buds, root tips
(c) Cytokinins – Root apical meristan
18. (a) Hyper elongation of internodes of rice seedlings will occur.
(b) Unripe fruits will lead to early ripening and ultimately it will result in rotting.
(c) Short bud formation will not occur.
19. Refer NCERT Book.
20. Refer NCERT Text Book Page no. 245.
21. Refer NCERT Text Book Page no. 248.
22. Refer NCERT Text Book Page no. 242 and 243.
23. Refer NCERT Text Book Page no. 241.

Long Answers

(5 marks each)

24. Refer NCERT Text Book Page no. 241-250.





Chapter - 16

Digestion and Absorption

Points To Remember

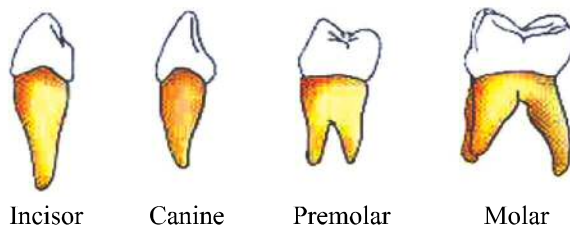
Digestion : The process in alimentary canal by which the complex food is converted mechanically and biochemically into simple substances suitable for absorption and assimilation.

Food : A substance which on taken and digested in the body provides material for growth, repair, energy, reproduction, resistance from disease or regulation of body processes.

Thecodont : The teeth embedded in the sockets of the jaw bone, *e.g.*, in mammals.

Diphyodont : The teeth formed twice in life time *e.g.*, in mammals.

Heterodont : An adult human has 32 permanent teeth which are of four different types.



Different Types of Teeth

- (a) **Canine**—for tearing
- (b) **Incisors**—for cutting
- (c) **Premolars** for grinding
- (d) **Molars** for churning and grinding

Dental formula of man :

Permanent Teeth)

	1	C	PM	M	
32 = 2 ×	2	1	2	3	Upper Jaw
	2	1	2	3	Lower Jaw

Dental formula of man :

(Milk Teeth)

	1	C	PM	
20 = 2 ×	2	1	2	Upper Jaw
	2	1	2	Lower Jaw

Peristalsis : The involuntary movement of the gut by which the food bolus is pushed forward.

Deglutition : The process of swallowing of food bolus. It is partly voluntary and partly involuntary.

Ruminants : The herbivorous animals (*e.g.*, cow, buffalo etc.) which have symbiotic bacteria in the rumen ! of their stomach which synthesize enzymes to hydrolyse cellulose into monosaccharides.

Diarrhoea : The abnormal frequent discharge of semisolid or fluid faecal matter from the bowel.

Vomiting : The ejection of stomach contents through the mouth, caused by antiperistalsis.

Dysentery : Frequent watery stools often with blood and mucus and with pain, fever and causes dehydration.

Chyme : The semifluid mass into which food is converted by gastric secretion and which passes from the stomach into the small intestine.

Gastric : Anything associated with stomach is given a prefix 'gastric'.

Proenzyme : The inactive forms of enzymes.

Sphincter : A flap like structure at various junctions of the alimentary canal which facilitates one way traffic in the alimentary canal.

Bolus : The masticated food mixed with saliva.

Hepatic : Anything associated with liver is given a prefix ‘hepatic’.

Goblet cells : The cells of intestinal mucosal epithelium which secrete mucus.

Glisson’s capsule : The connective tissue sheath which covers the hepatic lobules of liver.

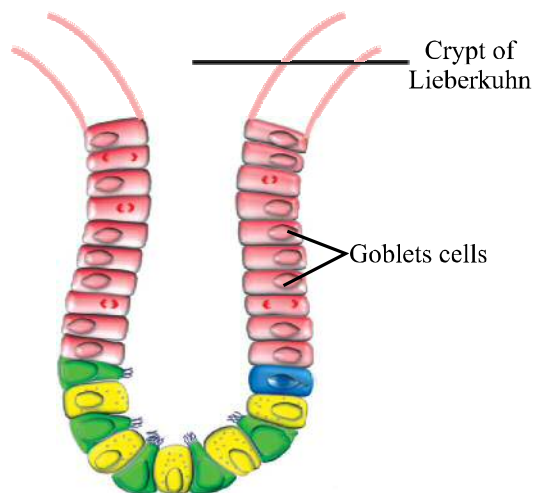
Hepatic lobules : The structural and functional units of liver containing hepatic cells which are arranged in the form of cords.

Sphincter of Oddi : The sphincter which guard the opening of common hepatopancretic duct.

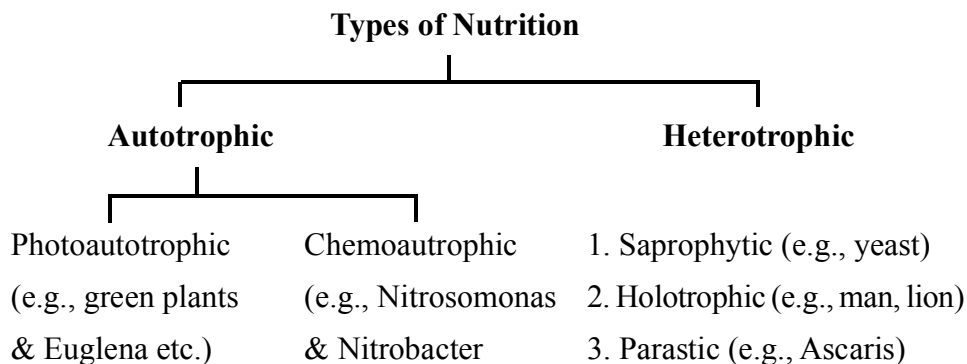
Villi : The small finger-like folding in the small intestine which increase the surface area for absorption of digested food.

Crypts of Lieberkuhn—pits of intestine

Success entericus—Intestinal juices.



Intestinal gland showing crypts of lieberkuhn



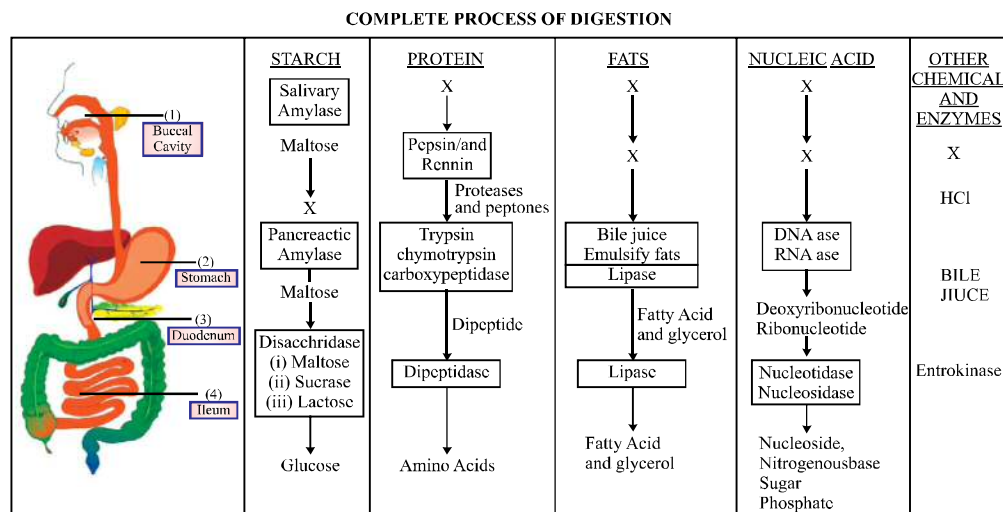
Basic Steps of Holozoic Nutrition :

- (1) **Ingestion** : Intake of food.
- (2) **Digestion** : Breaking down of complex organic food materials into simpler, smaller soluble molecules.
- (3) **Absorption and assimilation** : Absorption of digested food into blood or lymph and its use in the body cells for synthesis of complex components.
- (4) **Egestion** : Elimination of undigested food as faeces :

Digestive glands : (A) Salivary gland—3 types are (1) Parotid (cheek) (ii) (Below the tongue) Sublingula, (iii) Submaxillary or submandibular (lower jaw) Secrete saliva which contains ptyalin (Salivary Amylase)

(B) Pancreas : Secretes pancreatic juice.

Malnutrition—When a person is not getting enough food or getting unbalanced diet.



PEM—Protein Energy Malnutrition

Kwashiorkar	Marasmus
<p>The word means ‘rejected child’</p> <ul style="list-style-type: none"> It is a disorder found in children 1-5 years of age, where child is weaned off mother’s milk very early. Children get low protein and low carbohydrate diet are affected. 	<p>Word marasmus means working away</p> <ul style="list-style-type: none"> Child remaining under-nourished suffer from marasmus. Usually found in children below the age of 1 year. It is caused by deficiency of protein & carbohydrate both.

Symptoms

1. Stunted growth	1. Low body weight
2. Dry & scaly skin	2. Wasting of muscles
3. Odema (retention of water in tissues)	3. Prominent ribs
4. Match stick legs	4. Sunken Eyes
5. Protruded Belly	5. Lean body with thin limbs
	6. Mental retardation

Cure

Feeding the child with protein rich diet including milk, soyabean, egg etc.	Child should be given protein diet with enough quantity of carbohydrates & fats.
---	--

Calorific Value : Amount of heat energy required to raise the temperature of 1 kg of water by 1°C.

Calorific value of Carbohydrates is 4.1 k.cal/g

Protein is 5.6 kcal/g

Fats is 9.4 kcal/g (app.)

Questions

Very Short Answer Questions

(1 mark each)

1. What do you mean by the term malnutrition ?
2. Name the hardest substance in the body.
3. What is a lacteal and what is its function ?
4. Name the small projections, found on the upper surface of tongue.
5. Mention the function of epiglottis.
6. Write the names of major parts of stomach.
7. Name the enzyme that digest fats. Mention the end products of fat digestion.
8. In which part of alimentary canal does absorption of water, simple sugars and alcohol takes place ?
9. Why are proteases generally released in inactive form ?

10. Trypsinogen is an inactive enzyme of pancreatic juice. An enzyme, enterokinase, activates it. Which tissue/cell secrete the enzyme ? How is it activated ?
11. What is the role of insulin ?
12. Name any one country where children affected from PEM are found more.

Short Answer Questions-I

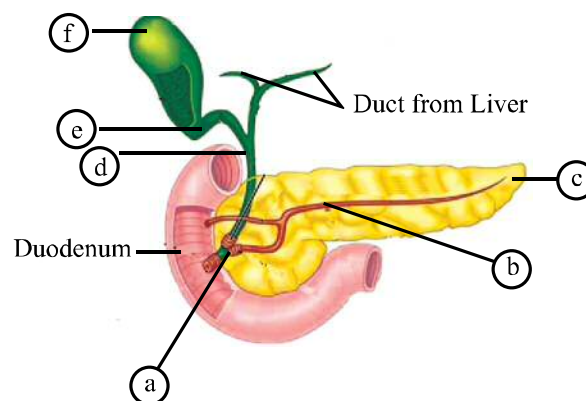
(2 marks each)

13. What is emulsification ? Where and how does it occur ?
14. Name three parts of large intestine. Which vestigial organ arises from the first part of it ?
15. Name the gland which perform/acts as exocrine and endocrine. Also name the product which are secreted by it.
16. The wall of alimentary canal is made up of four layers. Give the names of these four layers.
17. Hydrochloric acid is found in our stomach. What purpose does it serve in alimentary canal ?
18. In which part of the digestive system the absorption of following substances takes place ?
 - (a) Certain drugs
 - (b) Glucose, fructose and fatty acids
 - (c) Water, some minerals and drugs
 - (d) Simple sugar and alcohol
19. Differentiate between chylomicron and micelles.

Short Answer Question-II

(3 mark each)

20. In the following diagram of duct system of liver, gallbladder and pancreas, label a, b, c, d, e and f :



21. Give a diagrammatic representation of transverse section of gut.
22. Draw the sketch of anatomical regions of human stomach and label any four parts in it.
23. How does the nervous system control the activities of gastro-in-testinal tract ?
24. Draw a labelled figure of digestive system of human.
25. Give a summary of cause and symptoms of following disorders of digestive system :
 - (a) Jaundice
 - (b) Vomiting
 - (c) Diarrhoea
 - (d) Constipation
 - (e) Indigestion
26. Navya likes to eat fast food like burgers and fried food. She often complains of constipation and abdominal pain. On medical diagnosis her haemoglobin was also found low.
 - (a) Do you approve her feeding habit ? Why/why not.
 - (b) What can be the cause of Navya's problem ?
 - (c) What will you suggest her ?
 - (d) Which values would you use to convince her to get her condition cured ?

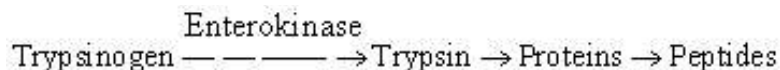
Answers

Very Short Answer

(1 mark each)

1. The state of health due to improper intake of food or nutrients. It covers both under nutrition as well as over nutrition.
2. Enamel
3. Lymph vessel found in villi. They help in absorption of fat globules and then release them into blood stream.
4. Papillae. Some Papillae have taste buds.
5. Prevention the entry of food into the glottis.
6. Cardia, fundic, pyloric.
7. Lipase, fatty acids and glycerol.

8. Stomach
9. If released in active form, they will start digesting the membranes and muscular walls of the alimentary canal.
10. Intestinal Mucosa.



11. Metabolism of sugar
12. Africa

Short Answer Questions–I (2 marks each)

13. The process of breakdown of large fat droplets into smaller ones. It occurs in small intestine. It is brought about by bile salts through reduction of surface tension of large fat droplets.
14. Caecum, colon and rectum. Vermiform appendix.
15. Pancreas. Exocrine secretion is pancreatic juice containing enzymes and exocrine secretions are hormones : Insulin and glucagon.
16. Serosa, muscularis, submucosa and mucosa.
17. (i) Killing of germs present in food
(ii) Conversion of inactive pepsinogen into active form pepsin.
18. (a) Mouth
(b) Small intestine
(c) Large intestine
(d) Stomach

19.	Chylomicron	Micelles
1.	Protein coated water soluble fat droplets released into the lymph.	Formed by combination of fatty acid, monoglycerides and bile salts.
2.	In this form fats lipids are put into circulation	In this form digested fats are absorbed in intestinal cells in alimentary canal.

Short Answers Questions–II (3 marks each)

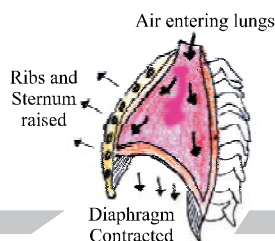
19. Refer Fig. 16.6, Page no. 261 (NCERT Text Book, XI Biology).
20. Refer Fig. 16.4, Page no. 260 (NCERT Text Book, XI Biology).
21. Refer Fig. 16.3, Page no. 259 (NCERT Text Book, XI Biology).
22. Refer page. 264 (NCERT Text Book, XI Biology).

Long Answers

(5 marks each)

23. Refer Fig. 16.1, Page no. 258 (NCERT Text Book, Class XI Biology).
24. Refer Page no. 265-266 (NCERT Text Book, Class XI Biology).
25. (a) No, I do not approve her feeding habit as it is unbalanced diet which can lead to diseases.
(b) Malnutrition.
(c) To include vegetables and fruit in her diet, to eat balanced diet.
(d) Scientific knowledge, caring about others.





Chapter - 17

Breathing and Exchange of Gases

Points To Remember

Breathing : (External respiration) The process of exchange of O_2 from the atmosphere with CO_2 produced by the cells.

Carbamino haemoglobin : Compound formed in RBCs when CO_2 combine with haemoglobin.

Inspiration : Oxygen from fresh air taken by lungs and diffuses into the blood.

Expiration : CO_2 given up by venous blood in the lungs is sent out to exterior.

Respiration : The sum total of physical and chemical processes by which oxygen and carbohydrates (main food nutrient) etc are assimilated into the system and the oxidation products like carbon dioxide and water are given off.

Diaphragm : A muscular, membranous partition separating the thoracic cavity from the abdominal cavity.

Hypoxia—Shortage of oxygen in tissues.

Partial Pressure—The pressure contributed by an individual gas in a mixture of gases. It is represented as pO_2 for oxygen and pCO_2 for carbondioxide.

Pharynx : The tube or cavity which connects the mouth and nasal passages with oesophagus. It has three parts (i) Nasopharynx (anterior part) (ii) Oropharynx (middle part) and (iii) Laryngopharynx (posterior part which continues to larynx)

Adam's Apple : The projection formed by the thyroid cartilage and surrounds the larynx at the front of the neck.

Tidal volume (TV) : volume of air during normal respiration (500 mL.)

Inspiratory Reserve Volume (IRV) : Additional volume of air inspired by a forcible inspiration. 2500mL to 3000mL.

Expiratory Reserve Volume (ERV) : Additional volume of air, a person can expire by a forcible expiration.

(RV) : volume of air remaining in the lungs even after a forcible expiration (1100 mL to 1200 mL)

PULMONARY CAPACITIES : Use in clinical diagnosis.

Inspiratory capacity (IC) = (TV + IRV) Total volume of air a person can inspire after a normal expiration.

Expiratory Capacity—Total Volume of air a person can expire after a normal inspiration E.C. = TV + ERV

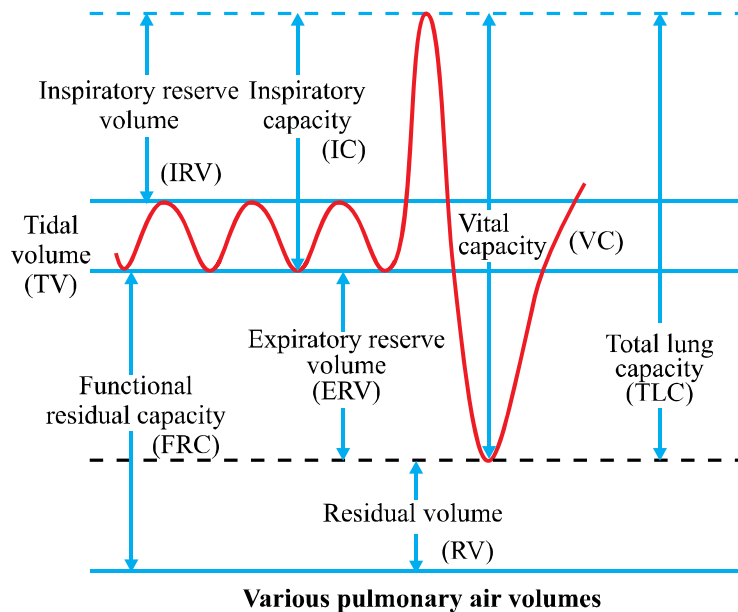
Functional Residual Capacity—Volume of air that will remain in lungs after a normal expiration (FRC) = (ERV + RV)

Vital Capacity (VC) = (ERV + TV + IRV) or the maximum volume of air a person can breath out after a forced inspiration.

Total Lung Capacity : It includes RV, ERV, TV and IRV or vital capacity + residual volume.

Pulmonary—Anything associated with the lungs is given the prefix 'pulmonary' **steps involved in respiration**—

- (i) Breathing or pulmonary ventilation (intake or atmospheric air and releasing out CO₂ rich alveolar air)
- (ii) Diffusion of gases (O₂ and CO₂) across alveolar membrane.
- (iii) Transport of gases by the blood.
- (iv) Diffusion of O₂ and CO₂ between blood and tissues.
- (v) Utilisation of O₂ by the cells for catabolic reactions and resultant release of CO₂.



Mechanism of Breathing

Inspiration :

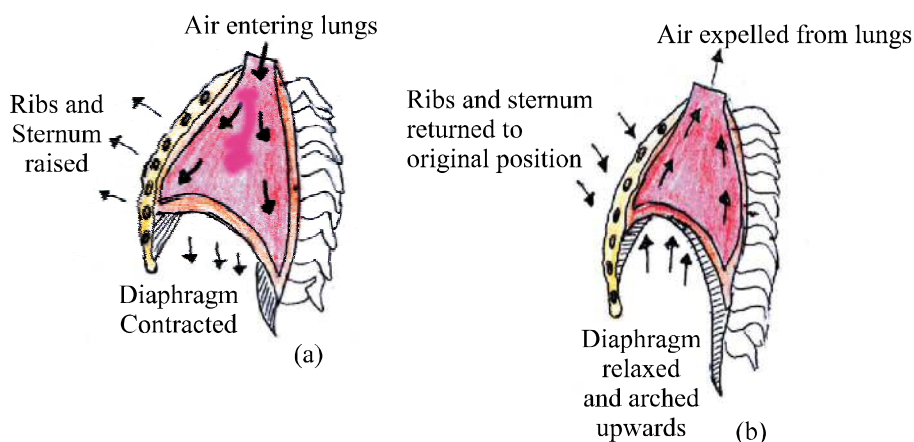
If the pressure within the lungs (intrapulmonary pressure) is less than the atmospheric pressure, *i.e.*, there is negative pressure in the lungs with respect to the atmospheric pressure.

- The contraction of diaphragm increases the volume of thoracic chamber in the antero-posterior axis.
- The contraction of external intercostals muscles lifts up the ribs and the sternum causing an increase in the volume of thoracic chamber in the dorso ventral axis.
- It causes an increase in pulmonary volume decrease the intra-pulmonary pressure to less than the atmospheric pressure.
- It forces the air out side to move in to the lungs, *i.e.*, inspiration.

Expiration :

Relaxation of diaphragm and sternum to their normal positions and reduce the thoracic and pulmonary volume.

- It increases in intrapulmonary pressure slightly above the atmospheric pressure.
- It causes the expulsion of air from the lungs, *i.e.*, expiration.



Mechanism of breathing showing (a) Inspiration (b) Expiration

Inspiration	Expiration
Contraction of diaphragm and external intercostal muscles	Relaxation of diaphragm and sternum
↓	↓
Increase in the volume of thoracic chamber	Decrease in the volume of thoracic chamber
↓	↓
Lungs expand	Lungs contract
↓	↓
Pressure inside the lungs fall	Pressure inside the lungs increase
↓	↓
Air rushes in	Air rushes out

Respiratory Tract :

A pair of external nostrils → nasal chamber through nasal passage → nasopharynx → glottis → larynx → trachea → Left and right primary bronchi → secondary and tertiary bronchi → bronchioles → vascularised bag like structures (alveoli) or air-sacs. Each lung is covered with double layered membrane known as pleura with pleural fluid between them.

Respiratory organs in animals :

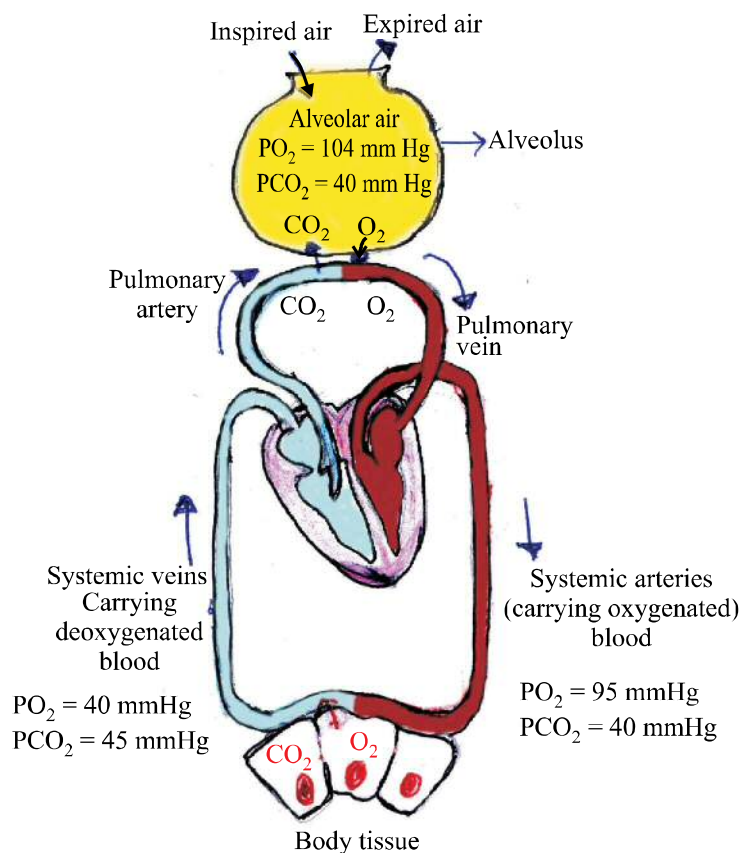
- Protozoans, annelids Frogs—**Body surface**
- Fishes, tadpole stage of frog and many other aquatic animals—**Gills**
- Insects and a few other arthropods—**Tracheal tubes**
- All land vertebrates (amphibians, reptiles, aves and mammal)—**Lungs.**

Conditions required for cutaneous respiration

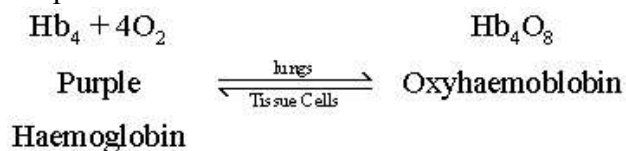
Skin should be moist and thin. It should be highly vascularised.

Physiology of Respiration :

- (a) **Exchange of gases**—Diffusion of gases takes place from the region of higher partial pressure to lower (lesser) partial pressure)
- pO_2 in alveolar air = 104 mm Hg.
 - pO_2 in venous blood = 40 mm Hg.
 O_2 diffuses from alveoli to venous blood.
 - pCO_2 in venous blood = 45 mm Hg.
 pCO_2 in alveolar air = 40 mm Hg.
 CO_2 diffuses from venous blood to alveoli

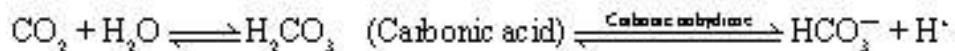


- (b) **Transport of O_2 by the blood**—About 10% of CO_2 forms carbonic acid with water of plasma.



- (c) **Transport of CO_2 in the blood**—

Carbonic anhydrase



About 20% of CO_2 is transported by combining with free amino group of Haemoglobin in RBC.

70% of CO_2 is transported as bicarbonates of sodium (NaHCO_3) and potassium (KHCO_3)

Regulation of Respiration

A specialised centre in medulla of brain controls the respiratory rhythm. Another region in the pons region of the brain called **pneumotaxic centre** can moderate the functions of respiratory rhythm centre. Neural signal from pneumotaxic centre can reduce the duration of respiration thereby increasing the respiratory rate. Chemosensitive area present near the rhythm centre, aortic arch can sense the change in CO_2 & H^+ concentration, which in turn send signal to rhythm centre to make necessary adjustment so that those substances can be eliminated.

Questions

Very Short Answer Questions

(1 mark each)

1. Name the organ in human respiratory system which produces sound.
2. How many oxygen molecules can be carried out by one haemoglobin molecule.
3. Give the name and function of a fluid filled double membranous layer which surrounds the lungs.
4. Which organ of our respiratory system acts as primary site of exchange of gases ?
5. Cigarette smoking causes emphysema. Give reason.
6. Name the principle or process of exchange of gases.
7. What is the role of oxyhaemoglobin after releasing molecular oxygen in the tissues ?
8. Name the muscles which facilitate breathing.
9. How is the entry of food prevented in the respiratory tract ?
10. About 97% of O_2 is transported by RBCs in the blood. How does the remaining 3% of O_2 transported ?

Short Answer Questions

(2 marks each)

11. Draw a labelled diagram of a section of an alveolus with a pulmonary capillary.
12. Following is the table showing partial pressure (in mm Hg) of oxygen and carbondioxide) at different parts involved in diffusion in comparison to those in atmosphere. Fill in the blank – a, b, c and d.

Respiratory gases	Atmospheric air	Alveoli	Blood (Deoxygenated)	Blood (Oxygenated)	Tissue
O ₂	(a)	104	40	(d)	40
CO ₂	0.3	(b)	(c)	40	45

13. Name the organs of respiration in the organisms.
 (a) Flatworms (b) Birds (c) Frog (d) Cockroach
14. What are occupational respiratory disorders ? What are their harmful effects ? What precautions should a person take to prevent such disorders ?
15. How is respiration different from breathing ?

Short Answer Questions-II (3 marks each)

16. Explain the role of neural system in regulation of respiration in human.
17. Explain the neural control of respiration in human.

Long Answer Questions (5 marks each)

18. With the help of labelled diagram explain the structure of human respiratory system.
19. Explain the mechanism of breathing with the help of labelled diagram involving both stages—inspiration and expiration.
20. Explain the process of exchange of gases with the help of a diagrammatic representation in human respiratory system.
21. A NGO has reported about children below the age of 16 years working in a tobacco factory. On reading this news in paper, what will be your reaction ? Would you like these children to continue working over there why/why not ?

Answers

Very Short Answers (1 mark each)

1. Larynx (Sound box)
2. Four molecules
3. Pleuron. It reduces the friction and keeps the two pleura together and the lungs inflated.

4. Alveoli of lungs.
5. Cigarette smoking damages alveolar walls due to alveolar sacs remaining filled with air leading to decreased respiratory surface for exchange of gases.
6. Diffusion.
7. Amino group of reduced haemoglobin combines with CO_2 forming carbamino haemoglobin to transport CO_2 .
8. External and internal intercostals muscles, situated between ribs.
9. During swallowing a cartilaginous flap like structure called epiglottis covers the glottis and prevents the entry of food into respiratory tract.
10. In simple solution form through plasma.

Short Answers-I

(2 marks each)

11. Refer fig 17.4, page 273 (NCERT Text Book Class XI Biology)
12. Refer fig 17.1, page 272 (NCERT Text Book Class XI Biology)
13. (a) Body surface (b) lungs (c) skin and lungs (d) Network of trachea
14. Refer fig 276 (NCERT Text Book Class XI Biology)
15. Slow oxidation of food to release energy is called respiration while breathing is a biophysical process which is the first step of respiration.

Short Answers-II

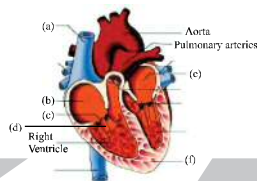
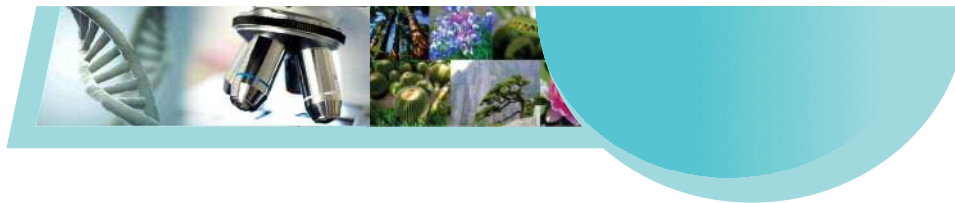
(3 marks each)

16. Refer page 275 (17.5) (NCERT Text Book Class XI Biology)
17. Refer content 17.5 regulation of respiration on page no. 275 (NCERT Text book XI Biology)

Long Answers-II

(5 marks each)

18. Refer content 17.1.1 page 29, diagrams 17.1, page 29 (NCERT Text Book Class XI Biology)
19. Refer content 17.2 and fig 17.2 page 270–271 (NCERT Text Book Class XI Biology)
20. Refer content 17.3 and fig 17.3 page 272–273 (NCERT Text Book Class XI Biology)
21. It is very painful to know about such things prevalent in our society. As a biologist I know long exposure to tobacco particles in air will give rise to inflammation leading to fibrosis and thus can damage the lungs severely. So I would not like the children to continue working over there.



Chapter - 18

Body Fluids and Circulation

Points To Remember

Blood : A special connective tissue that circulates in principal vascular system of man and other vertebrates consisting of fluid matrix, plasma and formed elements.

Plasma : The liquid part of blood or lymph which is straw coloured, viscous fluid and contains (only lymphocytes) about 90-92% of water and 6-8% proteins.

Lymph : A clear yellowish, slightly alkaline, coagulable fluid, containing white blood cells in a liquid resembling blood plasma.

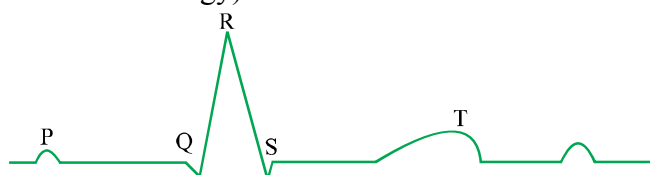
Serum : Blood plasma from which fibrinogen and other clotting factors have been removed.

Heart Beat : The rhythmic contraction and relaxation of the heart, which includes one systole (contraction phase) and one diastole (relaxation phase) of the heart. Heart beat count of healthy person is 72 times per minute.

Cardiac output : The amount of blood pumped by heart per minute is called cardiac or heart output. The value of cardiac output of a normal person is about $72 \times 70 = 5040$ mL or about 5L per minutes.

Electrocardiograph : (ECG) the machine used to record electrocardiogram.

Electrocardiogram ECG : The graphic record of the electric current produced by the excitation of the cardiac muscles. It is composed of a 'P' wave, 'QRS' wave. (complex) and 'T' wave (Refer fig. 18.3, page 286 (for a standard ECG) (NCERT class XI Biology)



Diagrammatic presentation of a standard ECG.

Name and Number/ Percentage	Structure	Life Span and Formation	Function
(A) Erythrocytes RBCs - 4.5 to 5.5 million per cubic millimetre of blood	Red colour Circular, biconcave denucleated, elastic lack of cell organelles like ER, ribosomes, mitochondria etc.	Formed from birth onward by red bone marrow Life-120 days excess RBCs are stored in spleen	Transport of oxygen and some amount of carbon dioxide through haemoglobin
(B) Leucocytes (WBCs) 5000-8000 per cubic mm of blood	Colourless rounded or irregular, nucleated 12 to 20mm wide, life 1-4 days	Formed in red bone marrow, Lymph nodes, spleen and thymus	Acts as soldiers scavenger and some help in healing
(i) Agranulocytes (a) Lymphocytes 20-45% of leucocytes	Large rounded nucleus, 6-10 mm	Lymph nodes, spleen, thymus red bone marrow, life few days to months or even years	Non Phagocytic secrete antibodies
(b) Monocytes 6-8% leucocytes,	Largest of all (12-15 mm) bean shaped nucleus	Red Bone marrow, life 10-20 hours	phagocytic, very motiles engulf germs
(ii) Granulocytes (a) Eosinophils 2-3% of leucocytes	bilobed nucleus, granules in cytoplasm	Red Bone marrow, life 4 to 8 hrs. in blood	play role in immunity non phagocytic
(b) Basophils 0-5% of leucocytes	Three lobed nucleus (s-shaped)	Red Bone marrow, life 4 to 8 hours in blood	release heparin and histamine
(c) Neutrophils 60- 65% of leucocytes	Many lobed nucleus fine granules	Red Bone marrow, life 4 to 8 hours in blood	phagocytic, engulf germ and dead cells
(C) Platelets thrombocytes 1,50,000-3,50,000 mm ₃ of blood	Colourless, rounded or oval, or irregular non-nucleated fragments	Red Bone marrow worm out ones phagocytized in blood	help in blood clotting

Blood Pressure—The resistance offered by the lumen of the artery to the flow of Blood.

Cardiac Cycle : The rhythmic contraction and dilation of different parts of heart in one beat.

Hypertension : The condition when blood pressure is higher than normal (120/80 mmHg)

Systole : Contraction of heart muscles.

Diastole : Relaxation of heart muscles.

Lymph

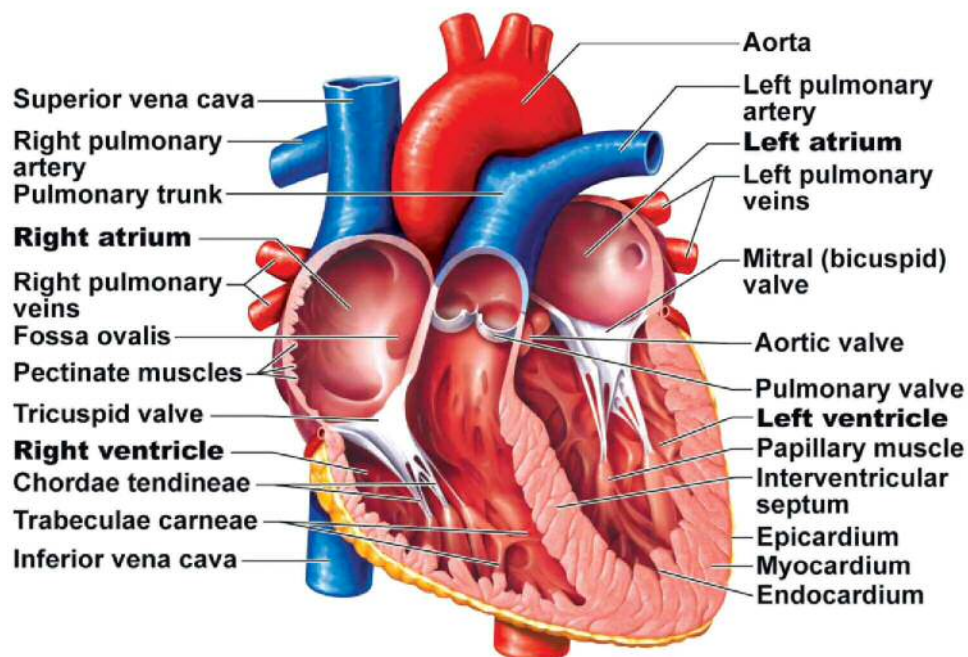
The colourless mobile fluid connective tissue drains into the lymphatic capillaries from the intercellular spaces. It is formed by squeezing of blood through capillaries, within tissues. Its flow is unidirectional *i.e.*, from tissues to heart.

Composition :

It is composed of fluid matrix, plasma, white blood corpuscles or leucocytes.

Functions :

- (i) It drains excess tissue from extra cellular spaces back into the blood,
- (ii) It contain lymphocytes and antibodies.
- (iii) It transport digested fats.

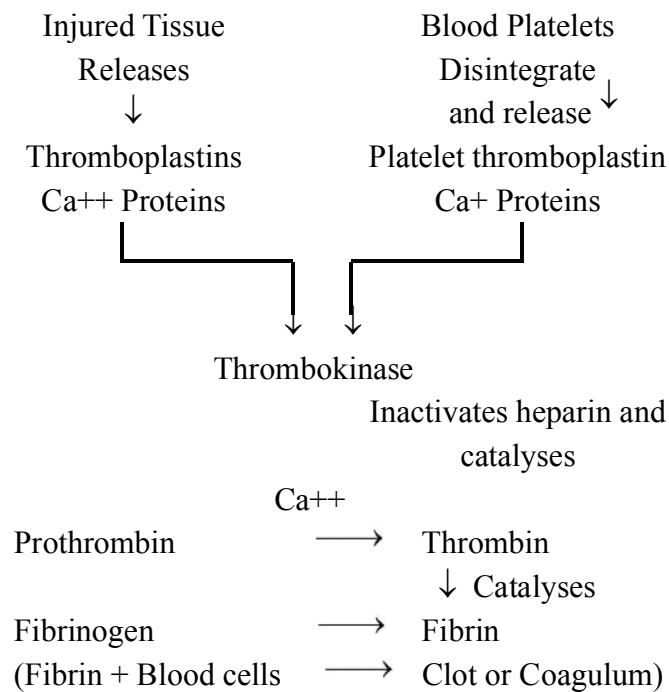


- It is the mesodermally derived organ situated in thoracic cavity in between the two lungs. Protected by a double membrane covering called Pericardium.
- Four chambers—two (left and right) atria, and two ventricles (left and right)
- Inner-atrial septum separates the two atria and inter ventricular septum separates the two ventricles, while the atria and ventricles are separated by atrioventricular septum.
- The valves between right atrium and right ventricle is tricuspid while between left atrium and ventricle is bicuspid or mitral value.
- The opening of the right and the left ventricles into the pulmonary artery and the aorta are guarded by semilunar values.
- The value allow the flow of blood only in one direction, *i.e.*, from atria to ventricles and from ventricles to pulmonary artery or aorta.

Functions of Blood

Transport, of food, respiratory gases (O_2 and CO_2), hormones, metabolic intermediates, waste products, supply of raw materials, regulation of water balance, regulation of pH and body temperature, and provides immunity.

Blood Clotting



Bipod Groups

Blood Group	Antigen (on the Surface of R.B.Cs)	Anti body : (in plasma)	Possible recipients having blood group	Possible donors having blood group	Remarks
A	A	Anti B	A, AB	O, A	—
B	B	Anti A	B, AB	O, B	—
AB	A and B	None	AB	O, A, B, AB	Universal recipient
O	None	Anti A and anti B	O, A, B, AB	O	Universal Donor

Rh (Rhesus) Group :

Discovered by Landsteiner and Wiener in 1940. The antigen found on the surface of RBCs. The presence of this antigen is termed as Rh-positive (Rh+) and its absence as (Rh-). It plays a crucial role in child's birth born out of a marriage between Rh- woman and Rh+ man, causing to produce anti Rh antibodies.

→**SAN (Sino-atrial node)** : A patch of tissues present in the right upper corner of the right atrium, acts as pacemaker due to having a unique property of self excitation.

→**AVN (Atrio Ventricular Node)** : A mass of tissues seen in the lower left corner of the right atrium close to the atrio-ventricular septum. Fresh wave of contraction generated here, passes over both the ventricles simultaneously along the bundle of his.

Heart Valves

Tricuspid Valve : The valves formed of three muscular flaps or cups, which guard the opening between the right atrium and the right ventricle.

Bicuspid Valve (Mitral Valve) :

The valves which guard the opening between the left atrium and the left ventricle, made up of two flaps.

Semilunar Valves : The valves present at the opening of the right and the left ventricles and allow the entry of blood into pulmonary artery and the aorta respectively.

Reading of ECG : 'P' Wave represents the electrical excitation (or depolarisation) of the atria and leads to the contraction of both the atria.

‘QRS’ complex : represents the depolarisation of the ventricles, which initiates the ventricular contraction.

‘T’ Wave : represents the return of the ventricles from excited to normal state (repolarisation). The end of T-wave marks the end of systole.

Double circulation : The passage of same blood twice through heart in order to complete one cycle. eg.

- (i) The blood pumped by the right ventricle (deoxygenated blood) is transported through pulmonary artery to lungs where CO_2 is exchanged with O_2 through diffusion and returns back to the heart through pulmonary vein. It is called pulmonary circulation.
- (ii) The oxygenated blood from left ventricle is transported through aorta to different body parts (cells and tissues) where O_2 is exchanged with CO_2 through diffusion and then returned back to the heart through vena-cava. It is called systemic circulation.

Disorders of circulatory System

Hypertension (High blood Pressure) : It results from narrowing of arterial lumen and reduced elasticity of arterial walls in old age. It can cause rupturing of capillaries. It is a silent killer.

Coronary Artery Disease : (CAD) Atherosclerosis. The supply of the blood to heart muscles is affected. It is “caused by deposits of Calcium, fat, cholesterol and fibrous tissues to make the lumen of arteries narrower.

Angina Pectoris : Caused due to arteriosclerosis, when not enough oxygen is reaching the heart muscle due to which the person experiences acute chest pain.

Heart attack : Caused when the heart muscle is suddenly damaged by an inadequate blood supply.

Cardiac arrest : The state in which the heart stops beating.

Arteriosclerosis : The state of hardening of arteries and arterioles due to thickening of the fibrous tissue and consequent loss of elasticity. It causes hypertension.

Questions

Very Short Answer Questions

(1 mark each)

1. Name the instrument used for measuring blood pressure.
2. What is lymph node ?
3. A cardiologist observed an enlarged QRS wave in the ECG of a patient. What does it indicate ?

4. Name the enzyme that catalyses the formation of carbonic acid in erythrocytes.
5. What is systemic circulation ?
6. Give two examples of extra-cellular fluids.
7. What name is given to the blood vessels which generally bring blood to an organ ?
8. Which adrenal hormone accelerates the heart beat under normal conditions ?
9. Name the blood vessel that carries blood from the intestine to liver.
10. Define cardiac cycle.
11. Name the protein found in RBCs.
12. What happens to a person suffering from hemophilia ?

Short Answer Questions-I

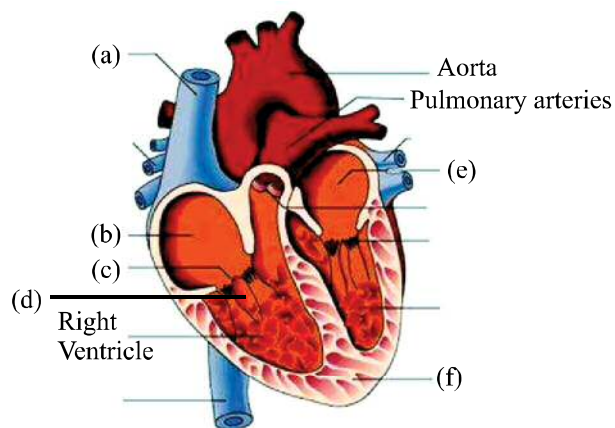
(2 marks each)

13. Explain when and how the two sounds of heart are produced.
14. Define joint diastole. What are constituents of the conducting system of human heart ?
15. Give the names of various types of formed elements present in the blood.

Short Answer Questions-II

(3 marks each)

16. Draw a diagram showing schematic plan of blood circulation in human.
17. Why is the SA node called pacemaker of the heart ? Write its full form.
18. In the following diagram of section of a human heart, label a, b, c, d, e and f.



19. What is lymph ? Describe its circulation in brief.
20. What is stroke volume ? What is its relation with cardiac output ?

21. A person suffering from fever is advised to take blood test. What may happen to his WBC count and why ?

Long Answer Questions

(5 marks each)

22. Neena is having blood group A-ve while her husband's blood group is O +ve. Their first child is having blood gp. A +ve. Her second child was born with severe anemia and jaundice. What could be the reason ? How this situation could have been avoided ?
23. Draw a diagram to show the internal structure of human heart. Label any two heart chambers, any two heart valves and chordae tendinae in it.
24. Describe the structure of human heart.
25. What is cardiac cycle ? Describe the event that occurs during it.
26. Explain Rh grouping and its incompatibility in humans.

Answers

Very Short Answer

(1 mark each)

1. Sphygmomanometer.
2. A lymph node is a specialised structure in lymphatic vessel concerned with the alteration of foreign bodies by the lymphocytes.
3. QRS waves denote ventricular contraction of heart which may be normal or abnormal.
4. Carbonic anhydrase.
5. The kind of blood circulation that is concerned with the supply of oxygenated blood from the left ventricle to all body parts and return of oxygenated blood to the right atrium of heart.
6. Interstitial fluid and blood plasma.
7. Afferent blood vessel.
8. Noradrenalin.
9. Hepatic portal vein.
10. A regular sequence of three events (i) auricular systole (ii) ventricular systole and (iii) Joint diastole during the completion of one heart beat.

11. Haemoglobin.
12. The person suffering from haemophilia lacks clotting factors in blood, which result the defective clotting mechanism. In case of injury the person is at a risk of blood loss.

Short Answer-I

(2 mark each)

13. (i) 'Lubb' the first sound which is low pitched, is caused by the closure of bicuspid and tricuspid valves.
(ii) 'Dup' the second sound which is high pitched, is caused by the closure of semilunar valves.
14. In a cardiac cycle when both atria and ventricles are in a diastole and are relaxed simultaneously is called a joint diastole.
Conducting system constitutes : SA node → AV node → Bundle of His → Purkinje fibres.
15. Erythrocytes, lymphocytes, monocytes, neutrophils * eosinophils, basophils and platelets.
16. SA node being self excitatory initiate a wave of contraction in the heart.
SA node — Sino-Atrial Node.

Short Answer-II

(3 marks each)

17. Refer fig. 18.4, page 287 (NCERT Text Book Class XI-Biology)
18. Refer fig. 18.2, page 283 (NCERT Text Book Class XI-Biology)
19. Refer fig. 18.2, page 282 (NCERT Text Book Class XI-Biology)
20. During one cardiac cycle or one heart beat the volume of blood pumped by the heart is called stroke volume. This is normally 70 mL.
In one minute the heart beats about 72 times and the amount of blood pumped per minute is called cardiac output. This is usually 4900 mL. or 5 litres.
21. The WBC count of this person may show an increase from the normal range. As pathogens may be present in his body, so the body is producing more WBCs to fight against those pathogens. WBC count is a good tool to assess the presence of infection in a sick person.

Long Answer

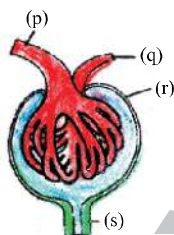
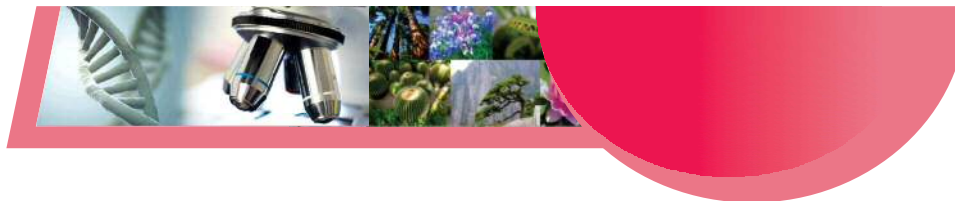
(5 marks each)

22. During her first pregnancy with her first Rh +ve child, her body prepared antibodies against Rh antigen in her blood. In second pregnancy these Rh antibodies from mother leaked into the blood of foetus (Rh +ve) and destroyed foetus RBCs. It was the cause of severe anemia.

This situation could have been avoided if she had got herself administered anti; Rh antibodies immediately after first deliver to kill Rh antibodies.

23. Refer fig. 18.2, page 283 (NCERT Text Book Class XI-Biology)
24. Refer content 18.3.1., page 283 (NCERT Text Book Class XI-Biology)
25. Refer content 18.3.2., page 284 (NCERT Text Book Class XI-Biology)
26. Refer content 18.3.2., page 281 (NCERT Text Book Class XI-Biology)





Chapter - 19

Excretory products and

Their Elimination

Points To Remember

Ammonotelism :

The animals which excrete ammonia are called ammonotelic and excretion of ammonia is known as ammonotelism eg. Amoeba, sycon, hydra, liver fluke, tapeworm, Leech, Prawn, bony fishes etc.

Ureotelism :

excretion of urea is known as ureotelism and the animals which excrete urea are ureotelic animals eg. mammals, many terrestrial amphibians and marine fishes and sting rays etc.

uricotelism :

Excretion of uric-acid is known as uricotelism and the animals are called uricotelic eg. most insects, land snails, lizards, snakes and birds.

Nephrons :

The structural and functional unit of kidneys. Each kidney contains about one million of nephrons.

Structure of Nephron :

A nephron consists of Glomerulus, Bowman's capsule, PCT (Proximal convoluted tubule), JG A (Juxtaglomerular Apparatus) and the collecting duct. (Refer fig., 19.3, page 292 (NCERT Text Book of Biology for Class XI))

Structure of Kidney :

Size 10-12 cm in length, 5-7 cm in width, 2-3 cm thick, average weight about 120-170 g.

- The blood vessels, ureter and nerves enter in the kidney through hilum (a notch).

- The outer layer of kidney is a tough capsule.
- The outer zone of kidney is cortex and the inner is medulla.
- The medulla is divided into few conical masses (medullary pyramids) projecting into calyces.
- The cortex extends between medullary pyramids called columns of Bertini.
Refer figure 19.2, page 292 (NCERT—Class XI Biology)

Glomerular Filtration :

The filtration of blood in glomerulus, about 1100-1200 ml of blood is filtered by the kidney per minute.

Glomerular Filtration Rate (GFR) :

The amount of filtrate formed by the kidney per minute is called GFR. In a healthy individual it is about, 125 ml/minute, i.e. 180 litres per day.

Types of Nephrons :

- Juxtamedullary Nephron**—About 15% of total nephrons, Glomeruli are found in inner region of cortex, large in size, long loop of Henle and found deep in medulla, associated with vasa recta control plasma volume when water supply is short.
- Cortical Nephron**—About 85% of total nephron mainly lie in renal cortex, glomeruli found in outer cortex, short loop of Henle, extends very little in medulla. They do not have vasa recta.

Functions of Tubules :

- PCT**—absorption of all essential nutrients and 70-80% of electrolytes and water, helps to maintain the pH and ionic balance of body fluids by selective secretion of H^+ , ammonia and K^+ into filtrate.
- Henele's Loop**—reabsorption in this segment is minimum, it plays a significant role in maintenance of higher molarity of medullary interstitial fluid.
- DCT**—conditional reabsorption of Na^+ and water takes place here, reabsorption of HCO_3 and selective secretion of H^+ and K^+ and ammonia to maintain the pH and sodium-potassium balance in blood.
- Collecting duct**—Large amount of water is absorbed from this region to produce concentrated urine, it plays a role in maintenance of pH and ionic balance of blood by selective secretion of H^+ and K^+ ions.

Steps of Urine Formation

- 1. Glomerular Filtration**—Blood is filtered by glomerules through three membranes i.e., endothelium of blood vessel, filtration slits of Bowman's capsule and basement membrane between these two layers. This filtration is called ultrafiltration as all constituents of plasma comes into filtrate except proteins.
- 2. Reabsorption**—90% of filtrate is reabsorbed by the renal tubules by active or passive mechanism.
It is evident by the fact that out of 180L of filtrate formed per day only 1.5 L of urine released.
- 3. Secretion**—Tubular cells secrete H^+ , K^+ , ammonia into the urine. It maintains acid-base balance of body fluids.

Mechanism of concentration of the Filtrate (Countercurrent Mechanism) :

Refer fig 19.6 page 296 (NCERT-Class XI Biology)

- This mechanism is said to be countercurrent mechanism because the out flow (in the ascending limb) runs parallel to and in the opposite direction of the inflow (in the descending limb).
- NaCl is transported by the ascending limb of Henle's loop which is exchanged with the descending limb of vasa-recta.
- NaCl is returned to the interstitium by the ascending portion of **vasa recta**.
- Henle's loop and vasarecta as well as the counter current in them help to maintain an increasing osmolality towards the inner medullary interstitium i.e., from 300 mosmol/L in cortex to about 1200 mosmol/L in inner medulla.
- Small amount of urea enter, the thin segment of ascending limb of Henle's loop which is transported back to the interstitium by the collecting tubule.
- This mechanism helps to maintain a concentration gradient in the medullary tubule interstitium.
- It helps in an easy passage of water from the collecting tubule to concentrate the filtrate i.e. urine.

Anti Diuretic Hormone (ADH) Controls the urine formation when there is less blood volume due to excessive loss of fluid from the body, osmoreceptors send the signal to hypothalamus to release ADH which in turn facilitates water reabsorption thus preventing diuresis (increase in frequency of urination)

Micturition :

The expulsion of urine from the urinary bladder is called micturition. It is a reflex process but can be controlled voluntarily up to some extent in grown up children and adults.

- The CNS (Central Nervous System) sends the signal which cause the stretching of the urinary bladder when it gets filled with urine.
- In response, the stretch receptors on the walls of the bladder sends signals to the CNS.
- The CNS passes on motor message to initiate the contraction of smooth muscles of the bladder and simultaneous relaxation of the urethral sphincter causing the release of urine.
- An adult human excretes on an average 1 to 1.5 lit res of urine per day.
- On an average 25-30 gram of urea is excreted out per day.

Renin Angiotensin System

Fall in GFR

↓ Renin from JG cells

Angiotensinogen → Angiotensin I → Angiotensin II

↓ Acts on

Adrenal Cortex

↓ Secretes aldosterone

Reabsorptin from DCT

↓

Increase in GFR

Role of other organs in excretion :

- **Lungs**—removes CO₂ (18L/day) and water.
- **Liver**—secretes bilirubin, biliverdin etc. helps to eliminate these substances along. with cholesterol, vitamins, drugs and degraded steroid hormones through digesive wastes.
- **Sweat and sebaceous glands**—These glands of skin help to eliminate small amount of urea, NaCl and lactic acid etc. through sweat while sebaceous glands help to eliminate some substances like steroids, hydrocarbons and waxes through sebum.
- **Saliva**—It can help to eliminate small amount of nitrogenous wastes.

Disorders of Excretory system :

- **Uremia**—The accumulation of urea in blood due to malfunctioning of kidney.
- **Hemodialysis**—The process; of removal of urea from the blood artificially. In this process the blood from an artery is passed into dialysing unit after adding an anticoagulant like heparin. The blood passes through coiled cellophane tube surrounding by dialysing fluid. The nitrogenous wastes from the concentration gradient and the blood becomes clear. This blood is pumped back to the body through vein after adding anti-heparin to it.
- **Renal calculi**—The formation of insoluble mass of crystallised salts (oxalates or phosphates of calcium).
- **Glomerulonephritis**—Inflammation of glomeruli of kidney.

Questions

Very Short Answer Questions

(1 marks each)

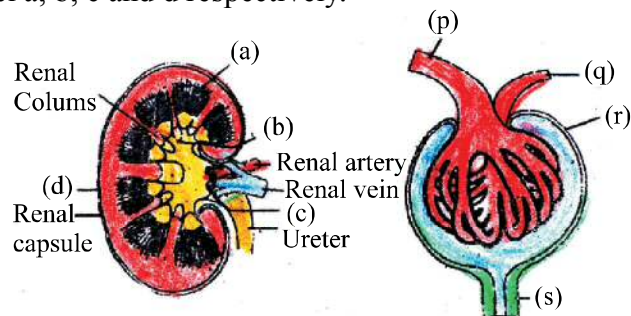
1. Which gland **secretes** sebum ?
2. One part of loop of Hanle is impermeable to water. Name it.
3. Besides water, name any two contents of human sweat.
4. Explain the function of vasa rectae.
5. Name two types of nephrons found in human kidney.
6. Define GFR (Glomerular Filtration Rate).
7. The mechanism of concentration of filtrate is also known as counter current mechanism. Justify the statement.
8. What is micturition ?
9. Write the function of hormone ‘renin’ produced by kidney.
10. Name the excretory product of (i) reptiles (ii) Prawns.
11. What is vasa recta ?

Short Answer Questions-I

(2 marks each)

12. Mark the odd ones in each of the following—
 - (a) Renal pelvis, medullary pyramid, renal cortex, ureter.
 - (b) Afferent arteriole, Henle’s loop, vasa recta, efferent arteriole.
 - (c) Glomerular filtration, antidiuretic hormone, hypertonic urine, collecting duct.
 - (d) Proximal convoluted tubule, distal convoluted tubule, Henle’s loop, renal corpuscle.

13. In the following diagram of longitudinal section of kidney (Fig.-1) identify and label a, b, c and d respectively.

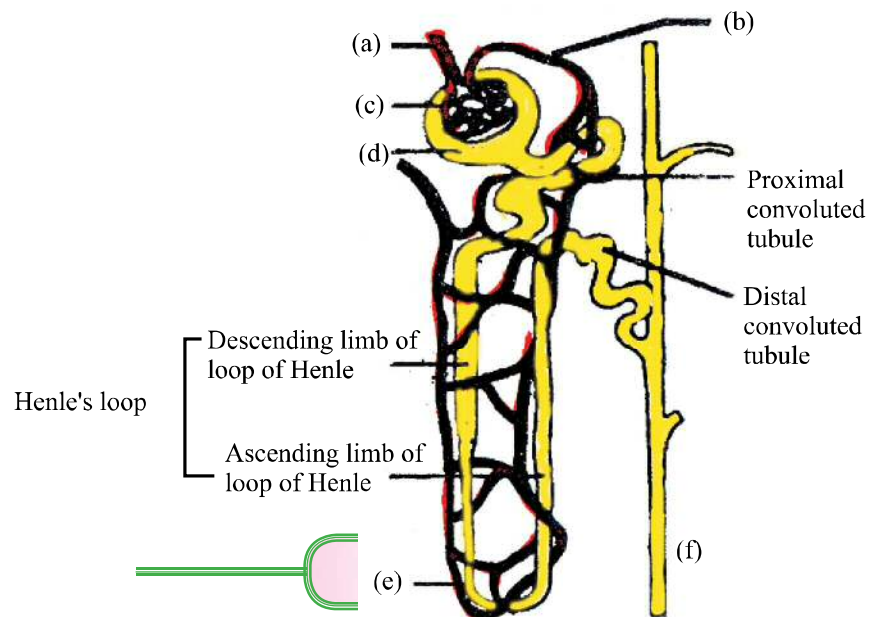


14. In the diagram (Fig.-2) showing malpighian body (renal corpuscle) identify and label p, q, r, s.
15. Name two metabolic disorder which can be diagnosed by analysis of urine.

Short Answer Questions-II

(3 marks each)

16. In the following diagram (Fig.-3) showing structure of a nephron label a, b, c, d, e and f.



17. Describe the hormonal feed back circuit in controlling the renal functions.
18. Give three points of difference between renin and Renin.
19. What are Ammonotelic, ureotelic and uricotelic animals ? Give an example of each type of these.
20. Why do urine formation less during summers ?

Long Answer Questions

(5 marks each)

21. Draw a labelled diagram of human urinary system and write one function of each adrenal gland, ureter, urinary bladder, kidney and urethra.
22. Describe how urine is formed in the nephron through filtration reabsorption and secretion.

OR

Explain the steps involved in the process of urine formation.

23. Distinguish between (i) Uricotelism and Ureotelism (ii) Sebaceous glands and sweat glands (iii) Proximal and distal convoluted tubules (iv) Ascending and descending limbs of Henle's loop (v) Cortical and Medullary nephrons.

OR

Explain the process of reabsorption and secretion of major substances at different parts of nephron with the help of schematic diagram.

Answers

Very Short Answer

(1 mark each)

1. Sebaceous glands (wax-glands)
2. Ascending limb.
3. Sodium chloride, lactic acid, glucose (any two).
4. It helps to retain reabsorbed ions and urea in the interstitial fluid of the medulla, to maintain its high osmotic pressure.
5. (i) Juxta medullary nephron (ii) Cortical nephron
6. The amount of filtrate formed by the kidney per minute.
7. (in the ascending limb) the out/flow runs parallel to and in the opposite direction of the inflow in the descending limb.
8. The act of passing out urine from urinary bladder.
9. Renin is used to convert angiotensinogen to angiotensin.
10. (i) Uric acid (ii) Ammonia
11. Capillary network running parallel to loop of Henle is known as Vasa recta.

Short Answer-I

(2 marks each)

12. (a) Ureter (b) Henle's loop (c) Glomerular filtration (d) Renal Corpuscle.
13. Refer fig. 19.2, page 292 (NCERT Class XI-Biology)

14. Refer fig. 19.4 page 293 (NQERT class XI-Biology)

15. Glycosuria, Ketonuria

Short Answer-II

(3 marks each)

16. Refer fig. 19.3, page 292, (NCERT class XI-Biology)

17. Refer content 19.5, page 297 (NCERT class XI-Biology).

18.	Rennin	Renin
(i)	It is a proteolytic enzyme	(i) It is a hormone that acts as an enzyme.
(ii)	It helps in the digestion of milk Protein	(ii) It converts the protein angiotensinogen into angiotensin
(iii)	It is secreted as an inactive form Prorennin which is activated to rennin by HCl	(iii) It is secreted as renin
(iv)	Its secretion is stimulated by food	(iv) Its secretion is stimulated by a reduction of Na^+ level in tissue fluid. (..... any three)

19. Refer content given in the beginning of the chapter or NCERT Text Book page 290 class XI-Biology.

20. Due to sweating in summers blood volume is decreased. ADH is secreted from hypothalamus which increase reabsorption from D.C. tubules thus amount of urine is decreased.

Long Answer

(5 mark each)

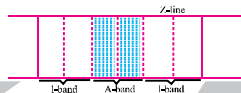
21. Refer fig. 19.1, page 291 and content 19.1 (NCERT Text Book page Class XII-Biology)

22. Refer content points to remember.

23. Refer the content given in the chapter or NCERT Text Book Class-XI Biology at pages 290, 298 (19.7), 292 and 293 respectively.

24. Refer content 19.3 and content 19.5 at page 294-295 (NCERT Text Book Class XI-Biology)





Chapter - 20

Locomotion and Movement

Points To Remember

Arthritis : an inflammatory joint disease characterised by inflammation of joints.

Coccyx : tail bone formed by fusion of four coccygeal vertebrae in man.

Dicondylic Skull : A Skull with two occipital condyles.

Endo Skeleton : A skeleton present inside the body.

Fascicle : Bundles of muscle fibres held together by connective tissue.

Fascia : Collagenous connective tissue layer that surrounds muscle bundles.

Floating ribs : The ribs that remain free anteriorly, **(last 2 pairs)**

False ribs : 8th, 9th and 10th pair of ribs not directly joins the sternum but to seventh pair of ribs, hence called pseudoribs.

Myoglobin : A red colored pigment present in sarcoplasm of muscle.

Sarcomere : A portion of myofibril between two successive 'Z' lines.

Sarcocolema : The plasma membrane of a muscle.

Gout : Inflammation of joints due to accumulation of uric acid crystal.

Suture : immovable joints between skull bones.

Synovial joints : Freely movable joints between limb bones.

Patella : A sesamoid bone acting as kneecap.

Intervertebral disc : Fibro cartilaginous pad present between the vertebrae that act as shock absorbers.

Tendon—Connective tissue made of yellow fibrous tissue which connect muscle to bone. It is not flexible.

Ligament—Connective tissue made of white fibrous tissue which joins two bones. It is flexible.

L.M.M. : Light meromyosin

HMM : Heavy meromyosin

Types of Movement :

1. **Amoeboid movement** : These movements takes place in phagocytes where leucocytes and macrophages migrate through tissue. It is affected by pseudopodia formed by the streaming of protoplasm (as in amoeba)
2. **Ciliary movement** : These movement occurs in internal organs which are lined by ciliary epithelium.
3. **Muscular Movement** : This movements involve the muscle fibers, which have the ability to contract and relax.

Properties of Muscle : (i) Excitability (ii) Contractility
(iii) Extensibility (iv) Elasticity

Types of Muscles :

- (a) **Skeletal muscles or striated muscles**—These involved in locomotion and change of body postures. These are also known as voluntary muscles.
- (b) **Visceral muscles or smooth muscles**—These are located in inner wall of hollow visceral organ, smooth in appearance and their activity are not under control of nervous system. They are called involuntary muscles.
- (c) **Cardiac muscles**—The muscles of heart, involuntary in nature, striated and branched, These are uninucleated.

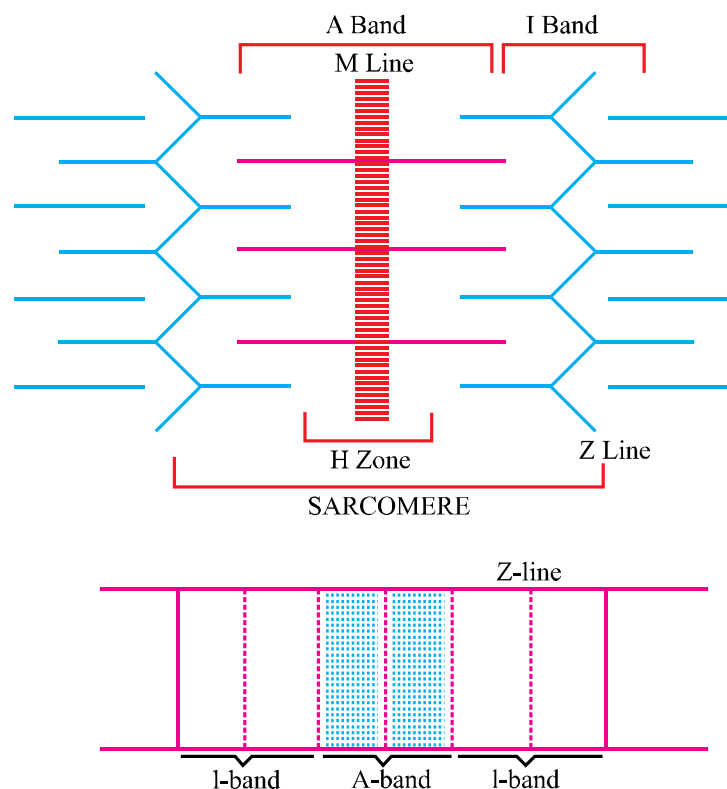
Characteristic	Skeletal Muscle	Smooth Muscle	Cardiac Muscle
Location	Muscles attached with skeletal components	muscles found in the inner walls of hollow visceral organs	Muscles found in heart
Appearance	Striated having light and dark bands.	Unstriated, smooth in appearance with tapering ends	Striated in appearance and branched
Control	They are controlled by our will hence called voluntary muscles	They are not under the control of our will hence called involuntary muscles	not under the direct control of nervous system

Structure of myofibril :

- Each myofibril consist of alternate dark and light band.
- Dark band—contain myosin protein and is called A-band or Anisotropic band.
- Light band—Contain actin protein and is called I Band or Isotropic band.
- I Band is bisected by an elastic fiber called 'Z' line. Actin filament (thin filament) are firmly attached to the 'Z' lines.
- Myosin filament (thick filament) in the 'A' Band are also held together in the middle of T Band by thin fibrous membrane called 'M' line.
- The portion between two successive 'Z' lines is considered as functional unit of contraction and is called a sarcomere.



Structure of Actin and Myosin Filament



- 1. Actin filament :** An actin filament is made of two 'F' actins which are helically wound to each other. Two filaments of tropo myosin protein also run close to 'F' actins throughout its length. A complex protein Troponin is distributed at regular intervals on tropomyosin which mask the actin binding site for myosin.
- 2. Myosin filament :** Each myosin filament is a polymer of meromyosin. Each meromyosin has two components—a globular head with a short arm and a tail. Head is made of heavy meromyosin while tail is made of light meromyosin. The head with its short arm project outward at regular distance and angle from each other and is known as cross arm. The head has an active site for actin and binding site for ATP.

Red muscle fibres :

- These are red in colour due to presence of high content of myoglobin.
- These contain plenty of mitochondria.
- Sarcoplasmic reticulum is less in these fibres.
- Show slow but sustained contractions for longer periods.

White muscle fibres

- These are pale or whitish due to presence of less content of myoglobin.
- These contain fewer mitochondria
- Sarcoplasmic reticulum is more/high
- During strenuous exercise, lactic acid accumulates in large quantity so muscle fatigues

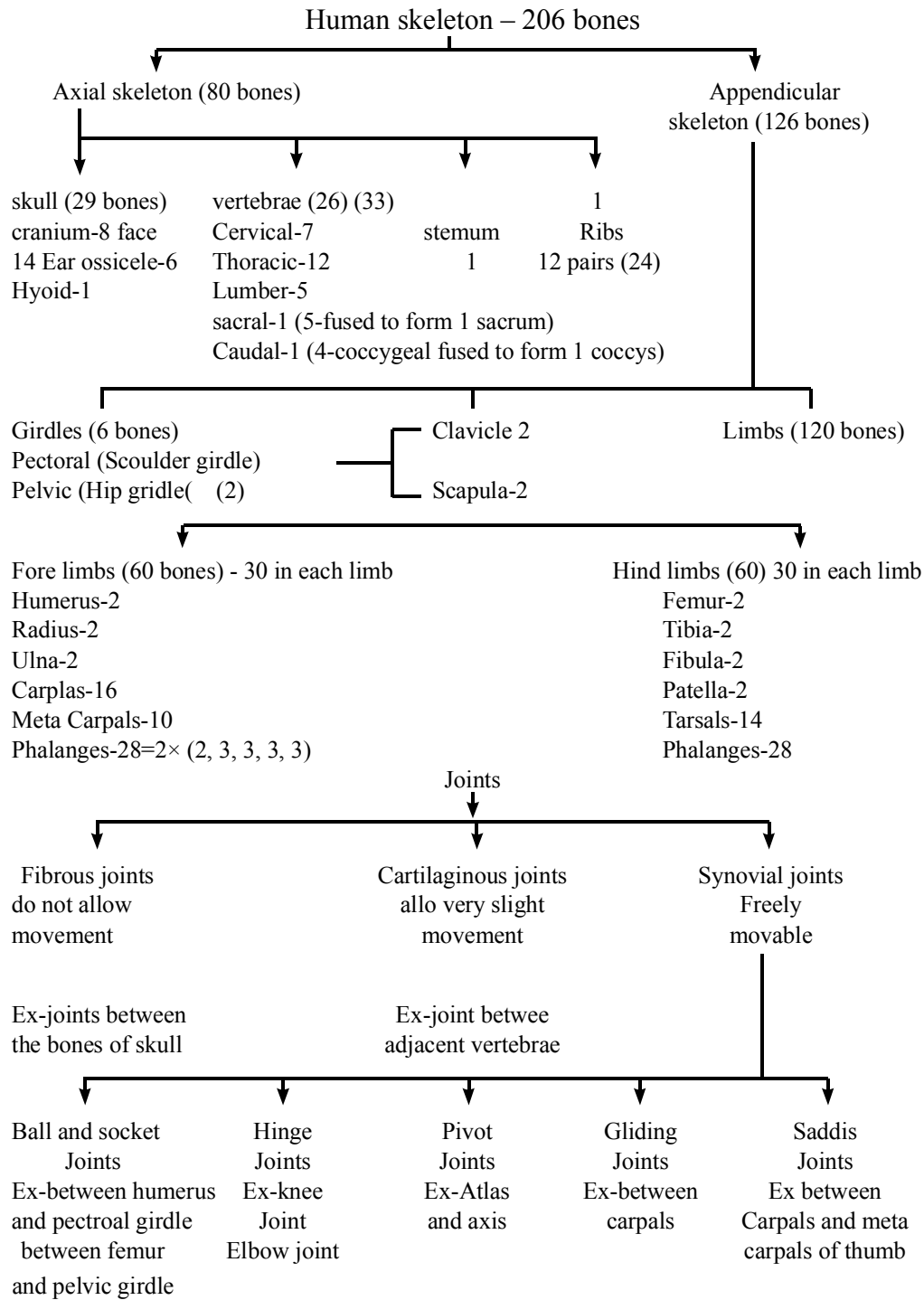
Mechanism or Muscle contraction : Sliding filament theory

The contraction of muscle fiber takes place by the sliding of actin (thin filament) on myosin (thick filament)

- Muscle contraction is initiated by a signal sent by the CNS via a motor neuron.
- Impulse from motor nerve stimulates a muscle fiber at neuro muscular junctions.
- Neurotransmitter releases here which generates an action potential in sarcolemma.
- This causes release of Ca^{++} into sarcoplasm. These Ca^{++} binds with troponin, thereby remove masking of active site.
- Myosin head binds to exposed active site on actin to form a cross bridge, utilising energy from ATP hydrolysis.
- This pulls the actin filament towards the centre of 'A' band.
- 'Z' lines also pulled inward thereby causing a shortning of sarcomere i.e. contraction.
- I band get reduced, whereas the 'A' band retain the length.
- During relaxation, the cross bridge between the actin and myosin break. Ca^{++} pumped back to sarcoplasmic cisternae. Actin filament slide out of 'A' band and length of I band increase. This returns the muscle to its original state.



Vertebral formulae of man $C_7T_{12}L_5S_{(5)}C_{(4)} = 33$



Questions

Very Short Answer Questions

(1 mark each)

1. What is the total number of bones present in left pectoral girdle and left arm respectively in human beings.
2. Why do skeletal muscle show striation.
3. Why are 11th 12th pair of ribs called floating ribs ?
4. Write the name of chemical that causes fatigue in the muscles.
6. What lubricate the freely movable joints at the shoulder ?
7. Name of longest bone of human body.
8. Give the name of first vertebra.
9. Define a sarcomere.
10. Name the cup shaped bone that constitutes the knee cap.
11. Which muscle fibre work during long flight of eagle ?
12. Name the cavity in the girdle into which the head of femur fits ?

Short Answer Questions-I

(2 marks each)

13. Write any two difference between cardiac muscle and skeletal muscle.
14. Distinguish between red fibre and white fiber.
15. Name the two types of girdles found in human body and write their role.
16. State the role of calcium ions and ATP in muscle contraction.
17. Name the bones of fore limb (hand) of human body. Give their number in each limb.

Short Answer Questions-II

(3 marks each)

18. What makes the synovial joints freely movable ? List any four types of synovial joints.
19. Name the category of bones forming the ribcage. How are these articulated to each other to form the cage ?
20. How are actin and myosin filament arranged in a muscle fibre ?
21. Mention the factor which is responsible for the following :
(i) Tetany (ii) Gout (iii) Osteoporosis

Long Answer Questions

(5 mark each)

22. Explain the important steps of sliding filament theory of muscle contraction.

Answers

Very Short Answers

(1 mark each)

1. Left pectoral girdle has 2 bones (1 clavicle and 1 scapula). Left Arm has 30 bones.
2. Due to distribution pattern of actin and myosin protein.
3. These ribs are not ventrally attached to sternum
4. Actin and myosin
5. Lactic acid
6. Synovial fluid
7. Femur
8. Atlas
9. A portion of myofibril between two successive 'Z' lines.
10. Knee cap
11. Red muscle fibre
12. Acetabulum

Short Answers-I

(2 marks each)

13. Refer NCERT Text book Class XI Page 303
14. Refer Points to remember
15. Refer NCERT Text book Class XI Page 311
16. Refer NCERT Text book Class XI Page 307 and 308.
17. Refer Points to remember

Short Answers-II

(3 marks each)

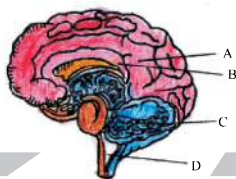
18. Refer NCERT Text book Page 312. Class XI
19. Refer NCERT Text book Page 310. Class XI
20. Refer NCERT Text book Page 305. Class XI
21. Refer NCERT Text book Page 312. Class XI

Long Answer

(5 marks each)

21. Refer Points to remember





Chapter - 21

Neural Control and Coordination

Points To Remember

Coordination : Process through which two or more organs interact and complement the functions of one another surrounding the brain.

Action potential : A sudden change in the electrical charges in the plasma membrane of a nerve fibre.

Aqueous humour : The thin watery fluid that occupy space between lens and cornea in eye.

Blind spot : A spot on retina which is free from rods and cones and lack the ability for vision.

Cerebrospinal fluid : An alkaline fluid present in between inner two layer of meninges, surrounding the brain and spinal cord.

Cerebellum : A part of hind brain that controls the balance and posture of the body.

Cochlea : A spirally coiled part of internal ear which is responsible for hearing.

Corpus callosum : A curved thick bundle of nerve fibres that joins two cerebral hemisphere.

Depolarisation : A condition when polarity of the plasma membrane of nerve fibre is reversed.

Endolymph : The fluid filled within membranous labyrinth.

Eustachian tube : A tube which connect ear cavity with the pharynx.

Fovea : An area of highest vision on the retina which contain only cones.

Meninges : Three sheets of covering of connective tissue wrapping the brain.

Grey Matter : This shows many convolutions which increase the amount of vital nerve tissue.

Medulla oblongata : Posterior most part of the brain which is continuous with spinal cord and control respiration, heart rate,swallowing,vomiting.

Pons : Thick bundles of fibres on the ventral side of brain below cerebellum.

Foramen magnum : A big aperture in the skull posteriorly through which spinal cord emerges out.

Spinal cord : A tubular structure connected with medulla oblongata of brain and situated in the neural canal of the vertebral column, covered by meninges.

Synaptic cleft : A narrow fluid filled space which separates two membranes of the two neurons at the synapse.

Synaptic vesicles : These are membrane bound vesicles in the axoplasm of the axon terminal and these store neurotransmitter.

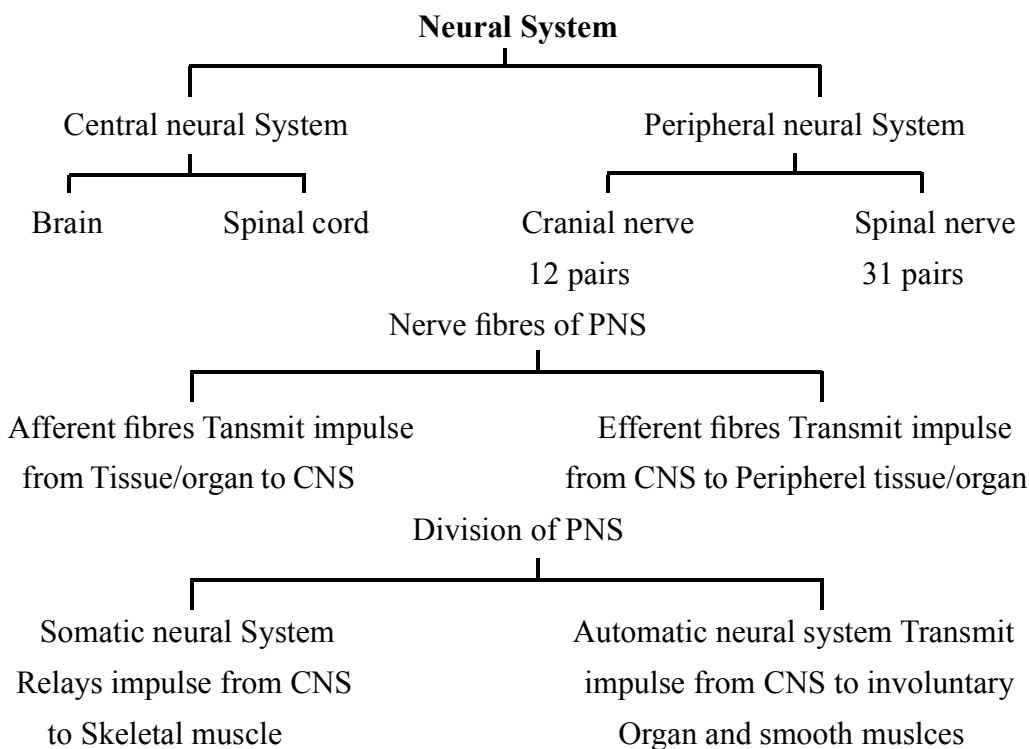
Neurotransmitter : These are chemicals stored in synaptic vesicles, diffuse to reach the membrane of next neuron for its stimulation.

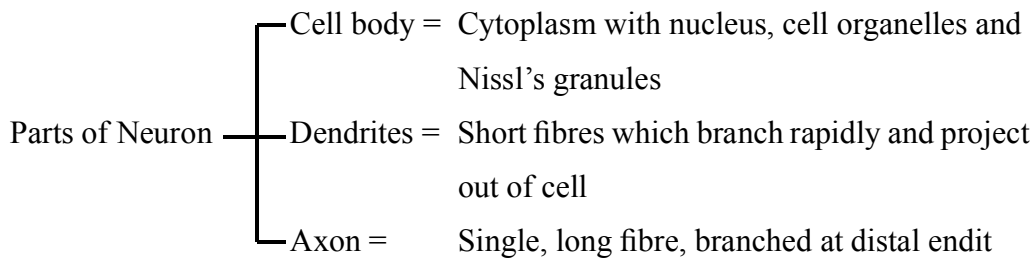
Synapse : A physiological junction between axon of one neuron and dendrite of next neuron.

CNS—Central neural system

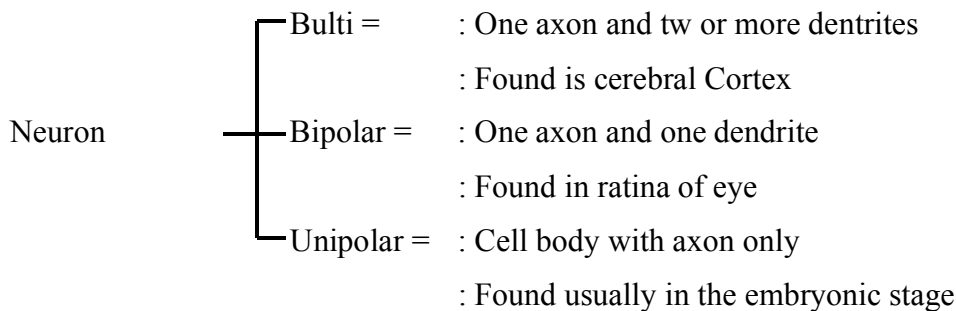
PNS—Peripheral neural system

ANS—Autonomic neural system





(Refer fig. 21.1, page 317, NCERT - Biology, Class-XI)



Conduction of nerve impulse along axon

Polarised membrane/Resting Potential

In resting phase when neuron is not conducting an impulse, the axonal membrane is called polarised. This is due to difference in concentration of ions across the axonal membrane.

At Rest :

- Axoplasm inside the axon contains high conc. of K^+ and low conc. of Na^+ .
- The fluid outside the axon contains low conc. of K^+ and high conc. of Na^+ .

As a result the outer surface of axonal membrane is positively charged and inner surface is negatively charged. The electric potential difference across the resting plasma membrane is called resting potential.

Action Potential : When a nerve fibre is stimulated, the permeability of membrane to Na^+ is greatly increased at the point of stimulus (rapid influx of Na^+) and hence polarity of membrane is reversed and now membrane is said to be depolarised. The electric potential difference across the plasma membrane at that site is called action potential, which is in fact termed as nerve impulse.

Depolarisation is very rapid, so that conduction of nerve impulse along the entire length of axon occurs in fractions of second.



Transmission of Impulses at Synapse

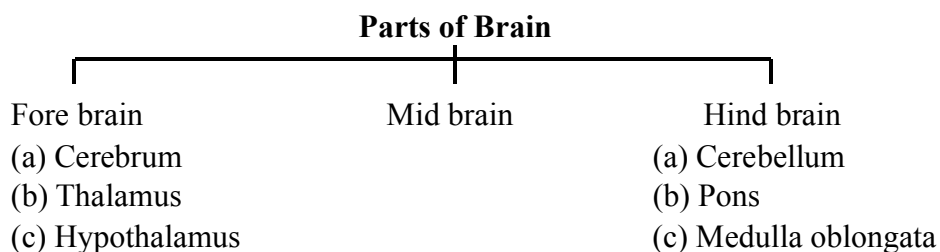
- (i) **At electrical synapses :** Here the membrane of pre and post-synaptic neuron are in very close proximity. Electric current can flow directly from one neuron into other across these synapses, like impulse conduction along a single axon.
- (ii) **At chemical synapses :** Here the membrane of pre and post-synaptic neuron are separated by fluid filled space called synaptic cleft. Neurotransmitter are involved here.

When an impulse arrives at the axon terminal, it stimulates the movement of the synaptic vesicles towards membrane and they fuse with the plasma membrane and release their neurotransmitter in the synaptic cleft. These chemicals bind to specific receptors, present on the post-synaptic membrane. Their binding opens ion channels and allow the entry of ion which generate new potential in post synaptic neuron.

Human brain : Human brain is the major portion of central neural system. Which is well protected by the skull.

The brain is surrounded by three cranial meninges—

- (i) Dura mater—outer layer
- (ii) Arachnoid—middle layer
- (iii) Pia mater—Inner layer-remain in contact with brain



Functions of parts of brain :

Cerebrum : Centre of intelligence, memory and imagination, reasoning, judgement, expression of will power.

Thalamus : Acts as relay centre to receive and transmit general sensation of pain, touch and temperature.

Hypothalamus : Centre for regulation of body temperature, urge for eating and drinking.

Midbrain : Responsible to coordinate visual reflexes and auditory reflexes.

Cerebellum : Maintains posture and equilibrium of the body as well as coordinates and regulates voluntary movement.

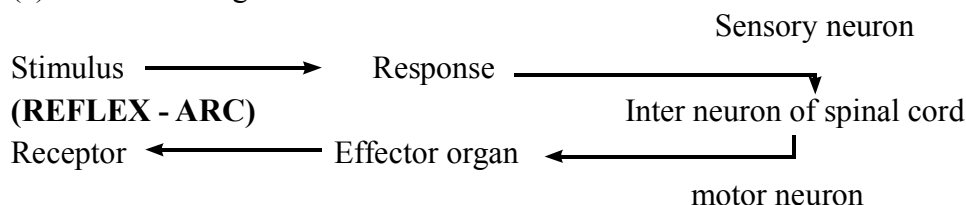
Pons : Relays impulses between medulla oblongata and cerebral hemisphere and between the hemisphere of cerebrum and cerebellum. It also helps to regulate breathing.

Medulla oblongata : Centre that controls heart beat, breathing, swallowing, salivation, sneezing, vomiting and coughing.

Reflex action : It is spontaneous, autonomic and mechanical response to a stimulus that occurs at the level of spinal cord, without involvement of brain.

Reflex arc : The flow of nerve along the specific during reflex action. It consists of—

- (a) A receptor
- (b) An Afferent neuron (sensory neuron)
- (c) An inter neuron
- (d) An efferent neuron (motor neuron)
- (e) An effector organ



Organ of Sight-Eye

Layer	Component	Function
1. External layer	Sclera	Protects and maintain shape of the eye ball
	Cornea	Outermost transparent portion of eye which allows light to enter
2. Middle layer	Choroid	Absorb light and prevent light from being reflected within the eye ball.
	Ciliary body	Holds lens, regulate shape of the lens.
	Iris	Control amount of light entering.
3. Inner layer	Retina	Vision in dim light, colour vision, vision in bright light. Sends the image to brain through optical nerves.

(Refer-Fig. 21.6, Page 323 NCERT-Biology, Class XI)



Organ of Hearing-Ear

Portion of the ear	Component	Function
1. External ear	Pinna External auditory canal	Collect sound waves Direct sound waves towards ear drum, ear wax prevents the entry of foreign bodies.
2. Middle ear	Tympanic membrane Ear ossicles Eustachian tube	Acts as resonator that reproduces the vibration of sound. Transmit sound waves to internal ear. Helps in equalising the pressure of either side of ear drum.
3. Internal ear	Cochlea Vestibular apparatus	Hearing organ. Balancing of body.

(Refer Fig. 21.7, page 325-NCERT-Biology, Class XI)

Questions

Very Short Answer Questions

(1 mark each)

1. Name the fluid present in membranous labyrinth.
2. Name the area of retina where only cones are densely packed.
3. Name the inner most meninges of the brain.
4. To which part of the brain communication and memory are associated ?
5. Name the bundle of fibres that connect two cerebral hemisphere in human being.
6. Name the photo pigment present in the rod cells.
7. Why can impulses flow only in one direction ?
8. Where is hypothalamus located in the brain ?
9. Which cells are responsible for scotopic vision ?

Short Answer Questions-I

(2 marks each)

10. Distinguish between electrical synapses and chemical synapses.
11. What is iris ? Give the function of iris.
12. What is organ of Corti ? Where is it located ?
13. Differentiate between cerebrum and cerebellum.
14. What is synapse ? Name its two types.

15. Fill in the blanks in the different columns A to D :

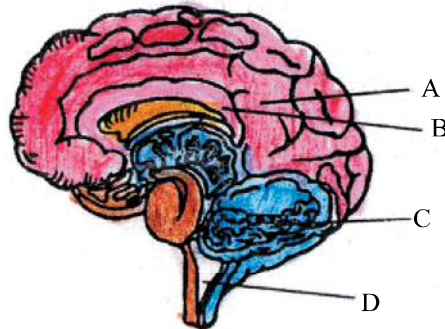
Part/Organ	Function
Pinna	.....(A).....
.....(B).....	Equalise the pressure on either side of ear drum.
Cone cells	.....(C).....
.....(D).....	regulate amount of light to pass into the eye.

16. why are grey matter and white matter contained in human nervous system named so ?

Short Answer Questions-II

(3 marks each)

17. Observe the diagram given right and answer the following questions :



- Label the parts A and B.
- Give the function of C and D.
- Name the layers which wrap this organ.

18. What is a synapse ? How does the nerve impulse cross the chemical synapse ?

19. Give the function of the following :

- Cerebrum
- Hypothalamus
- Mid brain

20. What is meant by reflex action ? Name the components of a reflex arc in correct sequence from receptor upto effector. Support your answer by a diagram.

21. Draw a diagram of V.S. of human eye and label the following :

Iris, Ratina, Cornea, Blind spot, Ciliary body and Vitreous chamber.



Long Answer Questions

(5 mark each)

22. Describe in detail, how conduction of nerve impulse takes place through a nerve fibre.

Answers

Very Short Answers

(1 mark each)

1. Endolymph
2. Fovea
3. Pia mater
4. Cerebrum
5. Corpus callosum
6. Rhodopsin
7. Because each synapse allows impulse to cross it in a single direction.
8. At the base of thalamus.
9. Rods

Short Answers-I

(2 marks each)

10. Refer NCERT text book, Class XI Page no. 319.
11. Refer NCERT Text book, Class XI Page no. 323.
12. Refer NCERT Text book, Class XI Page no. 326.
13. Refer NCERT Text book, Class XI Page no. 321.
14. Junction between two nerves Chemical synapse and electrical synapse
15. (A) To collect sound waves (B) Eustachian tube
(C) Colour vision (D) Iris
16. Refer NCERT book, Page no. 321.

Short Answers-II

(3 marks each)

17. (i) A : Cerebrum
B : Corpus callosum
(ii) C : Balancing of body and maintain posture
D : Vomiting, coughing, breathing, salivation or any other correct answer (anyone).
(iii) Pia mater, arachnoid and dura mater.

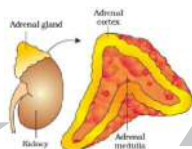
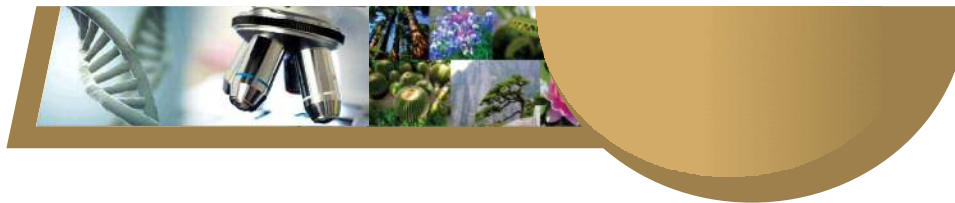
18. Refer NCERT Text book, Class XI Page no. 319.
19. Refer NCERT Text book, Class XI Page no. 321.
20. Refer NCERT Text book, Class XI Page no. 322.
21. Refer NCERT Text book, Class XI Page no. 323.

Short Answer

(5 mark)

22. Refer NCERT Text book, Class XI Page no. 317 and 318.





Chapter - 22 Chemical Coordination and Integration

Points To Remember

Endocrine glands : These are ductless glands which secrete hormones directly into the blood stream.

Hormones : Non-nutrient chemical, synthesised in trace amounts, acts as intracellular messengers and are specific in their action.

Hypothalamus :

- It is basal part of diencephalon.
- Has neurosecretory cells called nuclei which produce hormones to regulate the synthesis and secretion of pituitary gland hormones.
- Two types of hormones released are :

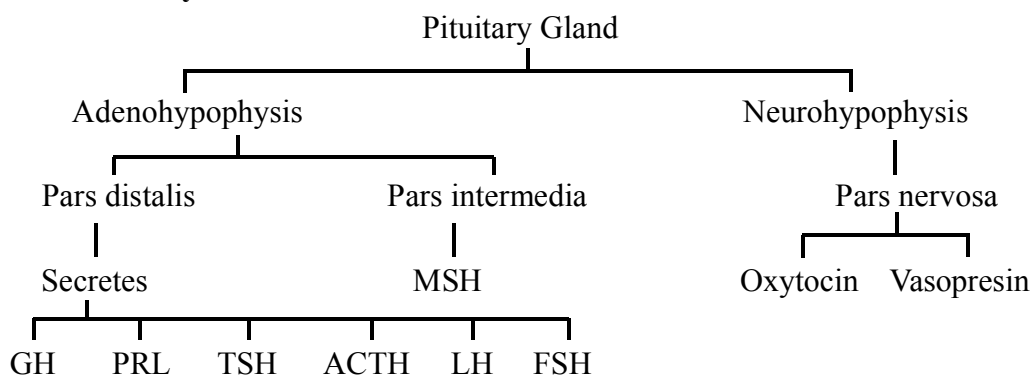
Releasing hormones : Stimulate secretion of pituitary hormones, *e.g.*, *Gonadotropin* releasing hormone stimulates pituitary gland to synthesise gonadotrophins.

Inhibiting hormones : Inhibit secretions of pituitary hormones, *e.g.*, Somatostatin inhibits secretion of growth hormone.

Pituitary Gland :

- Located in bony cavity called as sella tursica.
- Attached to hypothalamus by a stalk.
- Divided anatomically into : Adenohypophysis and Neurohypophysis.
- Hormones released from hypothalamic neurons reach anterior pituitary through portal system.
- Posterior pituitary is under neural control of hypothalamus.

1. Pituitary Gland



Adenohypophysis :

- **Growth hormone (GH) :** Oversecretion leads to gigantism and low secretion causes dwarfism.
- **Prolactin (PRL) :** Growth of mammary gland and formation of milk in them.
- **Thyroid stimulating hormone (TSH) :** Stimulates synthesis and secretion of thyroid hormones from thyroid gland.
- **Adrenocorticoirrophic hormone (ACTH) :** Stimulates synthesis and secretion of steroid hormones called glucocorticoids from adrenal cortex.
- **Luteinizing hormone (LH) :** Synthesis and secretion of hormones called androgens in males, and helps in ovulation and maintenance of corpus luteum in females.
- **Follicle stimulating hormone (FSH) :** Regulate spermatogenesis in males, and growth and development of ovarian follicles in females.
- **Oxytocin** helps in contraction of uterus during child birth and milk ejection from mammary gland in females.
- **Vasopressin :** Acts on kidney and stimulates reabsorption of water and electrolytes by distal tubules to reduce water loss through urine. It is also called as Anti Diuretic Hormone (ADH).
- **Acrommegaly :** It is a condition when the pituitary gland makes too much growth hormone. It is due to a tumour in pituitary gland. Person suffering from acromegaly (acro means tip and megaly means means enlargement) may gradually develop a long face with protruding lower jaw, enlarged nose and wider spacing between teeth and enlarged hands and feet.

2. Pineal Gland :

- Located on dorsal side of forebrain.

- Secretes Melatonin to regulation 24-hours rhythm, sleep-wake cycle, menstrual cycle, pigmentation etc.

3. Thyroid Gland :

- Has two lobes on either side of trachea interconnected by isthmus (connective tissue).
- Composed of follicles and stromal tissues.
- Follicular cells synthesis thyroxine (T_4) and tri-iodothyronine (T_3).
- Iodine is necessary for normal functioning in of thyroid.
- **Goitre (Hypothyroidism)** : Enlargement of thyroid gland; Hypothyroidism may lead to mental retardation and stunted growth (cretinism) Deaf-mutism in the baby if it occurs during pregnancy.
- **Hyperthyroidism** : Occurs due to cancer or due to development of nodules in thyroid glands. Effects body physiology as abnormal high levels of thyroid hormones is synthesised. Basic metabolic rate increase.
- **Exophthalmic goitre** : It is a form of hyperthyroidism, characterised by enlargement of thyroid gland, protrusion of eye balls and increased BMR
- Thyroid hormone controls protein, carbohydrate metabolism.
- Also secretes a protein hormone called Thyrocalcitonin (TCT) which regulates blood calcium level.

4. Parathyroid Gland :

- Present on back side of thyroid gland. Each lobe of thyroid gland has its one pair.
- Secrete peptide hormone called parathyroid hormone (PTH) which increases calcium levels in blood so called **hypercalcemia** hormone.
- PTH stimulates bone resorption, and reabsorption of calcium from blood and reabsorption of calcium by renal tubules, thus increasing blood Ca^{++} level.

5. Thymus Gland

- Located on dorsal side of heart and aorta.
- Secrete peptide hormones called Thymosins which play role in differentiation of T-lymphocytes (help in cell mediated immunity.)
- Thymosins also produce antibodies and provide humoral immunity.
- Immunity of old people usually becomes weak as thymus gets degenerated with age.

6. Adrenal Gland

- Located at anterior part of each kidney.
- Has centrally located adrenal medulla and at periphery in adrenal cortex.

- **Glucagon** : Peptide hormone, stimulates glycogenolysis by acting on liver cells. Also, stimulates gluconeogenesis. Hence called hyperglycemic hormone.
- **Insulin** : Peptide hormone, acts on hepatocytes and adipocytes to enhance cellular glucose uptake, stimulates conversion of glucose to glycogen (glycogenesis), so decrease blood glucose level called hypoglycemic hormone.
- Deficiency of insulin causes diabetes mellitus in which loss of glucose occurs through urine. Excessive hunger and thirst (polydipsia) are other symptoms of Diabetes.

Glycogenolysis : Breaking of glycogen into glucose.

Gluconeogenesis : Formation of glucose from substances other than glycogen.

Glycogenesis : Conversion of glucose into glycogen.

8. Testis :

- A pair of testis composed of seminiferous tubules and interstitial cells is present in the scrotal sac of males.
- Leydig cells (interstitial cells) produce androgens (mainly testosterone) which regulate development and maturation of male accessory sex organs, formation of secondary sex characters and play stimulatory role in spermatogenesis. Male sexual behaviour (libido) is influenced by androgens.

Ovary : A pair of ovaries which produce one ovum in each menstrual cycle are present in abdomen in females.

- Ovary composed of ovarian follicles and stromal tissue.
- Estrogen synthesised by growing ovarian follicles helps in stimulation of growth of female secondary sex organs, female behaviour, mammary gland development and female secondary sex characters.
- Ruptured follicle form corpus luteum which secretes progesterone. Progesterone supports pregnancy and stimulates alveoli formation and milk secretion in mammary glands.

Hormones secreted by tissues which are not endocrine glands :

- Heart** : Atrial wall secretes Atrial Natriuretic factor (ANF) which decreases blood pressure by dilation of the blood vessels.
- Kidney** : Juxtaglomerular cells secrete erythropoietin which stimulates erythropoiesis (RBC formation).
- Gastro-intestinal tract** : it secretes four peptide hormones.

- **Gastrin** : Acts on gastric glands and stimulates secretion of hydrochloric acid and pepsinogen.
- **Secretin** : Acts on pancreas and stimulates secretion of water and bicarbonation.
- **Cholecystokinin (CCK)** : Act on pancreas and gall bladder to stimulate secretion of pancreatic juice and bile juice respectively.

Gastric inhibitory peptide (GIP) : Inhibits gastric secretion and motility.

Mechanism of hormone action : By hormone receptors of two kinds, *i.e.*,

(a) Located on membrane of target cell

- These are membrane bound receptors.
- From hormone receptor complex.



Leads to biochemical changes in tissue.



Release of second messengers like (cyclic AMP, IP_3 , Ca^{2+} etc.) which regulate cellular metabolism.

(b) Located inside the target cell

- These are intra cellular receptors.
- Hormones (steroid hormones iodothyronines etc.) interact with them and cause physiological and developmental effects of regulating gene expression.

Questions

Very Short Answer Questions

(1 mark each)

1. Which two system Coordinate and regulate physiological functions of our body ?
2. What is the role of melanocyte stimulating hormone ?
3. Name the hormones which act antagonistically in order to regulate calcium levels in the blood.
4. Give the names of any one glucocorticoid and one mineralocorticoid.
5. How does atrial natriuretic factor decreases blood pressure ?
6. Which structure is formed from ruptured follicle infemales ? What is its role ?
7. Immunity of old persons becomes very week. Give reason.

Short Answer Questions-I

(2 marks each)

8. What happens if a person suffers from prolonged hyperglycemia ?
9. What are the two modes through which the hypothalamus causes the release of hormones by pituitary gland ?
10. Androgen regulated the development, maturation and other important functions in human male. List them.
11. Mr. Akshay notices that his shoe size has progressively increased. He also observes that shape of his face has gradually changing with protruding lower jaw. What can be the cause for all changes. Name the disorder.

Short Answer Questions-II

(3 marks each)

12. Define hormone and classify them on basis of their chemical nature.
13. How do oxytocin, progesterone and estrogen differ from each other ?
14. What are the disorders caused and the effects produced due to malfunctioning/improper secretion from thyroid gland ?
15. Name the disease/disorder caused by :
 - (a) Excessive secretion of Thyroid hormone in adults
 - (b) Insufficient amount of insulin secreted by pancreas
 - (c) Damage of adrenal cortex.

Long Answer Questions

(5 mark each)

16. 'The master gland regulates a number of physiological functions in our body.' Give reasons and explain.

Answers

Very Short Answers

(1 mark each)

1. Neural system and endocrine system.
2. Acts on melanocytes and regulates pigmentation of skin.
3. Thyrocalcitonin (TCT) and parathyroid hormone (PTH).
4. Glucocorticoid—Cortisol; Mineralocorticoid—aldosterone.
5. By dilation of the blood vessels.
6. Corpus luteum which secretes progesterone.
7. Thymus gland degenerates with age.

Short Answer Questions-I**(2 marks each)**

8. Gets affected by diabetes mellitus which causes loss of glucose through urine and formation of harmful ketone bodies.
9. Through hypothalamic neurons control anterior pituitary gland. Through neural regulation controls posterior pituitary gland.
10. Refer Points to Remember.
11. Increased secretion of growth hormone Acromegaly

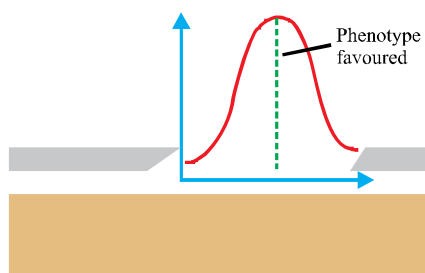
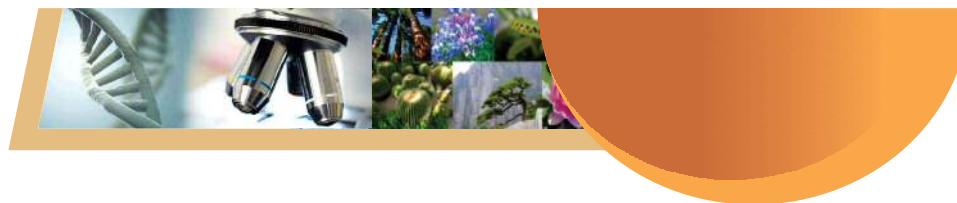
Short Answers Questions-II**(3 marks each)**

12. Refer Points to Remember and page no. 338, NCERT, Text Book of Biology for class XI.
13. Oxytocin causes milk ejection and contraction of uterus at time of child birth.
Progesterone—causes milk secretion and maintains pregnancy.
Estrogen : Refer Points to Remember.
14. Refer Points to Remember.
15. (a) Exopthalmic goitre
(b) Diabetes
(c) Addison's disease

Long Answers Questions-II**(3 mark each)**

16. Explain the role of pituitary gland + Refer Points to Remember.

●●



Sample Paper

Model Test Paper-I

(Solved)

Subject : Biology (044) (Theory)

Class : XII

Session-2016-17

Time : 3 Hrs.]

[MM : 70

General Instructions :

- (i) All Questions are compulsory.
- (ii) The question paper is consists of A, B, C, D, E and F Sections. Section 'A' Contain 5 Questions of 1 mark each, Section 'B' is of 5 Questions of 2 marks each, Section 'C' has 12 Questions of 3 marks each, Section 'D' contains 1 Question of 4 marks, Section 'E' contains 1 Question of 5 marks. Section 'F' contains 2 Question of 5 marks each from the content of OTBA.
- (iii) There is no over all choice. However, an internal choice is given in 1 Question of 2 marks, one question of 3 marks and one question of 5 marks. Students have to attempt only one question from such alternative questions.
- (iv) Whenever necessary or asked the diagrams should be neat and clean and well labelled.

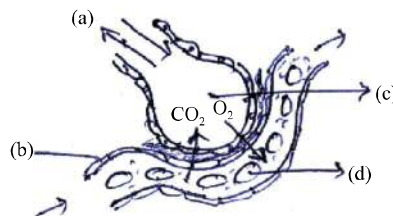
Section A

1. Name the epithelium layer that is found on inner surface of hallow organs like Bronchiole and Fallopian tube. 1
2. Name the chemical bond that connects (A) Mono-saccharides in Polysaccharides (B) Amino Acids in Proteins. $\frac{1}{2} + \frac{1}{2}$

3. Name the joint that exists in—
 (a) Skull bones (b) Bones of Elbow. $\frac{1}{2} + \frac{1}{2}$
4. Name the taxonomical Aid in which plant specimens that are dried, pressed and preserved on paper sheets alongwith all details about the specimen in a systematic way for future references.
5. Write the formula that indicates the relationship between water potential and solute potential and pressure potential.

Section B

6. Name the type of leaves which have—
 (A) Bulliform cells
 (B) Bundle sheath cells. Also write the function of these cells in leaves.
7. Write exact location and function of—
 (A) Hepatic caeca
 (B) Malpighian tubules in cockroach.
8. Identify ABC and D marked in following figure. Where does this process and this structure exist.



OR

What is 'Renal corpuscle/Malpighian Body' in a Nephron. Write the name of its component. Draw labelled diagram of it and Name the Process which takes place in this structure/body.

9. Differentiate between chondrichthyes and osteichthyes with reference to—
 (A) Position of Mouth;
 (B) Gills; and
 (C) Scales on body and;
 (D) Skeleton present in body.
10. What are plant Growth regulators ? Name them, which of these is a in a gaseous state. Write main role of this phytohormone.



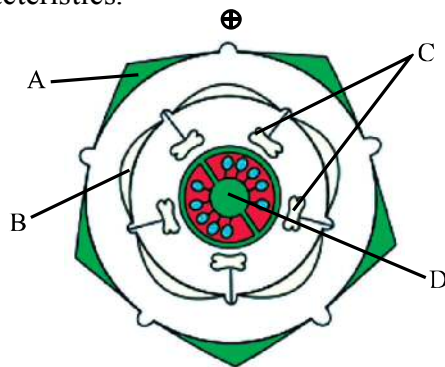
Section C

11. What are archaebacteria ? Give one example. Classify bacteria on the basis of their shapes and show these by diagram. $\frac{1}{2}+\frac{1}{2}+2$
12. Draw a well labelled diagram of funaria showing its various parts, gametophyte and sporophyte. Why do funaria has Root like, stem like and leaf like structure and not the true root and leaves. $2+1$
13. What are the basis of classification of Animals. List these six parameters and write briefly about these parameters.
14. What is cell theory ? Name three scientists and their contribution in formulation of all theory. $1+1+1$
15. Describe the origin structure and functions of the Endoplasmic Reticulum alongwith the labelled diagram. $1\frac{1}{2}+1\frac{1}{2}$
16. (A) Write structural formula of ribose sugar. How does it differ from Deoxyribose Sugar ?
(B) Write name and structural formula of any one Amino Acid.
(C) Write components of Nucleosides.
17. Explain all stages of prophase-I that occurs during Meiosis of gametogenesis in gonads sex organs. $\frac{1}{2}\times 6$
18. What are essential mineral elements for a plant ? What are the criteria for essentiality of a mineral for plants.
19. Define Growth ? What are the conditions necessary for plant growth ? How do plants grow in size ? $1+1+1$
20. Draw labelled diagram of Human Excretory system and write the functions of each part. $1\frac{1}{2}+1\frac{1}{2}$

OR

What is a reflex action ? Give one example of it. Show the process of knee jerk reflex action by a labelled diagram. $\frac{1}{2}+\frac{1}{2}+2$

21. Identify the parts marked as A, B, C, D in the floral diagram shown. Write the floral formula on the basis of this diagram if ovary is superior. Name the family in which these features exist and one example of a plant having these floral characteristics. $\frac{1}{2} \times 4$



22. Write six main differences between C_3 and C_4 Plants in reference to photosynthesis.

Section D

23. Anita stayed with the family of her friend Sarita in a village. She observed that Savita is giving a monotonous diet (same food) to her 4 year old son. Anita observed that the child is not having a good health. She suggested some tips to her friend Sarita for the good health of her son.

(A) Name the disease and its cause from which affect the health of child.

$\frac{1}{2} + \frac{1}{2}$

(B) What items Anita suggested her friend Sarita to include in the diet of her son.

2

(C) Write two skills of Anita.

$\frac{1}{2} + \frac{1}{2}$

Section E

24. Define and show the process of osmosis and osmotic pressure alongwith a labelled diagram.



OR

Define—

- (a) Plasmolysis;
- (b) Guttation;
- (c) Fermentation;
- (d) Photo respiration; and
- (e) Respiratory quotient (RQ).

Section F

- 25. From the content of OTBA for session 2016-17.
- 26. From the content of OTBA for session 2016-17.

Answer of Model Test Paper–I
Subject : Biology (044) (Theory)
(Solved)

Class : XI
(Session-2016-17)

Time : 3 Hrs.

MM : 70

Section A

1. Ciliated Epithelium.
2. (A) Glycosidic bond;
(B) Peptide bond.
3. (A) Fibrous joint;
(B) Synovial (Hinge) joint
4. Herbarium.
5. $\psi_w = \psi_s + \psi_p$
(Water Potential = Solute Potential + Pressure Potential)

Section B

6. (A) **Bulliform cells**—These cells are found in monocot leaves (Example grasses) After absorbing water these cells help in exposing leaf surfaces.
(B) **Bundle Sheath Cells**—These are found in leaves of C_4 plants. In these cells break down of C_4 Acids to release CO_2 and fixation of CO_2 .
7. (A) **Hepatic Caeca**—It is located at the junction of fore gut and mid gut. It secrete digestive enzymes.
(B) **Malpighian Tubules**—It is located at the junction of mid gut and hind gut. It help in removal of excretory products.
8. (A) Air;
(B) Blood Capillary;
(C) alveolar Cavity;
(D) RBC

This process and structure takes place in lungs.



9. Characteristics	Chondrichthyes	Osteichthyes
(A) Position	Ventral	Terminal
(B) Gills	Without operculum	With operculum
(C) Scales	Placoid scales	Cycloid/ctenoid scales
(D) Skeleton	Cartilaginous skeleton	Bony skeleton

10. The Plant Growth Regulators are small, simple molecules of diverse chemical composition which are produced in plants and control and regulate the plant growth. These are :

Auxins—Growth Promoter

Gibberlins—Growth Promoter

Cytokinins—Growth Promoter

Ethylene—Growth Promoter as well as inhibitor

Abscisic Acid—Growth inhibitor

Ethylene is a gaseous Plant Hormone. It's main function is ripening of fruits.

11. Those Bacteria which can live and survive in a harsh conditions such as in hot Vents in hyper saline water in gut of Cattles etc are called Archaeobacteria Example Methanogens. On the basis of shape Bacteria are classified into four major groups :

(1) Coccus—spherical shape

(2) Bacillus—rod shaped

(3) Spirillum—spiral shaped

(4) Vibrio—comma shaped.

(Refer to fig 2.1 page 18 NCERT Book).

12. (Diagram Refer to Fig. No. 3.2 (C) Page 34 NCERT Book). As funaria is a Bryophyte and it does not have vascular Bundles hence no xylem and no phloem. So it has root like stem like and leaf like structures and not the true root, stem and leaves.

13. Animals are classified on the basis of following parameters.

(i) Level of organisation—Cellular level tissue level organ level and organ system level.

(ii) Body symmetry—
 asymmetrical Radical Symmetry
 symmetrical Bilateral Symmetry.

(iii) Diploblastic or Triploblastic Organisation

Diploblastic—Presence of Ectoderm and Endoderm

Triploblastic—Presence of Ectoderm, Mesoderm and Endoderm

- (iv) Presence or Absence of Coelom—Body Cavity space b/w gut a Body wall
Coelomate—having coelom.
Acoelomate—without coelom.
Pseudocoelomate—scattered pouch of coelom.
- (v) Segmentation—Internal and External Segments in body.
- (vi) Presence or Absence of Notochord—
Chordate—having Notochord, Nonchordate without Notochord.

14. Cell Theory—

1. All organisms are made of cells and products of cells.
(Malthias as Schleiden and Theodore Schwann)
2. All cells arise from pre-existing cells.
(Omnis cellulae cellula) — (Rudolf Virchov.)

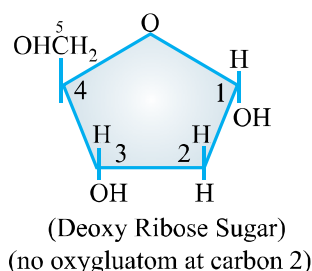
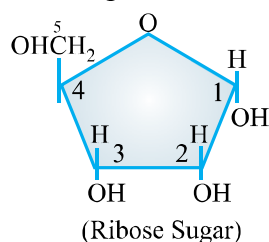
15. Diagram of Endoplasmic Reticulum

(Ref to fig 8.5 page 133 NCERT Book)

Endoplasmic reticulum orginate from outer membrane of Nucleus. These are of two types.

- (A) Rough Endoplasmic Reticulum (RER)—Presence of ribosome these Synthesise. Protein and transport protein within the cell.
- (B) Smooth Endoplasmic Reticulum (SER) without Ribosome. These synthesise lipids and transport lipid within cell.

16.



Ribose sugar differs from Deoxyribose sugar in having H and OH group at its C₂ Atom. While in Deoxyribose Sugar there two H atoms at C₂ Atom.

17. **Prophase I**—It is the longest phase of Meosis Ist. It is further divided into five stages.
- (a) Leptotene—The chromosomes appear thin thread like structure.
 - (b) Zygotene—The homologous chromosomes make pairs (Diad).
 - (c) Pachyytene—The paired chromosome become short and thick.



- (d) Diplotene—Each chromosome divides into two sister chromatids and crossing over takes place b/w non sister chromatids.
 - (e) Diakinesis—The chromosomes separates gets separated from chiasmata.
(these are value points)
(Only one fig showing crossing over) of prophase I
(Ref. to Fig. 10.3 page 169 NCERT Book)
18. The mineral elements without which life cycle of a plant can not be completed is called an essential mineral.

Criteria for essentiality of minerals—

- (a) The element must be involved in supporting growth and reproduction in absence of this mineral life cycle of plant will be incomplete.
 - (b) The mineral element must be specific and can not be replaced by other.
 - (c) The mineral element must be involved directly in metabolism.
19. **Growth**—It is defined as the permanent and irreversible increase in size of an organ or its parts or even in an individual cell or organism is called Growth. Growth occur at the cost of Energy and as a result of metabolism.

Conditions for Growth in Plants—Following are the necessary conditions for growth to occur—

- (a) Presence of water
- (b) Presence of O₂
- (c) Presence of essential elements
- (d) Presence of optimum temperature light and gravity also affect growth of plants.

How do Plants Grow ?—Plants grow in size by cell enlargement which in tern require water. Turgidity of cells help in extension growth and water also provide medium for metabolic activities. O₂ helps in releasing energy essential for growth activity. Essential Nutrients (Mirco and Macro) are required by plant for synthesis of protoplasm to form new cells and to act as source of energy. Optimum temperature is essential for rapid metabolism.

(Ref. Points 15.1, Page 240 and 15.1.5 Page 244)

20. **Diagram**—Ref. to Fig. 19.1 Page No. 291 NCERT Book).

Renal Artery—Bring blood having Nitrogenous waste to kidney.

Renal Vein—Carry filtered blood from kidney.

Kidney—Filter blood to remove Nitrogenous waste in the form of urine.

Ureter—Transfer urine from kidney to urinary bladder.

Urinary bladder—Store urine.

Urethra—Release urine and pass out of the body.

OR

Reflex Action—The sudden and quick response of body or its parts to a stimulus without any conscious effort is called a reflex action.

Ex. Knee jerk reflex action on touching a hot object.

Ex. Tearing from eyes on entry of some unwanted small particle in eyes.

(Diagram ref. to fig. No. 21.5 Page 322 NCERT Book)

21. (A) Calyx (sepals)
(B) Corolla (petals)
(C) Androecium (stamens)
(D) Gynoecium (carpels)

Floral formula— $\frac{\text{O}}{+} \text{K}_{(5)} \text{C}_{1+2+(2)} \text{A}_{(a)} + \underline{\text{G}}1$

Family, Fabaceae, Papilionoideae of Leguminosae.

Plant Pea (*Pisum sativum*) (Topic 5.9.1 Page 78 NCERT Book)

22. Difference between C_3 Plants and C_4 Plants

C_3 Plants	C_4 Plants
1. No Bundle sheath cells present.	1. Bundle sheath cells present.
2. Primary Acceptor of CO_2 is RUBP (C_5 compound)	2. Primary Acceptor is PEP. (C_3 Compound)
3. RUBISCO present in mesophyll cells.	3. RUBISCO is absent in mesophyll cells.
4. PEP case is Absent in mesophyll cell.	4. PEP case is present in mesophyll cell.
5. PGA is the primary product of CO_2 fixation.	5. OAA is the primary product of CO_2 fixation.
6. Calvin cycle takes Place in mesophyll cell.	6. Calvin cycle takes place in Bundle sheath cells.
7. Photo respiration occurs.	7. No Photo respiration takes place.

23. (A) Disease Kwashiorkor due to Malnutrition.
(B) Anita suggested Sarita to include sprouts whole grain food, green leafy vegetables, fruits, milk, jaggery and salad in food/diet of her son.
(C) (i) She has the knowledge of Balanced diet and about deficiency diseases.



- (ii) She has knowledge about health she is caring and has helping attitude.

24. **Osmosis**—The movement of water from a region of high concentration (from dilute solution hyposolution) towards the region of low concentration of water molecule (toward concentrated solution hypertonic solution) through a semipermeable membrane is called osmosis.

Example—Swelling of resins on keeping in water/milk.

Osmotic Pressure—Numerically osmotic pressure is equal to the external pressure applied to stop the process of osmosis through the semipermeable membrane.

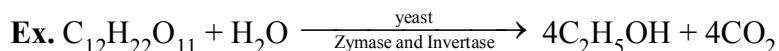
(Diagram Ref. Fig. No. 11.4 Page 181 NCERT Book)

OR

(a) **Plasmolysis**—Shrinking away of protoplast (plasma membrane and cytoplasm) on keeping a cell in a hypertonic solution is called plasmolysis.

(b) **Guttation**—Release of excess water in the form of water droplets from the special openings of veins near the tip of grass blade and of some herbaceous leaves in early morning or at night as a result of root pressure is called guttation.

(c) **Fermentation**—The chemical breakdown of complex organic matter into (alcohol) simpler water soluble substances along with the release of CO_2 by the action of enzymes released by microbes is called fermentation.



(d) **Photorespiration**—It is a wasteful process that occur in C_3 plants. Rubisco has affinity towards both O_2 and CO_2 so it is called/named as RUBISCO. In C_3 plant RUBISCO does bind with O_2 and hence CO_2 fixation is decreased and RUBP is not converted into PGA and PGA binds with O_2 to form phosphoglycerate and phosphoglycolate with the release of CO_2 . This process in which No ATP is formed and sugar is synthesised. Thus process is called photorespiration.

- (e) **Respiratory Quotient (RQ)**—It is defined as the ratio of volume of CO₂ evolved to the volume of O₂ consumed in respiration is called Respiratory Quotient, or respiratory ratio.

$$\text{R.Q.} = \frac{\text{Volume of CO}_2 \text{ released}}{\text{Volume of O}_2 \text{ consumed}}$$

Section F

25. Answer based on content OTBA for session 2016-17.
26. Answer based on content of OTBA for session 2016-17.



Model Test Paper
Subject : Biology (Theory)
Class : XI

Time : 3 Hrs.]

[MM : 70

General Instructions :

- (i) All Questions are compulsory.
- (ii) The question paper is consists of A, B, C, D, E and F Sections. Section 'A' Contain 5 Questions of 1 mark each. Section 'B' is of 5 Questions of 2 marks each. Section 'C' has 12 Questions of 3 marks each. Section 'D' has 1 Question of 4 marks. Section 'E' contains 1 Question of 5 marks. Section 'F' is OTBA of 10 marks (2 Question of 5 marks each).
- (iii) There is no overall choice. However, an internal choice has been provided in one question of 2 marks, one question of 3 marks and one question of 5 marks weightage.

Section A

- 1. Write the scientific name of Dog and Housefly.
- 2. Mention the ploidy of Endosperm and zygote in angiosperms.
- 3. Write two factors why all minerals cannot be passively absorbed by roots.
- 4. Name the property possessed by muscle fibres but not nerve fibres.
- 5. Write the calorific value of carbohydrates and protein.

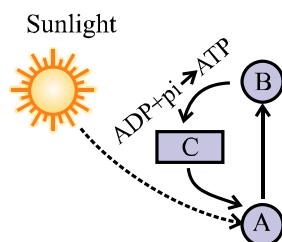
Section B

- 6. Describe any two mode of nutrition found in fungi. Write one example of each.
- 7. Fibroblasts produces proteins. Name any two and write their functions.

OR

Differentiate between spine and thorn.

- 8. Discuss the significance of crossing over and haploid chromosome in meiosis.
- 9. In the given diagram :
 - (1) Which type of phosphorylation is possible ?
 - (2) Identify A, B and C.



10. An NGO reported that children below the age of 15 are working in grinding industry. What will happen if these children continue to work in this industry ? Mention any one precaution other worker of this industry must take for themselves.

Section C

11. Explain different type of body symmetry found in animals with the help of diagrams.
12. Explain any three modifications of cell envelope of prokaryotes.
13. The stomatal pore is guarded by two guard cells. Name the epidermal cells surrounding the guard cells. How is it different from guard cells ? Illustrate your answer with the help of diagram.
14. Mention the role of gizzard, crop, tracheoles compound eyes, malpighian tubules and hepatic caeca in cockroach.
15. Differentiate between :
 - (1) Actinomorphic flower and zygomorphic flower.
 - (2) Apocarpous ovary and syncarpous ovary.
 - (3) Racemose inflorescence and cymose inflorescence.
16. How does enzyme bring about high rate of chemical conversion ? Illustrate with the help of diagram.
17. (a) Draw a neatly labelled diagram of an Interphase nucleus seen under electron microscope.
(b) What is the role played by nucleus in a cells ?
18. What do you understand by Electrical N_2 fixation, Industrial nitrogen fixation and Biological N_2 fixation ?

OR

Explain the steps of Nitrification in case of biological N_2 fixation.

19. Six turns of Calvin cycle are required to generate one molecule of glucose. Explain.



20. How is mycorrhizal association helpful in absorption and minerals in plants ?
21. (a) Draw a neatly labelled diagram of basic unit of kidney.
(b) Mention the glomerular filtration rate of a healthy individual.
22. Draw a diagram of human ear and label the following :
- (a) Hearing organ;
 - (b) Balancing of body;
 - (c) Act as resonator that produces vibration of sound;
 - (d) Collect sound waves;
 - (e) Help in equalising the pressure of either side of ear drum.
 - (f) Transmits sound waves to internal ear.

Section D

23. Garvita's uncle is suffering from some heart ailment. Doctor has advised him walk vegetable oil rich in polyunsaturated fat and lots of fruits. Garvita asked his brother that fat is not good for his uncle. The doctor explain her query.
- (a) Why did doctor recommend vegetable oil rich in polyunsaturated fat to her uncle ?
 - (b) Mention any one possible reason of heart ailment.
 - (c) Write any two values reflected by Garvita.

Section E

24. Explain the major steps in Kreb's cycle .Where does this process occur in a cell ? Why it also called as citric acid cycle ?

OR

- (a) Which part of the plant produces gibberellin ? State two functions of this hormone and mention why it is named gibberellin ?
- (b) Both a short day and a long day plant can produce flower simultaneously in given place. Explain with example.

Practice Paper

Time : 3 Hrs.

MM : 70

General Instructions :

- (i) All Questions are compulsory.
- (ii) The question paper consists of A, B, C, D, E and F Sections. Section 'A' contains 5 questions of 1 mark each. Section 'B' is of 5 questions of 2 marks each. Section 'C' has 12 questions of 3 marks each. Section 'D' has 1 question of 4 marks. Section 'E' contains 1 question of 5 marks. Section 'F' is OTBA of 10 marks (2 question of 5 marks each).
- (iii) There is no overall choice. However, an internal choice has been provided in one question of 2 marks, one question of 3 marks and one question of 5 marks weightage.
- (iv) Wherever necessary, the diagram drawn should be neat and properly labelled.

Section A

- 1. What do the terms phycobiont and mycobiont signify ?
- 2. Name the common step in aerobic and anaerobic and anaerobic pathway.
- 3. Select out uricotelic from the following animals :
Reptiles, insects, mammals.
- 4. Names for the following :
 - (i) The gametophyte of Ferns;
 - (ii) The male gametophyte of Angiosperms.
- 5. Write two characteristic features of mycelium of Deuteromycetes.

Section B

- 6. Distinguish between ovipary and vivipary with example.
- 7. Glycine and Alanine are different with respect to one substituent on α -carbon.
What are these groups ?



8. Match the following sets :

Set A

- (a) Chlorosis
- (b) Rhizobium
- (c) Hydroponics
- (d) Boron

Set B

- (i) Element required for germination of pollen
- (ii) Soil less culture
- (iii) Mineral deficiency in plants
- (iv) Symbiotic N_2 fixer

OR

Arrange the following terms based on their volumes in ascending orders.

- (a) Tidal volume (TV)
 - (b) Residual volume (RV)
 - (c) Inspiratory reserve volume (IRV)
 - (d) Expiratory capacity (EC)
9. In tea garden, gardeners trim the plants regularly, so that they remain bushy. Does this practice have any scientific explanation ?
10. (a) Why is mitosis called equational division ?
(b) Bring out the main difference between anaphase I of meiosis and anaphase of mitosis.

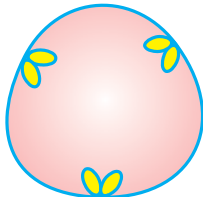
Section C

11. Explain how the transmission of nerve impulse takes place at chemical synapse ?
12. Draw a well labelled diagram of T.S. of Dicot stem.

OR

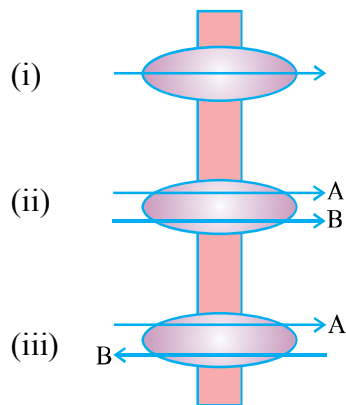
Draw a well labelled diagram of reproductive system of female cockroach.

13. Explain the significance of leg haemoglobin and nitrogenase in the root nodule.
14. (a) Differentiate between hypogynous and perigynous flowers along with an example of each.
(b) Identify the placentation, also give an example showing this placentation.



15. If a person is feeling dizzy, glucose or fruit juice is given immediately but not a cheese sandwich, which might have more energy. Explain.

16. The entire process of photosynthesis consists of number of reactions where in the cell do each of these take place :
- Synthesis of ATP and NADPH;
 - Photolysis of water;
 - Fixation of CO_2 .
17. (a) Why are Villi present in the intestine not in the stomach ?
 (b) How does pepsinogen change into its active form ?
 (c) How does bile juice help in the digestion of fats ?
18. (a) Name the type of joint between the following :
 (i) Carpel/Metacarpal of thumb;
 (ii) Between Cranial bones;
 (iii) Femur/Acetabulum
 (iv) Atlas/Axis.
 (b) Differentiate between Ligament and Tendon.
19. Define the term :
 (a) Bilateral symmetry;
 (b) Acoelomate animal;
 (c) Closed circulatory system.
20. A cell organelle is also considered as power house of the cell :
 (a) Identify the organelle.
 (b) Describe the structure of this cell organelle with the help of labelled diagram.
21. Observe the figure and identify the process (i), (ii) and (iii) :



22. Provide the scientific term for the following :
 (a) Sepal which are united;
 (b) The roots which arise from parts of the plant other than radicle;
 (c) The roots which come above the surface of soil to absorb air.

Section D

23. Avikal has been reading the structure of a nephron and the role played by the different parts of it in urine formation and osmoregulation; but there are certain mistakes and his elder brother helps him with a correct and detailed explanation :
- (a) What are two major parts of a nephron ?
 - (b) What is a Malpighian body ?
 - (c) Where is urine filtered from ? Why is it called ultrafiltration ?
 - (d) What values are shown by his brother in explaining the correct functions of nephrons ?

Section E

24. (a) Explain the major steps of glycolysis.

Or

- (b) (i) Explain ETS. (Electron transport system);
- (ii) In what form does pyruvic acid enter Krebs's cycle ?

OR

- (a) Where does non-cyclic photophosphorylation take place ? Describe it why is it called so.
- (b) Who proposed the fluid mosaic model of plasma membrane ? Describe the same along with help of a labelled diagram.

Section F

(OTBA)